NVEnergy

December 17, 2014

Nevada Division of Environmental Protection
NDEP – Bureau of Corrective Actions
901 S Stewart St
Carson City, NV 89701
Attn: Alison Oakley

Dear Alison:

Subject: NV Energy
Reid Gardner Station
Background Conditions Report

Based on your concurrence letter dated November 7, 2014, revised cover sheets and spine labels dated December 2014, reflecting that the Background Conditions Report is considered final, are enclosed.

If you have any questions regarding the enclosed errata sheets, please contact me at 702-402-1319.

Sincerely,

Michael Rojo
Environmental Team Lead
Reid Gardner Station

CC: William Campbell, NDEP (electronic copy via FilesAnywhere)
Michael Rojo, NV Energy
Tony Garcia, NV Energy (two copies)
John Kivett, ARCADIS
Bob Forsberg, ARCADIS

ndep
NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
protecting the future for generations

STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION

Brian Sandoval, Governor
Leo M. Drozdoff, P.E., Director
Colleen Cripps, Ph.D., Administrator

November 7, 2014

Michael Rojo
Environmental Services, Supervisor
NV Energy
PO Box 279, MS 77
501 Wally Kay Drive
Moapa, NV 89025

Re: **NV Energy (NVE)**
Reid Gardner Station (RGS)
NDEP Facility ID #H-000530
Nevada Division of Environmental Protection (NDEP) Comments on:
Draft Background Conditions Report, Dated: July 2014

Dear Mr. Rojo:

The NDEP has received and reviewed NVE's *Draft Background Conditions Report*, received by NDEP on August 5, 2014. The subject report summarizes the background soil and groundwater investigations, aquifer testing, and proposes background soil and groundwater concentrations. This report includes revisions to the October 2013 Draft Backgrounds Conditions Report and a *Document and Response to Comments Tracking Form*. The NDEP reviewed the changes made to the October 2013 draft, as presented in the July 2014 draft and has a couple of comments to the comment responses. Additional comments from NDEP are included in Attachment A. The NDEP concurs with the 2014 Draft Background Conditions Report. The attached comments do not require the Draft Background Conditions Report to be changed.

Please contact the undersigned with any questions or comments about this letter at (775) 687-9396 or aoakley@ndep.nv.gov

Sincerely,

Alison Oakley, CEM
Environmental Scientist III
Bureau of Corrective Actions
NDEP-Carson City Office

ec: Jeff Collins, Bureau of Corrective Actions, NDEP
Scott Smale, Bureau of Corrective Actions, NDEP
Todd Croft, Bureau of Corrective Actions, NDEP Las Vegas
Bill Campbell, Tribal Liaison, NDEP
Alan Tiney, Bureau of Water Pollution Control, NDEP
Ebrahim Juma, Clean Water Team
Joe Leedy, Clean Water Team
Dennis Campbell, Southern Nevada Health District (campbell@snhdmail.org)
Lynn M. Cintron, Sr. Administrative Assistant, Solid Waste & Compliance, SNHD, (cintron@snhdmail.org)
Brian Northam, Envi. Health, Solid Waste & Compliance, SNHD (northam@snhdmail.org)
Starla Lacy, NV Energy (SLacy@nvenergy.com)
Darren Patten, NV Energy (DPatten@nvenergy.com)
Tony Garcia, NV Energy (TGarcia@nvenergy.com)
Michael Rojo, NV Energy (MRojo@nvenergy.com)
Jason Reed, NV Energy (JReed@nvenergy.com)
Becky Svatos, Stanley Consultants, Inc., (SvatosBecky@stanleygroup.com)
William Carrig, Stanley Consultants, Inc., (CarrigBill@stanleygroup.com)
John Kivett, Arcadis, (John.Kivett@arcadis-us.com)
Brad Cross, Arcadis, (Brad.Cross@arcadis-us.com)

cc: William Anderson, Moapa Band of Paiutes, Chairperson, P.O. Box 340, Moapa, NV 89025
Ian Zabarte, Moapa Band of Paiutes, Environmental Director, P.O. Box 340, Moapa, NV 89025
Noelle Gentilli, Department of Water Resources, 1416 9th Street, Room 1118, Sacramento CA 95814

Appendix A

All comments below are regarding the Document and Response to Comments Tracking Form for the Draft Background Conditions Report, Administrative Order on Consent Activities, NV Energy Reid Gardner Station, dated July 31, 2014.

1. NVE's response to Comment #6 regarding IMW-2.5S does not satisfy fully NDEP's concerns regarding that well's use as a representative background well. The NDEP notes that the text of the report was changed to reflect that alluvial groundwater proposed background threshold values will not be used for remedial decision making purposes. However, the comment response states that NV Energy believes that the totality of the data indicates that IMW-2.5S is an appropriate alluvial background well. The response does not explain why total dissolved solid (TDS) concentrations spike and drop over very short periods of time at that well, or why TDS and other constituents periodically occur at higher concentrations than any other background well. If NVE's analysis can provide a plausible explanation regarding the unique conditions observed at that well, NDEP would like to see that analysis in its entirety. At this point, the NDEP will agree to disagree with NVE's supposition until the comprehensive conceptual site model is completed for the site.

2. Comment #8 refers to connectivity between the alluvial aquifer and the Muddy River. The NDEP's position is still that conclusions presented regarding the connectivity of the Alluvial and Muddy Creek Aquifers or the Alluvial Aquifer and the Muddy River based on pumping test results are tenuous at best and will require additional testing for verification. In unconfined aquifers, aquifer pore space is physically drained during extraction (the specific yield). A volumetric analysis of the unconfined alluvial aquifer that would be drained based on the total volume of water extracted (using reasonable effective porosity and thickness assumptions) may provide some insight into the potential radius of influence that may have existed at the end of the referenced test.

NVEnergy

July 31, 2014

Nevada Division of Environmental Protection
Bureau of Corrective Actions
901 S. Stewart Street, Suite 4001
Carson City, NV 89701
Attn: Alison Oakley

Subject: NV Energy Reid Gardner Generating Station
NDEP Facility ID # H-000530
Draft Background Conditions Report, Dated: July 2014

Dear Alison:

NV Energy is pleased to provide the revised *Draft Background Conditions Report* dated July, 2014. This report was revised based on comments received by the NDEP on April 28, 2014. A Response to Comments Tracking Form is also included. If you have any questions regarding the enclosed report, please contact me at 702-402-1319.

Sincerely,

NV Energy

Michael Rojo
Environmental Team Lead
Reid Gardner Station

cc: William Campbell, NDEP (electronic copy via FilesAnywhere)
Tony Garcia – NV Energy (two copies)
John Kivett – Arcadis, Inc.
Bob Forsberg – Arcadis, Inc.

Document and Response to Comments Tracking Form
NV Energy – Reid Gardner Station
Administrative Order On Consent Implementation

Document Title Draft Background Conditions Report, Administrative Order on Consent Activities, NV Energy, Reid Gardner Station

Preparer Stanley Consultants

Draft #1

To NDEP

From NV Energy

Submittal Date October 2013

Comment Date April 28, 2014

Response Date July 31, 2014

Commenter Alison Oakley, CEM

Responder Mike Rojo

Comment #1

The NDEP has some reservations about the interpretations and conclusions presented in the Draft Background Conditions Report, particularly as it pertains to alluvial groundwater; however, we accept the data as presented. As we have discussed, differences in interpretation of the data may not necessarily lead to different site outcomes, so the NDEP is comfortable moving forward with Site work recognizing that these differences might need to be resolved at a later date if they become critical for Site decision making.

Response #1

Section 7.2, Paragraph 5, has been revised as follows: "Because of NDEP concerns regarding the appropriateness of some wells used to establish alluvial groundwater BTVs, the alluvial groundwater BTVs will not be used for remedial decision making at this time. The alluvial groundwater BTVs may be revisited in the future in an amendment to this Background Conditions Report. The application of the Muddy Creek-North and Muddy Creek-Mesa groundwater BTVs to remediation decision-making should be evaluated on a case-by-case basis."

NVE will use the soil, Muddy Creek-North groundwater, and Muddy Creek-Mesa groundwater BTVs in remediation decision-making on a case-by-case basis. If NVE and NDEP reach a future agreement regarding the alluvial groundwater BTVs, the Background Conditions Report will be amended to present agreed-upon site-specific alluvial BTVs.

Comment #2

<u>General</u>: The 2007 US Geological Survey report for Clark County cited in Section 1 (Ludington et al., 2007) was a study biased towards mineralized areas to assess potential economic deposits. Samples were fully digested before analyses were performed. This study is not a good comparison for general background levels of inorganic constituents and should not be used in establishment of Site background.

Response #2

Information from the 2007 study was removed from the report text in Table 1-1, Table 5-1, Section 1.5.1, and Section 8, and Table D-1 in Appendix D and the CD.

Comment #3

<u>General</u>: Section 3.0 of the Report notes geologic data gaps that need further investigation as part of the conceptual site model (CSM). The NDEP would like for the CSM to address the potential for preferential pathways in the alluvial aquifer, such as paleochannels or other features that may affect mass flux. The CSM is a critical piece of the Site investigation for making defensible and effective decisions about potential risk at and/or from the Site and the future of groundwater at the Reid Gardner Station. The Muddy River study is also a critical data gap in the CSM.

Response #3

Comment noted; no changes were made to the report. Data gaps will be identified and addressed in future studies, such as the Muddy River investigation, where information is needed to augment the CSM to support remedial decision-making.

Comment #4

<u>General</u>: Section 7.0 of the Report states adequate soil and groundwater data were collected to establish background soil and groundwater concentrations for use during implementation of the AOC. NDEP has reviewed the statistical approach employed to develop the soil background levels and has no further comments on the approach at this time. NDEP concurs with the recommended BTVs for the Muddy Creek – North and the recommended BTVs for the Muddy Creek – Mesa. NDEP does not concur that adequate groundwater data have been collected to fully establish background groundwater concentrations for the alluvium. Due to the complexity of the Site, an improved CSM is needed to support development of background groundwater concentrations for the alluvium.

Response #4

Refer to Response #1. Section 7, Paragraph 1, has been revised as follows: "Adequate soil and groundwater data have been collected to establish background soil concentrations and background groundwater concentrations for the Muddy Creek-North and the Muddy Creek – Mesa for use during implementation of the AOC. Because of NDEP concerns regarding the appropriateness of some wells used to establish alluvial groundwater BTVs, the alluvial groundwater BTVs will not be used for remedial decision making at this time. The alluvial groundwater BTVs may be revisited in the future in an amendment to this Background Conditions Report."

Section 7.2, Paragraph 5 has been revised as follows: "Because of NDEP concerns regarding the appropriateness of some wells used to establish alluvial groundwater BTVs, the alluvial groundwater BTVs will not be used for remedial decision making at this time. The alluvial groundwater BTVs may be revisited in the future in an amendment to this Background Conditions Report. The application of the Muddy Creek-North and Muddy Creek-Mesa groundwater BTVs to remediation decision-making should be evaluated on a case-by-case basis."

Comment #5

Section 3.4.1, Page 3-14: The first paragraph states that the alluvial aquifer is primarily recharged by the losing section of the Muddy River. At this point we assume that the upper reach of the Muddy River through the Plant is losing; however we do not know the rate or the significance. The proposed Muddy River study is intended to confirm where the river is losing or gaining and to help quantify the amount of flow into or out of the river.

Response #5

Section 3.4.1, Page 3-14 was changed as follows: "Based on current data, it appears that the alluvial aquifer is primarily recharged by the losing section of the Muddy River and by several large washes during rain events… A proposed future study of the Muddy River will further evaluate the river and alluvial aquifer interaction."

Comment #6

Table 3-6, Page 3-23, TDS Concentrations: Determining a background condition for TDS in the alluvial groundwater is problematic because there are few wells installed into the alluvial aquifer in background locations. To assess background conditions in the Alluvial Aquifer, an analysis was conducted on one of the proposed alluvial background groundwater monitoring wells, IMW-2.5S, which shows significant concentration swings over time. Over a cycle where TDS concentrations varied from low to high and then back to low, groundwater gradients were assessed using a three-point problem analysis of monitor well data from MW-6, MW-5, and IMW-2.5S. The analysis showed a very strong correlation between gradient direction and TDS concentrations in IMW-2.5S. When gradients were more northerly, TDS concentrations at IMW-2.5S peaked. When gradients were easterly, TDS concentrations dropped off. Since Pond 4C-2 is located south of IMW-2.5S, it is likely that TDS compounds have migrated north and that IMW-2.5S is located along the periphery of a TDS plume emanating from that pond. The TDS plume shifts in accordance with the groundwater gradient such that a northerly gradient results in high TDS concentrations and more easterly gradients result in low TDS concentrations at IMW-2.5S. This would suggest that when gradients are more easterly and TDS concentrations are at their lowest, those concentrations are more representative of background conditions. Analysis of this well is an example of one of the problems with the alluvial background well data set. In general, alluvial wells located in close proximity to current or historical RGS operations are potentially susceptible to impacts of those operations.

Response #6

Refer to Response #1.

The last paragraph in Section 7.2 was revised as follows, "Because of NDEP concerns regarding the appropriateness of some wells used to establish alluvial groundwater BTVs, the alluvial groundwater BTVs will not be used for remedial decision making at this time. The alluvial groundwater BTVs may be revisited in the future in an amendment to this Background Conditions Report. The application of the Muddy Creek-North and Muddy Creek-Mesa groundwater BTVs to remediation decision-making should be evaluated on a case-by-case basis."

Regarding NDEP's analysis of well IMW-2.5S data cited above and presented at the April 30, 2014, AOC Quarterly Meeting: NVE and CDWR have further reviewed this issue. Our review incorporated the entire data set; including data collected since 2008, travel time from the pond to the well, and the appropriate range of groundwater gradient directions. When considering these factors, we believe the totality of the data indicates that IMW-2.5S is an appropriate alluvial background well.

Comment #7

Table 4-2, Page 4-5, Observed Water Level Drawdown: In many instances, excessive drawdown in pumping wells (shown as drawdown % of static water column) likely resulted in a significant portion of the drawdown being attributed to non-laminar flow and friction losses. This would lead to erroneous estimates of hydraulic parameters.

Response #7

Comment noted; no estimation of hydraulic parameters based on these data was presented in the report. Therefore, no changes were made to the report.

Comment #8

Section 4.3.2, Page 4-6, Alluvial Aquifer Muddy River Connection: In an unconfined aquifer, it is highly unlikely that pumping at the KMW-2 well cluster at rates of 2.5 to 7 gpm for less than 10 hours would have a radius of influence that would reach monitor well (MW-6) located 380 feet away. The minimal drawdown observed at MW-6 (0.06 to 0.14 feet) could have been the result of other factors. It is stated that the radius of influence would also reach the Muddy River. If that were to have occurred, a boundary condition would have been observed. As stated, additional testing would be necessary to establish a connection between the alluvial aquifer and the Muddy River.

Response #8

The last paragraph of Section 4.3.2 was changed as follows: "During the aquifer testing at KMW-2, a minimal drawdown was recorded in observation well MW-6 located approximately 380 feet away. This radius of influence could potentially intersect the Muddy River and potentially confirm Mifflin's study... A proposed future study of the Muddy River will further evaluate the river and alluvial aquifer interaction." Also, "This reach of the river may be disconnected from the underlying alluvial aquifer" was deleted from Section 4.3.2 and Section 7 paragraph 4.

Comment #9

<u>Table 5-2, Page 5-3, Soil Permeability Table:</u> The Table 5-2 is not a good representation of soil permeability. First, all results should specify ranges, not specific numbers. Second, the value for GW (well graded gravel) does not make sense in the context of material type. The permeability value for GW should be higher than silt and clay. Please reevaluate the values on this table.

Response #9

Table 5-2 was revised with ranges, soil descriptions were added to Table D-2, and the text in Section 5.1 was revised to clarify this information. The hydraulic conductivity values and soil descriptions on this table are from 6" of undisturbed soil collected in brass rings. The laboratory technician produced the soil descriptions for these samples. The USCS classifications were based on field observations and laboratory analysis of bulk samples collected from one to three feet of soil. Because the lithology at the site is heterogeneous, it appears that the soil collected in the brass ring was different than the soil collected for the bulk sample. This table has been revised to show only the information from the 6" undisturbed sample laboratory report.

Comment #10

<u>Section 5.2.1, Page 5-7, Quality Control Data:</u> The NDEP suggests that for future sampling events, a source blank be collected as part of the quality control samples to assess the quality of the deionized water.

Response #10

Comment noted; no changes made to the report. Source blanks of decontamination water have been collected during groundwater sampling events conducted since the background sampling activities were undertaken.

Comment #11

<u>Table 6-7, Page 6-10</u>: (Editorial) The footnote for table 6-7 does not match the abbreviation used within the table.

Response #11

The footnotes for Table 6-7 have been revised. Footnotes throughout the report were reviewed and revised if necessary.

Comment #12

<u>Table 6-9, Page 6-11</u>: (Editorial) Please include the units for the "BTVs for All Depths" column.

Response #12

The units have been added.

Comment #13

*<u>Table 6-14, Page 6-18:</u> (Editorial) Please include a definition for the * used in the table and include the definition for NA in the footnotes.*

Response #13

The asterisk was removed from the table and a definition of 'NA' was added to the footnotes.

Comment #14

*<u>Table 6-16, Page 6-20:</u> (Editorial) Please include a definition for the * used in the table in the footnotes.*

Response #14

The * has been removed. It was initially added to note that they were different populations with the same values.

Comment #15

<u>Appendix F:</u> Several of the groundwater histograms do not provide concentrations (labels along the x-axis).

Response #15

This was a limitation of the histogram program; values with low concentrations were not labeled. We have manually added the scales to the affected tables in Appendix F and updated these files in the CD submittal.

Additional Revisions:

ProUCL 4.0 was used to calculate the BTVs for the soil and groundwater data. During the January 29, 2014 AOC meeting, NVE and NDEP discussed using a decision tree to choose the appropriate statistical distribution and methods in ProUCL. Stanley Consultants provided NDEP with a decision tree used during the evaluation of the background data. After the discussions, Stanley Consultants reviewed the draft recommended BTVs and determined there was a more appropriate statistical method for a few of the BTVs.
This resulted in the following revised BTVs:
Table 6-7 (soil differentiated by soil classification, mg/kg): iron 20,000 (non-clay); magnesium 29,000 (non-clay); potassium 5,700 (non-clay); selenium 5.6 (clay); silica 1,200 (clay).
Table 6-8 (soil differentiated by depth, mg/kg): 0-20 ft. sodium 17,000; >20 ft. sodium 770.
Table 6-16 (groundwater with three populations, mg/L): Muddy Creek - North Nitrate 0.41
These BTVs were also updated on Table 7-2 and Table 7-4. Distributions were revised on Table 6-4, Table 6-5, and Table 6-15.

Table D-2: Column heading K/K_{20} was changed to K, and soil descriptions were added for clarity.

Final

To _____ From _____

Submittal Date _____ Approval Date _____

Approver _____

Background Conditions Report

Administrative Order on Consent Activities

NV Energy

Reid Gardner Station

Final

December 2014

20618.09

Stanley Consultants INC.

A Stanley Group Company

Engineering, Environmental and Construction Services - Worldwide

Certifications

NVE Certification

I certify that this document and all attachments submitted to the Division were prepared under the direction or supervision of NV Energy (NVE) in accordance with a system designed to gather and evaluate the information by appropriately qualified personnel. Based on my inquiry of the person or persons who manage the system(s) or those directly responsible for gathering the information, or the immediate supervisor of such person(s), the information submitted and provided by NVE is, to the best of my knowledge and belief, true, accurate, and complete in all material respects. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: James D. Hopper

Name: Don Hopper

Title: Plant Director, Reid Gardner Station

Company: NV Energy

Date: July 30, 2014

Certified Environmental Manager (CEM) Certification

I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession and to the best of my knowledge comply with all applicable federal, state and local statutes, regulations and ordinances.

Signature:	
Name:	Rebecca L. Svatos
Title:	Project Manager
Company:	Stanley Consultants
Date:	7/29/14
EM Certificate Number	EM-1931
EM Expiration Date:	9/30/2015

Table of Contents

Certifications ..... **i**

Section 1 - Introduction **1-1**
1.1 Introduction 1-1
1.2 Objective 1-2
1.3 Site Setting 1-2
1.4 Station History 1-2
1.5 Prior Background Investigations 1-3
1.5.1 Prior Soil Background Investigations 1-3
1.5.2 Prior Groundwater Background Investigations 1-4

Section 2 - Field Activities **2-1**
2.1 Sampling Preparation 2-1
2.1.1 Access Agreements and Permits 2-1
2.1.2 Project Field Parties 2-2
2.1.3 Health and Safety 2-3
2.1.4 Utility Clearances 2-3
2.2 Field Procedures 2-3
2.2.1 Dates of Field Activities 2-3
2.2.2 Drilling Methods 2-3
2.2.3 Soil Sample Collection 2-4
2.2.4 Well Installation 2-7
2.2.5 Well Development 2-7
2.2.6 Groundwater Sample Collection 2-8
2.2.7 Quality Control Samples 2-9
2.2.8 Sample Analysis 2-9
2.2.9 Decontamination 2-10
2.2.10 Investigation-Derived Waste 2-10
2.2.11 Surveying 2-10
2.3 Deviations 2-10

Section 3 - Geology **3-1**
3.1 Regional Geology 3-1
3.1.1 Alluvium 3-1

3.1.2 Post-Muddy Creek Tertiary Deposits 3-2
3.1.3 Muddy Creek Formation 3-3
3.1.4 Horse Spring Formation 3-6
3.1.5 Paleozoic Carbonate Formations 3-7
3.2 Local Geology 3-7
3.2.1 Alluvium 3-7
3.2.2 Post-Muddy Creek Tertiary Deposits 3-8
3.2.3 Muddy Creek Formation 3-9
3.3 Surface Soils 3-12
3.4 Hydrogeology 3-13
3.4.1 Alluvial Aquifer 3-14
3.4.2 Muddy Creek Aquifer 3-16
3.4.3 Carbonate Aquifer of the WRFS 3-17
3.4.4 Hydraulic Gradients 3-19
3.4.5 Groundwater Quality 3-21

Section 4 - Aquifer Testing 4-1
4.1 Objectives 4-1
4.2 Testing Procedures 4-1
4.3 Aquifer Performance Testing Results 4-4
4.3.1 Hydraulic Connection between Alluvial and Muddy Creek Aquifers 4-4
4.3.2 Alluvial Aquifer - Muddy River Connection 4-5

Section 5 - Analytical Results 5-1
5.1 Soil Laboratory Analyses 5-1
5.1.1 Quality Control Data 5-3
5.1.2 Soil Data Validation 5-4
5.1.3 Soil Data Qualitative Objectives 5-4
5.2 Groundwater Laboratory Analyses 5-5
5.2.1 Quality Control Data 5-7
5.2.2 Groundwater Data Qualitative Objectives 5-7
5.2.3 Groundwater Data Validation 5-8

Section 6 - Statistical Data Evaluation 6-1
6.1 Soil Statistical Analysis 6-1
6.1.1 Statistical Analysis 6-3
6.1.1.1 Statistical Analysis Software 6-3
6.1.1.2 Process for Determining BTVs 6-3
6.1.2 Population Evaluation – Geologic Formation 6-5
6.1.2.1 Distribution 6-5
6.1.2.2 Two-Sample Hypotheses 6-5
6.1.3 Population Evaluation – Soil Classification 6-6
6.1.3.1 Distribution 6-6
6.1.3.2 Two-Sample Hypotheses 6-6
6.1.4 Population Evaluation - Depth 6-7
6.1.4.1 Distribution 6-7
6.1.4.2 Two-Sample Hypotheses 6-8
6.1.5 Population Evaluation – Undifferentiated Data 6-8
6.1.6 Outliers 6-8
6.1.7 Background Threshold Values 6-9
6.2 Groundwater Statistical Analysis 6-11
6.2.1 Population Evaluation 6-16

6.2.1.1 Distribution 6-16
6.2.1.2 Two-Sample Hypotheses 6-16
6.2.2 Outliers 6-19
6.2.3 Background Threshold Values 6-19

Section 7 -Conclusions and Recommendations 7-1
Section 7.1 Soil Background Concentrations 7-2
Section 7.2 Groundwater Background Concentrations 7-5

Section 8 - References 8-1

Section 9 - Acronyms and Abbreviations 9-1

TABLES

Table 1-1 Regional Soil Concentrations 1-3

Table 1-2 Regional Alluvial Groundwater Concentrations 1-5

Table 1-3 Action Levels Established for Station Groundwater in 2003 1-6

Table 2-1 Background Activities Parties 2-2

Table 2-2 Soil Boring and Monitoring Well Summary 2-4

Table 2-3 Soil Sampling Summary 2-5

Table 2-4 Well Development Summary 2-8

Table 2-5 Deviations 2-11

Table 3-1 Geologic Formations Identified in Mapping Studies Near the Station 3-5

Table 3-2 Local Alluvium on Top of the Muddy Creek Formation 3-8

Table 3-3 Depths to Top of Green and Red Claystone Units of the Muddy Creek Formation 3-11

Table 3-4 Soil Characteristics in the Area of the Station 3-13

Table 3-5 Groundwater Elevations at Background Well Clusters - 2012 3-20

Table 3-6 TDS Concentrations in the Alluvial and Muddy Creek Aquifers 3-23

Table 4-1 Summary of Aquifer Test Data 4-2

Table 4-2 Observed Water Level Drawdown in Well Clusters During Pump Testing 4-5

Table 5-1 Background Soil Concentrations Compared to Regional Soil Concentrations 5-1

Table 5-2 Soil Permeability Summary 5-3

Table 5-3 Soil Quality Control Sample Results 5-4

Table 5-4 Background Groundwater Concentrations Compared to Previous Station and Regional Groundwater Concentrations 5-6

Table 6-1 Geologic and Soil Classifications of Background Soil Samples 6-2

Table 6-2 Soil Population Groupings Considered 6-4

Table 6-3 Soil Statistical Results for Parameters Differentiated by Geologic Formation 6-6

Table 6-4 Soil Statistical Results for Parameters Differentiated by Soil Classification 6-7

Table 6-5 Soil Statistical Results for Parameters Differentiated by Depth 6-8

Table 6-6 Soil Statistical Results for Parameters With Undifferentiated Data 6-8

Table 6-7 Recommended BTVs for Parameters Differentiated by Soil Classification 6-10

Table 6-8 Recommended BTVs for Parameters Differentiated by Depth..... 6-10

Table 6-9 Recommended BTVs for Parameters With Undifferentiated Populations..... 6-11

Table 6-10 Groundwater Data Used for Statistical Analysis……..6-12

Table 6-11 Well Grouping for Statistical Analysis as Two Groupings……..6-13

Table 6-12 Final Well Grouping for Groundwater Statistical Analysis……..……..……..6-15

Table 6-13 Groundwater Parameter Summary..... 6-17

Table 6-14 Groundwater Statistical Results for Parameters with Distinct Populations for One or More Well Groupings: Alluvial, Muddy Creek - North, and Muddy Creek - Mesa Wells.... 6-18

Table 6-15 Groundwater Statistical Results for Parameters with Populations Undifferentiated by Alluvial, Muddy Creek - North, or Muddy Creek - Mesa Well Locations..... 6-19

Table 6-16 Recommended Groundwater BTVs for Parameters with Three Distinct Populations: Alluvial, Muddy Creek – North, and Muddy Creek - Mesa Wells..... 6-20

Table 6-17 Recommended Groundwater BTVs for Parameters With Undifferentiated Populations……..……6-20

Table 7-1 Soil Statistical Populations 7-3

Table 7-2 Comparison of Soil Recommended BTVs and Current Screening Levels 7-4

Table 7-3 Groundwater Statistical Populations..... 7-7

Table 7-4 Comparison of Groundwater Recommended BTVs and Current Screening Levels..... 7-8

APPENDICES

Appendix A - Figures..... A-1

Appendix B - Photographs..... B-1

Appendix C - Field Documentation C-1

Appendix D - Laboratory Data Summary D-1

Appendix E - Soil Physical Analysis Reports.....E-1

Appendix F - Statistical Calculations.....F-1

Appendix G - AqQA Data..... G-1

Section 1

Introduction

1.1 Introduction

The Reid Gardner Generating Station (Station) is a coal-fired electric power generation facility that was developed in 1964 and became commercially operational in 1965. It can produce approximately 600 megawatts (MW) of power from four generating units. The Station is located approximately 45 miles northeast of Las Vegas, within the Moapa Valley.

NV Energy (NVE) and the Nevada Division of Environmental Protection (NDEP) entered into an Administrative Order on Consent (AOC) for the Station on February 22, 2008 (NDEP and NVE, 2008). The AOC calls for NVE to continue with environmental contaminant characterization activities and for the identification of corrective actions and/or clean-up measures for the soil and groundwater at the Station. The Scope of Work in Appendix B of the AOC requires that NVE conduct an assessment of background conditions. Because many parameters are naturally occurring in the environment, background concentrations need to be established that represent the expected conditions if there were no influence from Station activities. These background soil and groundwater concentrations will be used to evaluate the impacts to the environment from the Station and to help determine whether corrective actions are necessary to protect human health and the environment. In 2003, NDEP approved background concentrations for groundwater at the Station that consisted of average concentrations of data from a limited number of monitoring wells. A more rigorous evaluation of background groundwater conditions was needed to develop concentrations that better represent background groundwater for the Station. Background conditions for soil had never been established for the Station.

On January 10, 2010, NVE submitted the *Evaluation of Background Conditions* Workplan (Workplan) (Stanley Consultants, 2010) to NDEP. Approval of the Workplan was received from NDEP, with comments, on February 25, 2010. The application of the background concentrations to the AOC implementation was stated in the Workplan as follows, *"Parameter levels in soil and groundwater will be evaluated and compared with background levels and other applicable action levels to evaluate whether remediation is required. These values will also be used to evaluate whether remediation is complete"* (Stanley Consultants, 2010).

This report provides the results of the Workplan implementation. It summarizes the background soil and groundwater investigations conducted December 2011 through March 2012, aquifer testing conducted in August 2012, and proposes background soil and groundwater concentrations.

1.2 Objective

The objective of this report is to statistically determine background threshold values (BTVs) of Site-Related Chemicals (SRCs) in soil and groundwater at the Station. In addition, data were collected from aquifer testing to estimate aquifer characteristics for both the Muddy Creek and alluvial aquifers, evaluate the hydraulic connection between the two aquifers, and evaluate the potential hydraulic connection between the alluvial aquifer and the Muddy River.

1.3 Site Setting

The Station is located within the Moapa Valley, which is a relatively flat-bottomed desert valley that includes the Muddy River, a spring-fed perennial stream that runs through the Station property. The Station property also includes a Class III permitted landfill on a Mesa that is approximately 150 feet above the surrounding area. Prior to 1964, the area was native desert or irrigated pastureland.

1.4 Station History

The first two generating units at the Station went into service in 1965 and 1968. A third unit was added in 1976, followed by the fourth unit that was commissioned in 1983. Since 1965, there have been many modifications and improvements to the facility.

The Station currently obtains its process water supply from a combination of off-site groundwater wells and upstream surface water withdrawals from the Muddy River. The water is combined and stored in the Raw Water Ponds at the north side of the Station. Water is used without treatment for dust control, fire protection, in the cooling towers, and for miscellaneous use (utility water). After use, utility water is discharged to the ash transport and dewatering system. Some of the raw water is treated by demineralization and then used in the boilers. Cooling tower blowdown is treated before it is reused in the air pollution control equipment. To reduce water usage, the Station recycles its water as much as possible. Water which has been used beyond serviceable limits is discharged to lined evaporation ponds. There are no surface water discharges of wastewater from the Station.

The evaporation ponds were originally designed and constructed according to engineering practices and regulations in effect at the time of construction. Some of the first ponds were not lined. Other early ponds tied into existing geologic clayey soils and had berms that were built to engineering standards. Groundwater at the Station has been impacted by past leakage from these ponds. Today, all active evaporation ponds are double-lined with high density polyethylene (HDPE) and have an interstitial leak-detection and collection system to protect groundwater.

Wastes historically and currently generated at the Station include, but are not limited to, fly ash and bottom ash left from coal combustion, pond solids (fly ash, bottom ash, salts remaining after evaporation), water treatment wastes, and municipal-type solid wastes. Historically, many of these wastes have been disposed at locations throughout the plant that have been designated as Waste Management Units (WMUs).

1.5 Prior Background Investigations

In 2003, NDEP approved background concentrations for groundwater at the Station that consisted of average concentrations of data from a limited number of monitoring wells. The 2008 AOC required that NVE conduct an assessment of background conditions. A more rigorous evaluation of background groundwater conditions was needed to develop concentrations that better represent background groundwater for the Station. In addition, background conditions for soil had never been established for the Station. The following paragraphs provide the 2003 groundwater background concentrations for the Station and summarize background concentrations available from other studies in the area of the Station. The published soil and groundwater background concentrations for Clark County and other areas of Nevada are provided for comparison with the background concentrations developed for the Station.

1.5.1 Prior Soil Background Investigations

Prior to this investigation, background conditions for soil had not been established for the Station. A regional study of background soil concentrations was completed by the United States Geological Survey (USGS) for the State of Nevada in 1984 (Shacklette and Boerngen, 1984). The background soil concentrations included in this study are summarized on Table 1-1.

Table 1-1 **Regional Soil Concentrations**

Parameter	USGS – Nevada – 1984[1]
Metals (mg/kg)	
Aluminum	700 - >1,000
Antimony	<1 - 10
Arsenic	<0.1 - 100
Barium	10 - 5,000
Beryllium	<1 - 15
Boron	<20 - 300
Cadmium	NA
Calcium	130 - 330,000

Table 1-1 **Regional Soil Concentrations**	
Parameter	**USGS – Nevada – 1984[1]**
Metals (mg/kg)	
Chromium (hexavalent)	NA
Chromium (total)	1 - 2,000
Cobalt	<3 - 70
Copper	<1 - 700
Iron	100 - >100,000
Lead	<10 - 700
Magnesium	200 - >100,000
Manganese	<2 - 7,000
Mercury	<0.01 - 5.1
Molybdenum	<3 - 15
Nickel	<5 - 700
Potassium	2,200 - 65,000
Selenium	<0.1 - 5
Silica	NA
Silver	NA
Sodium	3,000 - 100,000
Thallium	NA
Titanium	70 - 20,000
Vanadium	30 - 500
Zinc	28 - 3,500

Note – not applicable (NA)
[1]Shacklette and Boerngen, 1984. *Element Concentrations in Soils and Other Surficial Materials in Conterminous United States*, Geological Survey Professional Paper 1270, U. S. Geological Survey, 1984.

1.5.2 Prior Groundwater Background Investigations

Groundwater beneath the Station occurs in basin fill deposits (alluvial aquifer, Muddy Creek aquifer, and Horse Springs aquifer), and in the underlying carbonate aquifer of the White River Flow System (WRFS). There have been numerous studies of background water quality completed on regional water production wells; however, most of these wells are completed in the carbonate aquifer, and the analytical data were typically for general chemistry parameters. Few wells were completed in the Muddy Creek aquifer because it is a poor aquifer for water production.

Two studies were found that included analysis of wells completed in the alluvial aquifer. In 1991, the USGS completed a study of water chemistry and isotopic data for wells, springs, and streams in southern and eastern Nevada (Thomas, et al, 1991). In 1987, The Desert Research Institute (DRI) studied the southern end of the Meadow Valley Wash and the White River drainage system (Schroth, 1987). The background groundwater concentrations included in these studies are summarized on Table 1-2. The groundwater aquifers are discussed in detail in Section 3.4.

Table 1-2 **Regional Alluvial Groundwater Concentrations**	
Parameter	**Range**
Metals (mg/L) (dissolved)	
Barium	0.049-0.34[1]
Beryllium	<0.0005[1]
Cadmium	<0.001[1]
Calcium	33-137[3]
Cobalt	<0.003[1]
Copper	<0.010[1]
Fluoride	0.5-1.2[1]
Iron	0.01-0.77[1]
Lead	<0.010[1]
Magnesium	7.5-70.4[3]
Manganese	0.8 – 0.3[1]
Molybdenum	<0.010-0.02[1]
Potassium	1.2-19.9[3]
Silica	14-65[3]
Sodium	34-306[3]
Vanadium	<0.006[1]
Zinc	0.006–0.55[1]
General Chemistry (mg/L)	
Bicarbonate (HCO3)	160-361[3]
Chloride	26-219[3]
Nitrogen, Ammonia (as N)	0.06-0.47[1]
pH	7.0-8.4[3]
Total Phosphorous	0.01-0.04[1]
Specific Conductance	460-820[1]
Sulfate	20-670[3]
Total Dissolved Solids (TDS)	499-1620[2]

[1] Range compiled using data from three monitoring wells; VF-1, CSV-3, and SHV-1 from Thomas, et al, 1991. *Chemical and Isotopic Data from Water from Wells, Springs, and Streams in Carbonate-Rock Terrain of Southern and Eastern Nevada and Southeastern California*, 1985-88, U.S. Geological Survey Open File Report 89-422.
[2] Range compiled using data from 11monitoring wells; Anderson, Lewis #1-#3, Abbot, NPC #1-#5, and EH-1 from Schroth, 1987 *Water Chemistry Reconnaissance and Geochemical Modeling in the Meadow Valley Wash Area, Southern Nevada*. Desert Research Institute, Water Resources Center, April 20, 1987; Selenium and Silica only Abbot, NPC wells, and EH-1.
[3] Range compiled using data from both Thomas and Schroth.

Background conditions in groundwater at the Station were first addressed in the Revised Hydrogeologic Characterization Report prepared by NVE and dated February 20, 2002 (NPC, 2002). NVE used data from monitoring wells KMW-2S, M, and D; IMW-2.5S and D; IMW-3S and D; KMW-16; HP-2S; and HP-15S to demonstrate background groundwater quality.

In letters to NDEP dated June 25, 2003 (NPC, 2003a), and October 1, 2003 (NPC, 2003b), NVE reevaluated background groundwater quality when requesting a reduction in quarterly groundwater monitoring requirements. NVE utilized concentration data from well clusters

IMW-2.5 and KMW-2. In approval letters from the NDEP to NVE dated September 8, 2003, and October 23, 2003 (NDEP, 2003), action levels for groundwater at the Station were established at these background concentrations or relevant drinking water standards, whichever was higher, as shown in Table 1-3 below.

Table 1-3 **Action Levels Established for Station Groundwater in 2003**

Parameter	Average Station Background Concentration (2003)[1]	NDEP Action Level for Reid Gardner Station (2003)	Nevada Drinking Water Standard[2]
Metals (mg/L)			
Aluminum	0.32	0.32	0.2
Arsenic	0.162	0.16	0.01
Barium	0.07	2	2
Beryllium	<0.005	0.004	0.004
Boron	1.4	1.4	NA
Cadmium	<0.005	0.005	0.005
Chromium	0.06	0.1	0.1
Iron	0.85	0.85	0.6
Lead	ND	0.015	0.015
Magnesium	165	165	150
Manganese	0.27	0.27	0.1
Mercury	ND	0.002	0.002
Molybdenum	0.033	0.03	NA
Nickel	<0.04	0.7	NA
Selenium	0.008	0.05	0.05
Sodium	520	520	NA
Titanium	0.013	0.01	NA
Vanadium	0.004	0.004	NA
General Chemistry (mg/L)			
Nitrate	0.42	10	10
Chloride	520	520	400
Phosphate	0.2	0.2	NA
Sulfate	1072	1070	500
Total Dissolved Solids (TDS)	2570	2570	1000

Note – non-detect (ND), not applicable (NA), milligrams per liter (mg/L)
[1]Average of IMW-2.5 S and D data from 1996-2003 and KMW-2S, M, and D data from 1998-2003. (NPC, 2003a; NPC, 2003b)
[2]Federal/Nevada Primary and Secondary MCLs.

These 2003 NDEP Action Levels will be replaced by the BTVs developed in this Report. The BTV evaluation is presented in Section 6, and a comparison of the NDEP Action Levels established in 2003 to the recommended BTVs is included in Table 7-4.

Section 2

Field Activities

2.1 Sampling Preparation

The background well installation and soil sampling activities included installation of five new well cluster locations; BG-1, BG-2, BG-3, BG-4, and BG-6; each with a shallow, medium, and deep well. Although the Workplan only included installation of four well clusters (BG-1 through BG-4), a fifth well cluster was added, as noted in Section 2.3. Originally, the fifth well cluster was identified as BG-5, but a different location was later chosen and designated as BG-6. Therefore, a BG-5 well cluster was never installed. Figure 1 in Appendix A shows the location of the well clusters. For lithology determination and well screen placement, soil samples were collected continuously from the deep boring at each of the five new well cluster locations. Selected soil samples were collected for chemical and physical laboratory analyses. Field activities were conducted in general accordance with the procedures and protocols in the Workplan and the Generic Quality Assurance Project Plan (QAPP) (Stanley Consultants, 2011a).

NVE, Stanley Consultants, Eagle Drilling Services, and Converse Consultants held a "kick-off" conference call on December 14, 2011, to discuss site safety requirements, responsibilities, and logistics for the upcoming field activities scheduled to start on December 19, 2011. A second kick-off conference call was held on December 16, 2011, between NVE, Stanley Consultants, ESC Lab Sciences (ESC), Veritas Laboratories (Veritas), and Ordway and Associates pertaining to sampling, analysis, reporting, and data quality requirements for the background sampling activities.

2.1.1 Access Agreements and Permits

SWCA Environmental Consultants (SWCA) was tasked with completing the Plan of Development (POD), Environmental Assessment (EA), and the Finding of No Significant Impacts (FONSI) necessary for the Bureau of Land Management (BLM) to grant right-of-way (ROW) permits to allow installation and sampling at the five new background well clusters. SWCA also provided biologists to survey the ROW for desert tortoises, identify and

mark protected vegetation, monitor for desert tortoises, and monitor compliance with the biological opinion during all background activities performed on BLM property. The BLM issued the ROW permits for the well clusters and associated access roads on December 1, 2011 (BLM, 2011).

A Dust Control for Construction Activities permit from the Clark County Department of Air Quality and Environmental Management (DAQEM) was obtained by Eagle Drilling Services, the Nevada licensed well driller contracted for background activities, on December 11, 2011 (DAQEM, 2011). Eagle Drilling Services also submitted the Notice of Intent to drill and the Well Logs and Records of Work to the Nevada Division of Water Resources (NDWR).

NVE Daily Work Permits were obtained by Eagle Drilling Services during soil boring, well installation, and well development activities. Eagle View Contractors obtained NVE Daily Work Permits during aquifer testing activities. OGI Environmental Consultants (OGI) obtained NVE Daily Work Permits for the groundwater sampling activities.

2.1.2 Project Field Parties

Parties participating in the Background Conditions activities are listed in the table below.

Table 2-1 **Background Activities Parties**

Company	Responsibility
NVE	BLM permitting, surveying
USA North Utilities	Utility clearances
SWCA	Desert tortoise awareness training, biological monitoring
Eagle Drilling Services	Well installation and development, utility clearances, dust permit
Eagle View Contractors	Aquifer testing assistance, dust control, purge water hauling and disposal
FHI Plant Services	Soil cutting hauling and disposal
Veritas	Chemical laboratory analysis – primary laboratory contracted to NVE
ESC	Chemical laboratory analysis – subcontracted to Veritas
TestAmerica	Chemical laboratory analysis – subcontracted to Veritas
Fiberquant	Chemical laboratory analysis – subcontracted to Veritas
Converse Consultants	Analysis of soil samples for physical properties
OGI	Groundwater sampling
Stanley Consultants	Field oversight, boring logs, sampling, aquifer testing
Ordway and Associates	Chemical laboratory data validation

2.1.3 Health and Safety

A General Health and Safety Plan (HASP) dated March 2008, and accepted by NDEP on March 31, 2008, was the basis for the completion of a task-specific HASP in April 2011 (Stanley Consultants, 2011b).

On December 19, 2011, prior to the start of background investigation activities, field personnel received site-specific safety training from NVE and desert tortoise awareness training from SWCA. Eagle Drilling Services conducted a "tailgate" health and safety meeting prior to the start of each day's activities. Field personnel were required to sign a daily log attesting that they attended the tailgate meeting and had reviewed the HASP.

2.1.4 Utility Clearances

Eagle Drilling Services was responsible for working with USA North Utilities to locate underground utilities for all boring activities. As an added precaution, Eagle Drilling Services removed the upper five feet of soil with an air knife prior to drilling at each location. At BG-1, representatives from Moapa Valley Water Authority and Overton Power District were onsite to clear drilling locations due to a buried communication line located along the south side of the access road and the possibility of other underground utilities in the area.

2.2 Field Procedures

2.2.1 Dates of Field Activities

Background soil boring advancement, soil sampling, and monitoring well installation activities were conducted December 19, 2011, through March 8, 2012. Well development activities began immediately after the monitoring well installation was completed and continued through March 17, 2012. Background groundwater samples were collected on March 20-24, May 21-31, August 21-30, and November 26-28, 2012. Photographs of the field activities are provided in Appendix B.

2.2.2 Drilling Methods

Soil borings were advanced by Eagle Drilling Services using a Sonic SDC550 track drilling rig. Continuous soil cores were collected from each of the borings and logged in accordance with the Unified Soil Classification System (USCS) and American Society for Testing and Materials (ASTM) Standard D 2488-09a, (ASTM, 2009). Boring logs are provided in Appendix C. Table 2-2 summarizes the soil boring and monitoring well installation activities.

Table 2-2 **Soil Boring and Monitoring Well Summary**						
Well ID	**Start Date**	**Completion Date**	**Total Boring Depth (ft. bgs)/Bottom Elevation (AMSL)**	**Monitoring Well Screen Interval[1] (ft. bgs)/Screen Elevation (AMSL)**	**Depth to Water[2] (ft. bgs)**	**Formation (ft. bgs)**
BG-1S	1/13/2012	1/13/2012	43 (1567.39)	18 – 38 (1595.13-1575.13)	25	
BG-1M	1/10/2012	1/12/2012	73 (1537.14)	52 – 67 (1561.24-1546.24)	25	Alluvium 0-42'
BG-1D	1/4/2012	1/9/2012	105 (1504.88)	85 – 100 (1527.95-1512.95)	25	Muddy Creek 42'-105'
BG-2S	12/29/2011	12/30/2011	40 (1573.73)	15 – 35 (1602.23-1582.23)	21	
BG-2M	12/28/2011	12/29/2011	65 (1548.99)	40 – 60 (1577.59-1557.59)	22	Alluvium 0-24.5'
BG-2D	12/20/2011	12/27/2011	100 (1514.15)	78 – 93 (1539.65-1524.65)	27	Muddy Creek 24.5'-100'
BG-3S	3/5/2012	3/7/2012	80 (1541.07)	60 – 75 (1563.60-1548.60)	61	
BG-3M	2/29/2012	3/5/2012	117 (1504.30)	95 – 110 (1528.60-1513.60)	61	Alluvium 0-11'
BG-3D	2/21/1012	2/29/2012	151 (1470.22)	130 – 145 (1493.91-1478.91)	61	Muddy Creek 11'-151'
BG-4S	2/1/2012	2/2/2012	105 (1554.94)	72 – 97 (1590.43-1565.43)	80	
BG-4M	1/27/2012	1/31/2012	135 (1524.52)	115 – 130 (1547.43-1532.43)	80	
BG-4D	1/17/2012	1/26/2012	174 (1485.55)	152 - 167 (1510.52-1495.52)	80	Muddy Creek 0'-174'
BG-6S	2/15/2012	2/16/2012	72 (1544.27)	47 – 67 (1571.85-1551.85)	53	
BG-6M	2/13/2012	2/15/2012	105 (1511.26)	84 – 99 (1535.20-1520.20)	53	Alluvium 0-11'
BG-6D	2/6/2012	2/13/2012	135 (1481.25)	115 – 130 (1504.37-1489.37)	53	Muddy Creek 11'-135'

Note – Depths measured below ground surface (bgs) and surveyed to above mean sea level elevations (AMSL)
[1] All wells constructed with 5' tailpipe below the screen interval. Some borings advanced more than 5' below tailpipe due to flowing sand
[2] Depth to water bgs at the time of well completion

2.2.3 Soil Sample Collection

Soil samples were collected to evaluate chemical and/or physical differences between the lithologies and formations as well as to establish background chemical concentrations for soil. Continuous soil cores were collected from each deep boring for lithology determination and monitoring well screen placement. Soil samples were collected from the cores for chemical and physical analyses from different lithology and stratigraphic units above and below the observed water table. Samples for chemical analyses were placed in laboratory jars supplied by Veritas and placed on ice in coolers under standard laboratory chain-of-custody (COC) procedures. Soil samples for physical analyses were placed in laboratory containers supplied by Converse Consultants. Undisturbed soil samples were collected for permeability testing by driving a split-spoon sampler lined with brass rings.

Samples were collected in general accordance with the procedures and protocols in the Workplan. At each of the five deep borings, soil samples were collected for chemical and physical laboratory analysis as summarized in Table 2-3.

Table 2-3 **Soil Sampling Summary**					
Boring ID	**Depth (ft. bgs)**	**Type of Analyses**		**Soil Classification**	**Formation**
		Chemical	**Physical**		
BG-1	0-2	X		CH – Fat Clay	Alluvium
	10	X		ML – Sandy Silt with Gravel	Alluvium
	19	X		SW – Well Graded Sand with Gravel	Alluvium
	19-22		X	SW/GW –Well Graded Gravel	Alluvium
	29	X		CL/SP – Sandy Lean Clay/Poorly Graded Sand	Alluvium
	40	X	X	GW – Well Graded Gravel with Sand	Alluvium
	43	X		CL – Lean Clay	Muddy Creek
	45-48		X	SM/CL – Silty Sand/Sandy Lean Clay	Muddy Creek
	46	X		SM/CL – Silty Sand/Sandy Lean Clay	Muddy Creek
	55	X		CL – Lean Clay with Gravel	Muddy Creek
	62-65		X	CL/SM – Lean Clay with Sand/Silty Sand	Muddy Creek
	78	X		CL – Lean Clay	Muddy Creek
	92	X		SM – Silty Sand	Muddy Creek
	99-102		X	CL/SM – Lean Clay/Silty Sand	Muddy Creek
BG-2	0-2	X		SP – Poorly Graded Sand	Alluvium
	10	X		SP – Poorly Graded Sand	Alluvium
	19	X		SM – Silty Sand with Gravel	Alluvium
	19-21		X	SM – Silty Sand with Gravel	Alluvium
	21	X		SM – Silty Sand with Gravel	Alluvium
	30	X		SM – Silty Sand	Muddy Creek
	32	X		CH – Fat Clay	Muddy Creek
	42-44		X	CL/CH – Lean Clay with Sand/Fat Clay	Muddy Creek
	58	X		SM – Silty Sand	Muddy Creek
	59-62		X	CH – Fat Clay	Muddy Creek
	75	X		SM – Silty Sand	Muddy Creek
	75-77		X	SM/CH – Silty Sand/Sandy Fat Clay	Muddy Creek
	81	X		CH – Fat Clay	Muddy Creek
	82 – 84		X	SM – Silty Sand	Muddy Creek
BG-3	0-2	X		SP-SM – Sand with Silt and Gravel	Alluvium
	10	X		SM – Silty Sand	Alluvium
	17	X		CL – Lean Clay	Muddy Creek
	22	X		CL – Lean Clay	Muddy Creek
	29	X		SP – Poorly Graded Sand	Muddy Creek
	40-42		X	CL/SP – Lean Clay/Poorly Graded Sand	Muddy Creek
	58-60		X	SP/CH –Silty Sand/Fat Clay	Muddy Creek
	63	X		SP – Poorly Graded Sand	Muddy Creek
	65	X		SP – Poorly Graded Sand	Muddy Creek
	69	X		CL – Lean Clay	Muddy Creek
	80-82		X	SM/CL – Silty Sand/Lean Clay	Muddy Creek
	95	X		SP – Poorly Graded Sand	Muddy Creek
	100-102		X	SP/SM –Poorly Graded Sand/ Silty Sand	Muddy Creek
	105	X		ML – Sandy Silt	Muddy Creek
	120-122		X	SM – Silty Sand	Muddy Creek
	131	X		SM – Silty Sand	Muddy Creek
	136	X		SM – Silty Sand	Muddy Creek
	142-145		X	ML/CL – Sandy Silt/Lean Clay with Sand	Muddy Creek

Table 2-3 **Soil Sampling Summary**					
Boring ID	**Depth (ft. bgs)**	**Type of Analyses**		**Soil Classification**	**Formation**
		Chemical	**Physical**		
BG-4	0-2	X		CL – Sandy Clay	Muddy Creek
	10	X		SC – Clayey Sand	Muddy Creek
	19	X		CL – Lean Clay	Muddy Creek
	20-22		X	CL – Lean Clay	Muddy Creek
	40	X		CL – Lean Clay	Muddy Creek
	40-42		X	CL/CH – Lean Clay/Fat Clay	Muddy Creek
	60-62		X	ML – Silt with Sand	Muddy Creek
	65	X		SC – Clayey Sand	Muddy Creek
	79	X		CL – Lean Clay	Muddy Creek
	80-82		X	CL/ML – Lean Clay/Silty Clay	Muddy Creek
	82	X		ML – Silty Clay	Muddy Creek
	95	X		CL/SP/ML – Interbedded Clay/Sand/Silt	Muddy Creek
	100-102		X	ML/CL – Sandy Silt/ Sandy Lean Clay	Muddy Creek
	117	X		SC – Poorly Graded Sand	Muddy Creek
	120	X		SM – Silty Sand	Muddy Creek
	120-122		X	SM/CL – Silty Sand/ Lean Clay	Muddy Creek
	140-142		X	SM/CL – Silty Sand/ Lean Clay	Muddy Creek
	160-162		X	CL – Lean Clay	Muddy Creek
	161	X		CL – Lean Clay	Muddy Creek
	163	X		CL – Lean Clay	Muddy Creek
BG-6	0-2	X		GW – Well Graded Gravel with Sand	Alluvium
	9	X		SW – Well Graded Sand with Gravel	Alluvium
	19-22		X	SP – Sand	Muddy Creek
	28	X		CH – Fat Clay	Muddy Creek
	40-42		X	CH/SM – Fat Clay/Silty Sand	Muddy Creek
	53	X		CH – Fat Clay	Muddy Creek
	58	X		SM – Silty Sand	Muddy Creek
	72-74		X	CH – Fat Clay	Muddy Creek
	75	X		CL/ML/SM – Interbedded Clay/Silt/Sand	Muddy Creek
	79-82		X	CL/ML/SM – Interbedded Clay/Silt/Sand	Muddy Creek
	87	X		CH – Fat Clay	Muddy Creek
	98	X		SM – Silty Sand	Muddy Creek
	99-102		X	SM – Silty Sand	Muddy Creek
	114	X		ML – Sandy Silt	Muddy Creek
	119-122		X	CH/ML – Fat Clay/Sandy Silt	Muddy Creek
	127	X		CL/ML/SM – Interbedded Clay/Silt/Sand	Muddy Creek

2.2.4 Well Installation

Permanent monitoring wells were installed to collect groundwater data for establishing background concentrations as well as to evaluate water quality in different aquifers and at varying depths within the saturated zones that are potentially isolated by confining layers. At each of the five new well cluster locations, three separate soil borings were advanced to varying depths within the saturated zones of the underlying alluvial and bedrock aquifers. The borings were converted to groundwater monitoring wells designated as shallow, medium, and deep, with the depths based on hydrogeology, aquifer characteristics, and well depth designations previously established. The shallow well designation corresponds to well screens that were set within the upper 25 feet of the saturated zone of the aquifer. A well designated as medium has the screen set at a depth between 25 feet to 50 feet into the saturated zone of the aquifer. A well screen set at a depth greater than 50 feet into the saturated zone has a deep well designation. The well depth designations correlate to IMW and KMW well clusters previously installed at the Station by Intellus and Kleinfelder, which were used to establish background groundwater concentrations in 2003. At all locations, flowing or heaving formation sands caused difficulties in setting the wells. On numerous occasions, well materials were pushed up the borehole above the intended well completion depths, which required that the material be removed and the boreholes over drilled in an attempt to set the bottom of the well in a competent clay layer.

Monitoring well installation was in general accordance with the United States Environmental Protection Agency (EPA) Standard Operating Procedures (SOPs) in the QAPP, Nevada Administrative Code (NAC) Chapter 534, and the NDEP Guidance Document for Design of Groundwater Monitoring Wells (NDEP, 1996). Four-inch-diameter threaded Schedule 40 polyvinyl chloride (PVC) well materials with varying lengths of 0.01-inch slot screen were used in the construction of the wells. A five-foot tailpipe with a threaded end cap was installed below the screen to act as a sediment trap or sump, and a locking expansion plug was placed in the top of the well. Expandable centralizers were attached to the PVC wells to position them in the center of the borehole. The annular space around the tailpipe and well screen was filled with #12 silica sand from the bottom of the borehole to approximately two feet above the top of the screen. Bentonite clay chips were installed a minimum of two feet above the filter pack sand to create a seal. Tremie pipes were used to inject bentonite grout slurry into the annular space of the borehole above the seal to within ten feet of the ground surface. Once the grout had cured, concrete slurry was used to fill the remainder of the annular space from the top of the grout to the ground surface. The surface of each well was completed with an approximate three-foot stickup steel protective casing and a concrete pad.

2.2.5 Well Development

Following well installation, the wells were developed to remove silt introduced during drilling activities, establish hydraulic communication with the aquifer, and enable the collection of representative groundwater samples. Eagle Drilling Services used submersible pumps for well development. Wells were purged by raising and lowering the pumps and varying the flow rate as required by the EPA SOPs in the QAPP. Stanley Consultants monitored conductivity, temperature, pH and turbidity for stabilization during the development in accordance with ASTM D5521-05 (ASTM, 2005). Imhoff cones were used

to visually assess the effectiveness of the well development activities. Well development water was pumped into a water truck and transported to an onsite evaporation pond for disposal in accordance with NVE's discharge permit. Table 2-4 summarizes the well development activities, and Well Development Forms are provided in Appendix C.

Table 2-4 **Well Development Summary**

Well ID	Date	Duration (min)	Total Well Depth (ft. btoc)	Initial Depth to Water (ft. btoc)	Maximum Drawdown (ft. btoc)	Approximate Pump Rate (gpm)	Total Gallons Purged
BG-1S	3/12/2012	37	45.74	27.87	28.73	5 – 7	180
BG-1M	3/9/2012	90	75.10	28.07	70.35	1 – 7	240
BG-1D	3/9/2012	124	108.07	27.64	54.50	2 – 5	500
BG-2S	3/9/2012	72	43.50	24.71	38.60	2 – 7	260
BG-2M	3/8/2012	67	68.60	24.75	64.75	1 – 7	200
BG-2D	3/8/2012	98	101.50	19.55	55.15	3 – 17	600
BG-3S	3/15/2012	78	82.53	65.42	78.46	1 – 2	130
BG-3M	3/16/2012	40	117.30	65.60	90.45	5	180
BG-3D	3/16/2012	50	152.69	67.39	88.72	10	240
BG-4S	3/13/2012	149	104.49	82.77	99.90	3 – 4	270
BG-4M	3/17/2012	74	137.91	82.53	119.67	10 – 11	360
BG-4D	3/12/2012	133	174.97	79.94	>135	10 – 27	630
BG-6S	3/15/2012	47	74.58	54.25	66.45	7	210
BG-6M	3/15/2012	40	106.94	55.35	78.72	8	280
BG-6D	3/15/2012	54	138.12	54.91	98.47	8	320

Note – depths measured below top of casing (btoc), pump rate in gallons per minute (gpm)

2.2.6 Groundwater Sample Collection

OGI collected four sets of groundwater samples from each of the 15 new background wells in 2012. In addition, OGI collected background groundwater samples at the same times from ten existing wells: IMW-2.5S and D; IMW-3S and D; KMW-2S, M, and D; LMW-7; LMW-9; and LMW-10. The IMW-3 wells were not sampled during the third and fourth sampling events due to BLM access restrictions. Groundwater samples were also collected from monitoring wells LMW-12R, LMW-13R, LMW-14R, LMW-15, and LMW-16 (installed in 2012 for non-AOC Mesa Pond monitoring); monitoring well LMW-11 (installed in 2006 for groundwater monitoring and abandoned in 2012), and replacement well LMW-11R. Groundwater samples were collected from these wells to provide additional groundwater data for statistical analyses.

Sample containers were supplied in advance by Veritas and pre-preserved, as appropriate. Groundwater samples were collected in general accordance with the procedures in the Workplan and the SOPs in the QAPP and placed on ice in coolers under standard laboratory COC procedures.

2.2.7 Quality Control Samples

Quality control (QC) samples (blanks and duplicates) were collected in accordance with the Workplan and QAPP and are discussed in Sections 5.1.1 and 5.2.1 For soil sampling, Equipment Blanks (EBs) and Field Blanks (FBs) were collected per Table 4 of the QAPP utilizing laboratory-grade deionized (DI) water and sample containers from Veritas. The FBs were collected by pouring DI water into sample containers while in the field in the background sampling areas. The EBs were collected by pouring DI water through a decontaminated split-spoon sampler and into a stainless steel bowl containing a stainless steel sampling utensil and nitrile glove. During the groundwater sampling events, duplicate samples, EBs, and FBs were collected in accordance with Table 4 of the QAPP. Dedicated disposable bailers, rope, and gloves were used to reduce the chance for cross-contamination. EBs were collected on non-dedicated sampling equipment, such as pumps and tubing, to evaluate the thoroughness of the decontamination process.

2.2.8 Sample Analysis

Soil, groundwater, and QC samples were delivered to Veritas for chemical analyses in accordance with the QAPP. All of the parameters in the following SRC categories were analyzed in both the soil and groundwater samples:

- general chemistry
- metals
- asbestos
- semi-volatile organic compounds (SVOCs) including polynuclear aromatic hydrocarbons (PAHs)

Samples were not analyzed for the SRC parameters total petroleum hydrocarbons (TPH), polychlorinated biphenyls (PCBs), dioxins, Volatile Organic Compounds (VOCs), aldehyde, diols, and radionuclides. The background sampling locations were chosen in areas that have not been impacted by Station activities. Although SVOCs are generally related to human activity and not naturally occurring, they are widely detected in soils, therefore all samples were analyzed for SVOCs. TPH, PCBs, dioxins, VOCs, aldehyde and diols are generally related to human activity, not naturally occurring and not widely detected in soil samples, therefore background soil samples were not analyzed for these parameters. Radionuclides were not analyzed for per the August 11, 2009, conference call between NDEP, NVE, LFR (ARCADIS), and Stanley Consultants.

The soil chemical analytical results organized by SRC categories are summarized in Appendix D, Table D-1. Table D-1 in excel format and the data in pivot table format are included electronically at the end of this report. In addition to the SRC parameters; bicarbonate, carbonate, and nitrite were analyzed in the groundwater samples so that a cation/anion balance could be calculated, as described in the Workplan and QAPP.

Converse Consultants provided sample containers for the soil samples for physical characteristics analysis. Samples were delivered to the Converse laboratory for analysis of the following parameters by ASTM methods:

- bulk density
- grain size
- permeability
- pH
- Atterberg limits
- Percent moisture content
- Total organic content (TOC)

2.2.9 Decontamination

Decontamination of sampling equipment was conducted in accordance with the Workplan and the QAPP. All equipment that came into contact with soil or groundwater was decontaminated between uses unless the equipment was only used once. The sampling equipment included bowls, spoons, and trowels used for soil sampling, as well as pumps and tubing used for groundwater sampling. Decontamination procedures consisted of washing with an Alconox and water solution, rinsing with DI water, and air drying. In addition, the bowls, spoons, and trowels used for soil collection were rinsed with hexane, nitric acid, and hydrochloric acid to remove residual metals contamination. Dedicated disposable equipment such as bailers, rope, and gloves, was used when practical to minimize the potential for cross-contamination.

2.2.10 Investigation-Derived Waste

The investigation-derived waste was disposed in accordance with the Workplan and applicable regulations. Soil cuttings were disposed in NVE's onsite landfill in accordance with their Southern Nevada Health District (SNHD) Class III landfill permit. Well development and purge water, aquifer test water, and decontamination wash water was containerized and disposed in the onsite evaporation ponds in accordance with NVE's discharge permit. Decontamination chemicals consisting of hexane, nitric acid, and hydrochloric acid were used sparingly and were collected, containerized, and allowed to evaporate, as described in the QAPP.

2.2.11 Surveying

NVE and Stanley Consultants marked the planned background well locations and ROW access areas with survey stakes on December 7, 2011. The 100 foot by 100 foot permanent ROW areas and the temporary 200 foot by 200 foot construction ROW areas were staked and flagged with different color survey tape. Following well installation and development, NVE surveyed the wells on April 2, 2012. The survey data for the ROW and background well locations are included in Appendix C.

2.3 Deviations

The following is a summary of deviations to the NDEP-approved Workplan and QAPP.

Table 2-5 **Deviations**			
Workplan Requirement	**Reference**	**Deviation**	**Notes**
Monitoring wells to be installed in alluvial aquifer	Workplan Section 4. 1	Monitoring wells were installed in a combination of alluvium and Muddy Creek formations	Alluvium was not present at all locations and objectives changed to include evaluating groundwater quality in the Muddy Creek Formation as well as the alluvium. NDEP was notified of this deviation through the Daily Field Activity Reports.
A total of 25 groundwater samples will be collected for laboratory analyses	Workplan Section 4.1	A total of 121 groundwater samples were collected for laboratory analyses. Including historical data from existing background wells, the total number of groundwater samples used was 240.	Increased quantity of groundwater data collected and used for statistical analysis. Approval of the use of the Mesa Pond wells was provided by NDEP at the March 13, 2012, quarterly AOC meeting. NVE believes the Mesa Pond wells represent background conditions because these wells are in an area that has recently been developed and it is unlikely that these wells could already be impacted by the new ponds. In addition, these wells are located either cross-gradient or up-gradient of previous Station activities and source areas.
Collect 5 to 10 soil samples per boring for chemical analysis, one sample per boring from the Muddy Creek Formation; collect physical samples from confining layers and the top of the Muddy Creek Formation	Workplan Sections 4.2 and 5	Collected 8 to 12 soil samples per boring for chemical analysis, 4 to 12 samples per boring collected in the Muddy Creek Formation; physical samples collected from alluvium and Muddy Creek formations	Increased quantity of data collected. NDEP was notified of this deviation through the Daily Field Activity Reports.
Laboratory Services provided by ATL Laboratories	Workplan Section 5	Chemical analyses was performed by Veritas, ESC, Test America, and Fiberquant, all Nevada-certified laboratories	This deviation was approved by NDEP in letters dated September 1, 2011 (NDEP, 2011), and January 6, 2012 (NDEP, 2012).
Conduct slug tests for aquifer analysis, drawdown and recovery analysis on all new background monitoring wells	Workplan Section 6.3	Step and constant rate tests performed on two well clusters	This deviation was approved by NDEP in the subsequent Site-Specific Aquifer Testing Outline Memo dated May 24, 2012 (NVE and Stanley Consultants, May 2012). NVE agreed to conduct step drawdown and recovery tests on BG-1, IMW-3, and KMW-2 wells (per the Aquifer Testing Procedure Memo). Aquifer testing was not completed on the IMW-3 wells as a result of NVE's determination that they did not have adequate access from BLM to the IMW-3 wells. NDEP was informed of this deviation in an email correspondence dated July 19, 2012.
Laboratory analyses to include total phosphorous	Workplan Appendix E	Laboratory reported phosphates as P	This deviation was an oversight during the change in contracted laboratory services. Corrective action for this deviation is reporting future analyses as total phosphorous. Soil remediation would not be based on phosphorous concentrations, and there are no screening levels for total phosphorous or phosphates as P.

Section 3

Geology

3.1 Regional Geology

The Station is located in the Moapa Valley within the Basin and Range physiographic province characterized by isolated long and narrow parallel mountain ranges, trending roughly north-south, separated by broad intervening valleys. The mountains surrounding the Station consist of complex folded and faulted blocks of sedimentary and igneous rocks. The sedimentary formations making up the mountain ranges are primarily a mixture of dolomite, gypsum, limestone, quartzite, sandstone, and shale. Volcanic activity in the mountains has resulted in formations of basalt, latite and rhyolite (Bagley, 1980). A Regional Geologic Map is included as Figure 2 in Appendix A.

Moapa Valley floor sediments are described as gravel, sand, silt, and clay that were deposited in a former lake environment that covered much of southern Nevada, along with braided and meandering streams. These former lake bottom deposits formed the Muddy Creek Formation in the Moapa Valley area. *"These deposits, coarse grained near the mountain borders, grade basinward into regular beds of fine-grained sandstone, silt, and clay. Except in a few disturbed zones near faults the beds are nearly everywhere flat lying"* (Longwell, et al., 1965). The formation varies considerably in thickness from the edges to the centers of each basin and also from basin to basin.

The Muddy River meanders through the center of the Moapa Valley eroding the surface of the Muddy Creek Formation, leaving a sharp contact and depositing a thick sequence of unconsolidated alluvium over it in narrow and linear paleochannels.

3.1.1 Alluvium

Alluvium is generally described as unconsolidated material that differs widely in character and origin. The alluvium in the Moapa Valley consists of clay, silt, sand, and gravel deposits on the old flood plains of the Muddy River, and is generally of Quaternary age. These

floodplain deposits are composed of sediments eroded from the nearby mountain ranges as well as re-worked materials from the underlying Muddy Creek Formation (Eakin, 1964). "*For the most part, these [alluvial] deposits consist of fine-grained overbank deposits that have resulted from past floods overflowing the river channel and depositing clay, clayey sand, silty sand, and sand. These deposits are at least 75 feet deep next to the river*" (Converse Consultants, 2009). The gravel deposits in the alluvium consist primarily of dolomite, limestone, and volcanic rocks with minor amounts of caliche and sandstone from adjacent highlands. "*Clasts within the alluvium are primarily composed of volcanic material. Boulders and cobbles are common. Due to the mode of deposition, no distinct beds or units are continuous over the area"* (ENSR, 2005). This mode of deposition resulted in the presence of an unconformity between the alluvium and underlying deposits as summarized in Table 3-1. The presence of an unconformity indicates a sharp distinct contact rather than gradational transition between deposits.

The alluvium thickness in the Muddy River Basin ranges from 0 - 100 feet, but in general is about 50 - 60 feet thick (Maxey, et al., 1966). Well driller's logs for NVE exploration wells located approximately 2-3 miles northwest of the Station describe the alluvium as a mixture of sand, silt, clay, and gravel, ranging from 75 feet to 135 feet thick (logs numbers 9836/Behmer and 35225) (NDWR, 2013). The exploratory well locations are shown on Figure 2 in Appendix A.

3.1.2 Post-Muddy Creek Tertiary Deposits

Post-Muddy Creek Tertiary age deposits include the marl of White Narrows, a yellow basal sand of the Aggradational gravel of Whitmore Mesa, and a regrade gravel of Moapa, as well as carbonate soils developed on these deposits. The Preliminary Geologic Map of the Moapa West Quadrangle (Schmidt et al., 1996) states "…*thick carbonate soils developed on stream terrace and piedmont deposits are mapped because they constitute genuine mapable units, contrary to the convention of not mapping soils*." The host terrace and piedmont deposits developed by both deposition and erosion at various times. In earlier mapping studies, these deposits were considered to be the uppermost unit of the Muddy Creek Formation (Gardner, 1968).

The marl of White Narrows is subdivided into two members, the graben-fill and channel-fill units. Both units are comprised of calcareous clay or mudstone and limestone with varying amounts of sand, silt, and gravel. The channel-fill unit includes a subordinate calcareous silty to sandy conglomerate. The clasts are a mixture of igneous, metamorphic, and sedimentary rocks originating from the Prospect Mountain Range (Williams, 1996) and the Arrow Canyon Range (Schmidt, et al., 1996). These conglomerates cut into the underlying green and red claystones of the Muddy Creek Formation, creating a disconformity. In general, the graben-fill was deposited directly on top of the underlying green claystone unit whereas the channel-fill is found on top of the underlying red claystone unit (Schmidt, et al., 1996). It is unclear whether the channel-fill eroded away the green member or it was coincidently not present. Either way, the presence of the conglomerates marks a major change in the regional drainage into the former lake (Williams, 1996).

3.1.3 Muddy Creek Formation

The Quaternary deposits of Moapa Valley are underlain by a thick accumulation of alluvial, fluvial and lacustrine rocks of the Horse Spring and Muddy Creek Formations (Longwell, et al., 1965). The Muddy Creek Formation is primarily a lacustrine deposit of claystone with discontinuous deposits of fine-grained clastics and evaporites (Schmidt, et al. 1996). The formation exceeds 1200 feet in thickness in the center of the valley (Schroth, 1987).

The green claystone unit of the Muddy Creek Formation is described as thin to massive beds of greenish-gray clay in the lower half and various shades of reddish to yellowish-brown clay in the upper half. The unit contains varying amounts of calcite and gypsum and is generally between 20 and 50 feet thick, but can be as much as 100 feet thick. It lies conformably on top of the red claystone unit (Schmidt, et al., 1996).

The red claystone unit of the Muddy Creek Formation is described as being salmon and pale reddish brown in color with thin to laminar bedded claystone containing sparse siltstone and very fine sandstone. The upper portion of the red claystone unit is composed of massive, red, dense, hard clay layers with interbeds of loose fine sand and silt and contains up to 10% fine to medium grained, calcite cemented sandstone, in lenses and discontinuous beds less than four inches thick. Gypsiferous sandstone beds are moderate to well sorted and pinch out laterally within 150 to 650 feet (Schmidt, et al., 1996). The beds of the Muddy Creek Formation are horizontal with localized tilted and deformed beds approaching near vertical as a result of drag folds and faulting (Kleinfelder, 2000). The alternating layers of sand, silt, and clay range from massive to interbedded and tend to be laterally discontinuous. Individual beds will pinch out or interfinger in distinctive elongated stringers or lenses (Gardner, 1968).

Gypsum is known to exist throughout the Muddy Creek Formation in crystals, lenses, pods, and extensive beds that are pure enough to have been historically mined within five miles of the Station. Halite or rock salt is also present in the Muddy Creek Formation ranging from individual crystals to economically mined deposits (Sulenski, 1973). Climatic changes resulted in the formation of evaporate deposits. Calcite and clay are the major cementing agents that hold the otherwise unconsolidated sediment together to form sandstone and siltstone. Gardner refers to cemented hardpan (caliche) or calcrete forming as a result of evaporation and consequent precipitation of calcium carbonate from the capillary fringe of the groundwater. This explanation would apply to the alluvial floodplain deposits of the Muddy River where depth to groundwater is less than 10 feet below ground surface (bgs) and where groundwater is consumed by evapotranspiration (Prudic, et al., 1995). Alternatively, Gardner speculates that the cementation could be due to a repeated wetting and drying of the upper few feet of gravel by infrequent precipitation. The gravel formed from parent material containing calcium carbonate. With each wetting and drying cycle, a minor amount of calcium carbonate is leached from the surface and redeposited lower in the soil profile (Gardner, 1968). This may explain why the upper surface of the caliche layer is hardest and the deposit becomes less cemented with depth, and is a more appropriate explanation for the Mesa where depth to groundwater is greater than 100 feet bgs.

The Muddy Creek Formation may be up to 2000 feet thick (Gardner, 1968). At exploration boring EH-2 on the Mesa (shown on Figure 2 in Appendix A), Hess determined the Muddy

Creek Formation to be approximately 1200 feet thick (Hess, 1986). Well driller's logs 9836/Behmer and 35225 indicate the depth to the top of the Muddy Creek Formation ranges from 75 to 135 feet bgs and describe the formation as red to brown clay (NDWR, 2013).

Four mapping studies have been completed that describe the Muddy Creek Formation as containing between two and seven units, depending on the location. Figure 2 in Appendix A shows the approximate areas of the mapping studies in the Moapa Valley. Table 3-1 below illustrates the geologic formations identified in these mapping studies above the Paleozoic carbonate formations.

- *Preliminary Geologic Map of the Moapa West Quadrangle* (Schmidt, et al., 1996). The USGS studied the Muddy Creek Formation in the Moapa West 7.5-minute Quadrangle where the Station is located and found it to contain only the green and red claystone units. A Site Geologic Map included as Figure 3 in Appendix A shows the mapped surface exposed units from this publication for the area near the Station.
- *Stratigraphy and Sedimentology of the Muddy Creek Formation* (Dicke, 1990). Dicke completed a study of the Muddy Creek Formation in the nearby Meadow Wash and described seven units or facies: 1) orange-pink conglomerate, 2) interbedded unconsolidated and cemented medium to fine sand; 3) orange-pink-brown interbedded medium to very fine sand, silt, and mud (clay); 4) interbedded medium sand, silt and gypsiferous clay; 5) greenish-gray to olive-gray clay and medium to fine sand; 6) interbedded coarse to fine sand, silt, and sandy limestone; and 7) medium to coarse sand.
- *The Quaternary Geology of Moapa Valley, Clark County Nevada, A Thesis in Geology*. (Gardner, 1968). .
  Gardner completed a study in the Moapa 15-minute Quadrangle, as well as the Muddy Peak, Overton and Overton Beach Quadrangles and determined there were three different units or members present: 1) Upper White Narrows member; 2) red sand, silt, clay and interbedded Basalt Flow member; and 3) red Carbonate Clast Gravel member.
- *Preliminary Geologic Map of the Mesquite Quadrangle* (Williams, 1996). .
  Williams completed a study of the Muddy Creek Formation in the Mesquite Quadrangle approximately 30 miles northeast of the Station and described three geologic units: 1) Upper Conglomerate unit, 2) orange/red/brown interbedded sandstone, siltstone, and claystone unit, and 3) Basal Lava Flow and Ash unit). .

Table 3-1 **Geologic Formations Identified in Mapping Studies Near the Station**

Geologic epoch	Schmidt, et al., 1996	Dicke, 1990	Gardner, 1968	Williams, 1996
Quaternary - Holocene – 11,500 years ago to present	**Af – artificial fill** **Qc – Channel alluvium** - tan silt and sand, grey gravel **Qs – slope and wash talus deposit** **Qr – Recent terrace alluvium**	**Quaternary caliche** - Limestone with oncolites, medium quartz sand	**Terrace gravels**: **Qf - Muddy River flood plain alluvium** - whitish sand, silt, and clay **Qal-wash gravels -** red, carbonate clast gravel and sand	
Quaternary - Pleistocene – 2.5 million to 11,500 years ago	**Qy – Young terrace alluvium** **Qi - Intermediate terrace alluvium** **Qo – Old terrace alluvium-** tan to gray silt, fine sand, clay, silty to sandy gravel		**Ancient Muddy River gravels -** gray, well rounded volcanic clast gravels	
Tertiary - Pliocene – 5.3 to 2.5 million years ago	**disconformity**			
	Trk-Tertiary Calcrete - carbonate soil developed on regrade gravel of Moapa **Tr – regrade gravel of Moapa** - gray to tan, thick bedded, well sorted, coarse gravel of limestone, dolomite, and chert, calcite, sand lenses; well cemented in most areas			
	disconformity			
	Aggradational gravel of Whitmore Mesa: **Tay – yellow basal sand** - fine and medium sand above the green claystone member, chert pebbles **Marl of White Narrows:** **Twg** – **graben-fill unit**, gray to greenish to buff, calcareous fine grained sediments, claystone, limestone, and sand **Twc –channel fill unit** – gray to greenish to buff, calcareous mudstone, white limestone, and conglomerate			**Tf-Post-Muddy Creek Tertiary basin-fill sediments** - Gray, poorly bedded, poorly sorted sandstone and conglomerate. Overlies the conglomeratic member of the Muddy Creek Formation in angular unconformity and is generally coarser and lighter colored than the Muddy Creek
Tertiary - Miocene – 23 to 5.3 Million years ago	**angular unconformity**	**conformity to unconformity**	**unconformity**	**unconformity**
	Muddy Creek Formation: **Tmg– green claystone unit**- thin, massive to thick-bedded claystone greenish-gray in lower half and reddish and yellowish brown in upper half. Calcite and gypsum	**Muddy Creek Formation** **Facies 7**-medium to coarse sand	**Tmw – White Narrows Member of the Muddy Creek Formation** - white calcareous silt and clay and light grey impure vuggy limestone **Tm - Muddy Creek Formation** - red sand, silt, and clay facies, interbedded basalt flow **Tmg** – red, carbonate clast gravel facies	**Tmc – Muddy Creek Formation, conglomerate facies** - uncemented sandy cobble conglomerate, pebble- to boulder-size clasts, clasts include brown quartzite and black and grayish-green chert and lesser amounts of subangular to subrounded gneiss, granite, gray quartzite, basalt, pegmatite, limestone, and dolomite
		Facies 6-pinkish grey to light brown beds of coarse to fine sand and silt interbedded with thin beds of sandy limestone (thin bedded white caliche with medium to fine grained sand, porous, root and stem molds		
		Facies 5- greenish-gray to olive-gray clay and medium to fine sand, gypsum veins. Overlies a green, medium to fine grained sand layer. Iron oxide present between sand and clay layers		
	Tmr –red claystone unit– salmon and pale-reddish-brown, well-bedded, thin to laminar claystone, sparse siltstone, very fine to fine grained sandstone. In uppermost unit contains fine to medium-grained calcite-cemented sandstone. Estimated 349 meters thick	**Facies 4**- orange-pink to brown interbedded fine to medium sand, silt, and clay, local gypsum and halite in clay beds		**Tms – Muddy Creek Formation** - moderate orange-pink, reddish-orange, light-red, and light-brown, fine to medium-grained, partly consolidated, poorly to well bedded sandstone, small amounts of siltstone and claystone, minor conglomerate sandstone beds are moderately to well sorted, with common cross bedding and ripple marks, clasts are locally cemented by calcite, clay, or gypsum
		Facies 3 – orange-pink to brown thick bedded blocky silt and mud, with thin interbeds of medium to very fine grained sand, local gypsum and halite		
		Facies 2 – orange pink to light brown, interbedded unconsolidated and cemented medium to fine sand, rare silt and clay		
		Facies 1 – orange-pink conglomerate		
	unconformity (8.5 million years ago)	**unconformity**	**angular unconformity**	
	Horse Spring Formation – basin-fill deposit: **Thc**-upper conglomerate member of clastic debris **Thl**- lower limestone member	**Horse Spring Formation** – carbonate and fine-grained clastic sediments, air-fall and ash-flow tuffs	**Horse Spring Formation** – Limestone, dolomite, magnesite, clay, silt, gypsum, volcanic ash, sandstone, and conglomerate	**Tb – Tertiary basalt lava flow and ash -** Olivine basalt lava flow and coarse olivine basalt ash

NVE has been studying the Muddy Creek Formation as a potential cooling water source for the Station since the 1980s. DRI conducted drilling activities in 1985 and 1986 to investigate the potential for water supply development for the Station (Hess, 1986; Johnson et al., 1986). The drilling programs included ten exploratory borings. Three holes each were advanced in the Upper Muddy River Valley and Lower Muddy River Valley, and two each in the Meadow Valley Wash and Weiser Wash. Hess reported encountering the Muddy Creek Formation, a volcanic ash formation, the Bird Springs limestone (upper Muddy River Valley), and the Chinle/Moenkopi Formations (near Weiser Wash) during this investigation. Three borings were located near the Station; EH-1 approximately 0.5 mile north of the Station near the raw water ponds, EH-2 and EH-2A approximately 0.5 mile southwest of the Station on the Mesa (see Figure 2 in Appendix A). At boring EH-1, alluvium was encountered from the surface to 65 feet bgs and the Muddy Creek Formation was encountered from 65 to 300 feet bgs. At boring EH-2, alluvium was encountered to 55 feet bgs, the Muddy Creek Formation was encountered from 55 feet to 1300 feet bgs, and a volcanic ash, possibly the Horse Springs Formation, was encountered from 1300 to 1960 feet bgs. At boring EH-2A, the Muddy Creek Formation was encountered from 120 feet to 1410 feet bgs, a gypsiferous volcanic ash with tan limestone interbeds was encountered from 1410 to 3946 feet bgs, and "red beds" possibly Mesozoic, were encountered from 3946 to 4000 feet bgs.

The DRI conducted a Hogan Spring Drilling Project approximately 3.5 miles south of the Station (Pohlmann, et al., 1988). Between September 1986 and February 1987, three deep exploratory borings (HS-8, HS-8A, HS-8B) were drilled in the vicinity of Hogan Springs in search of a source of cooling and process water for NVE (see Figure 2 in Appendix A). The objective was to drill a 2,000-foot deep well to evaluate the water quality and yield of the carbonate aquifer. The first two borings were abandoned at 900 and 976 feet bgs due to drilling difficulties. The third boring, HS-8B, reached the target depth of 2000 feet bgs. At boring HS-8B, alluvium was encountered from the surface to 15 feet bgs. The Muddy Creek Formation was described as consisting of tan, brown, and red sand, silts, and clays from 15 to 490 feet bgs. A mixture of limestone and volcanic tuff described as the Horse Spring Formation was encountered from 490 to 1642 feet bgs, and dolomitic limestone was encountered from 1642 to 2000 feet bgs. It was unclear to Pohlmann whether dolomitic limestone was of Paleozoic age or how it related to the regional deep carbonate system. (Pohlmann, et al., 1988).

3.1.4 Horse Spring Formation

Underlying the Muddy Creek Formation is the Horse Spring Formation, which is described by Schmidt as *"…basin-fill deposits that formed during opening and subsidence of the Glendale basin…rocks in map area are everywhere moderately deformed, commonly dipping 10 to 20 degrees and locally folded"*. The Horse Spring Formation is divided into two units. The upper conglomerate member is composed of pale red-brown, well-graded, silty sandy conglomerate. The clasts range in size from boulders to pebbles and consist of limestone, dolomite, and chert, in a sand and silt matrix. The lower limestone member is described as white to pale pinkish-gray, thin-bedded to laminate limestone (Schmidt, et al., 1996). Volcanic ash and tuff is locally present.

3.1.5 Paleozoic Carbonate Formations

Beneath the basin-fill deposits is the Paleozoic Carbonate-Rock Providence of the Great Basin, a thick limestone and dolomite sequence containing several groundwater flow systems, two of which are the WRFS and Meadow Valley Flow System. The carbonate rocks were deposited as layers of ancient marine sediment that cumulatively were as much as 40,000 feet thick on the continental shelf between about 570 and 280 million years ago. Within and between layers of carbonate rock are non-carbonate layers of shale, quartzite, chert, and siltstone, but the overall accumulation is dominated by carbonate rock. *"Since deposition, the carbonate and non-carbonate rocks have been greatly deformed and, as a result, have been thickened during thrusting, compressional deformation, thinned during extension, tensional deformation, and juxtaposed against each other during deformations"*. (Dettinger, et al., 1995). These features were later buried under a thick sequence of basin-fill materials. In some areas the carbonate bedrock is so severely fractured and tilted that it diverts the groundwater flow direction (Dettinger, 1992).

3.2 Local Geology

The local geology is defined by information collected during soil boring activities at the Station. During these boring activities, the quaternary alluvial deposits, tertiary basin-fill deposits of the Muddy Creek Formation, and post-Muddy Creek tertiary deposits were observed. This local geologic information was used to create five cross-sections to provide a better understanding of the local geology. Figure 4 in Appendix A shows the geologic cross-section locations relative to all monitoring well and soil boring locations and the geologic cross-sections are included as Figures 4-1 through 4-17 in Appendix A. These cross-sections are approximate and based on available information. When multiple soil borings and CPT logs were in close proximity to each other, the deepest boring or CPT was presented on the geologic cross-sections.

During the installation of the background wells (BG-1, BG-2, BG-3, BG-6), the contact between the alluvium and underlying Muddy Creek Formation was found to be sharp and characterized by a change in color, gradation and mineralogy of the sediments. However, in reviewing the historical soil boring logs it was difficult to determine the contact, if there was one, based on the lack of a detailed description of the sediments. The lack of borings at the Station that penetrate the Muddy Creek Formation is considered a geologic data gap. As more information is collected, the contact between the alluvium and Muddy Creek Formation will be refined as part of the Conceptual Site Model (CSM) development. Sections 3.2.1 through 3.2.3 discuss the deposits observed during the background drilling activities and the geologic cross-sections are discussed in Section 3.2.4. Appendix B contains photographs of the local geology observed during the background drilling activities and Appendix C contains boring logs.

3.2.1 Alluvium

The shallow soil stratigraphy at the Station is primarily recent alluvium from the Muddy River. During the background investigation, alluvium deposits were encountered on top of the underlying Muddy Creek Formation at the BG-1, BG-2, BG-3, and BG-6 well locations from 11 to 42 feet bgs. The alluvium encountered consisted of tan, grey, brown, and reddish brown silt, clay, sand and gravel (volcanic material, limestone, and dolomite). The gravel clasts were found to be rounded as a result of the fluvial processes in which they were deposited. The contact between the alluvium and underlying Muddy Creek Formation was

found to be sharp and distinct, indicating the presence of an unconformity. This was particularly apparent in BG-1 and BG-2 where the change from high energy to low energy deposition was clear. At BG-4, only the Muddy Creek Formation was present. Table 3-2 summarizes the alluvium lithology encountered at the new background well locations.

Table 3-2 **Local Alluvium on Top of the Muddy Creek Formation**

Location	Depth Interval (ft. bgs)/ Elevation (AMSL)	Lithology
BG-1	0 – 10 (1609.88 - 1599.88)	fat clay, sandy silt with gravel
	10 – 20 (1599.88 - 1589.88)	sandy silt with gravel, well-graded sand with gravel
	20 – 30 (1589.88 - 1579.88)	well-graded gravel, silty sand with gravel, sandy lean clay with gravel, well-graded gravel with sand and silt, sandy lean clay, poorly-graded sand
	30 - 42 (1579.88 - 1567.88)	well-graded gravel with clay and sand, clayey gravel, poorly-graded sand, well-graded gravel with clay and sand
BG-2	0 - 24.5 (1614.15 - 1589.65)	poorly-graded sand, silty sand with gravel
BG-3	0 - 11 (1621.22 - 1610.22)	sand with silt and gravel, lean clay with sand, silty sand
BG-6	0 - 11 (1616.25 - 1605.25)	well-graded gravel with sand, well-graded sand with gravel

Previous investigations by Intellus (Intellus, 1986b) and Kleinfelder (Kleinfelder, 1998b) found that the alluvium has a thickness of at least 100 feet in IMW-5, 80 feet at IMW-16 and at least 75 feet at KMW-2. Coarse gravel and boulders were encountered in Hogan Spring Wash, beneath the Muddy River, and in a possible buried channel in the northeastern portion of the Station. A thick clay deposit has been observed in the river valley. Some early ponds were tied into this clay layer. The alluvium thins at locations further from the Muddy River. At KMW-1, west of the Muddy River, the alluvium is approximately 40 feet thick and further to the west at BG-2, it is 24.5 feet thick. Similarly, to the east of the Muddy River at IMW-3 and BG-1, the alluvium has thinned to approximately 42 feet, and further east at BG-3 and BG-6, the alluvium has thinned to 11 feet and is non-water bearing. In all cases the contact between the alluvium and underlying Muddy Creek Formation was marked by a sharp contact with sand and gravel deposit above and clay below, signifying a change from a high energy to low energy depositional environment resulting in an unconformity.

3.2.2 Post-Muddy Creek Tertiary Deposits

Post-Muddy Creek Tertiary deposits include the marl of White Narrows, a yellow basal sand of the Aggradational gravel of Whitmore Mesa, and a regrade gravel of Moapa, as well as carbonate soils associated with these units. The marl of White Narrows unit is exposed on top of the Mesa located south of the Station, and also above the Muddy Creek Formations

exposed north and south of the valley. This conglomerate unit is approximately 40 feet thick on top of the Mesa and regionally has a maximum thickness of approximately 125 feet. Converse Consultants installed monitoring wells on the Mesa in 2011 and noted, "*…weathering of this unit has produced the partially cemented surficial gravel and colluvium present [on the Mesa]. A second conglomerate unit was encountered during drilling. This unit is hard and presented some difficulty during drilling. The lowermost unit encountered is a relatively soft sequence of interbedded silty claystone and clay-rich sandstones. This unit appears to be the aquifer in the project area*" (Converse Consultants, 2011). The post-Muddy Creek Tertiary deposits on the Mesa are illustrated on Cross-Section E-E"" in Figures 4-14, 4-15, 4-16, and 4-17 in Appendix A.

Cemented sand, gravel, or conglomerate (hardpan or caliche), was penetrated at varying depths above and below the water table during the background drilling activities. Caliche or cemented sand provided little resistance to the Sonic drilling. However, the higher the percentage of clasts and the larger they were within the cemented materials, the slower the drilling advanced.

A sandy, cobbly gravel layer was encountered at BG-1 from 8 to 42 feet bgs (Appendix B, Photos 32-36, pages B-17 to B-19) on top of the red claystone unit and is similar to the stratigraphic sequence described in nearby IMW-3 (Appendix A, Figure 4-3; Appendix C, Boring Logs). The lithology of this gravel deposit, and the Site Geology Map (Appendix A, Figure 3) suggest that the Muddy Creek Formation in this area is overlain by young terrace alluvium. This alluvium is composed of gravel, silt, sand, and clay (Schmidt et al. 1996) and was deposited by the pre-Holocene Muddy River. It is unknown if this alluvium is of uniform thickness, or if paleochannels exist that could be preferential pathways for contaminants. This is a geologic data gap that will be addressed as part of the CSM.

3.2.3 Muddy Creek Formation

Former lake bottom deposits formed the Muddy Creek Formation in the area of the Station. Faulting and subsequent erosion of the valley floor deposits left a series of scarps ranging in height from a few feet to many feet that expose the Muddy Creek Formation in the vicinity of the Station. These scarps expose the unconformity and sharp contact between the Muddy Creek Formation and overlying geologic unit. This is evident in the east face of the Mesa located west of the Muddy River at the Station.

During the background investigations, the top of the Muddy Creek Formation was determined based on the locations shown on the Moapa West Geologic Map (Schmidt, et al., 1996) and review of current and historic boring logs. The lithology of the upper portion of the Muddy Creek Formation red claystone member has been described in detail by Converse Consultants in several of their geotechnical investigations on the Mesa south of the Station (Converse Consultants, 1999, 2002, 2007, 2009, 2011, 2012). Converse Consultants' lithologic interpretations of the Muddy Creek Formation, DRI's top of the Muddy Creek Formation elevations at EH-1, EH-2 and EH-2A (Hess, 1986), combined with the results of the background investigation were used in the evaluation of other consultants' boring logs and well driller's logs. The level of detail in the boring log was critical to the interpretation of different lithologic units. Soil characteristics, color, and the presence of evaporated minerals

were key criteria used to identifying the Muddy Creek Formation. During the background investigation and previous studies, a sharp contact was found between the Muddy Creek Formation and overlying geologic unit.

Historical boring logs usually do not identify the Muddy Creek Formation, and the logs often do not have detailed descriptions of the lithologies encountered. It is difficult to distinguish between the alluvium and the Muddy Creek Formation from these logs because the lithologies in the two can be similar. In general, descriptions including tan sediments and gravel were interpreted as alluvium, while descriptions of reddish brown or greenish gray clay, silt, and fine sand were interpreted as the Muddy Creek Formation. Due to the difficulty of interpreting historical boring logs and the lack of recent borings that encountered the Muddy Creek Formation in the valley near the Station, the contact between the alluvium and the Muddy Creek Formation in the valley is a geologic data gap that will be further investigated as part of the CSM. Based on soil boring logs at IMW-5, IMW-16, and KMW-2, the depth to the top of the Muddy Creek Formation is greater than 100, 80, and 75 feet deep, respectively, at those locations adjacent to the Muddy River.

The green claystone unit of the Muddy Creek Formation is described as thin to massive beds of greenish-gray clay in the lower half and various shades of reddish to yellowish-brown clay in the upper half. The unit contains varying amounts of calcite and gypsum and is generally between 20 and 50 feet thick, but can be as much as 100 feet thick. It lies conformably on top of the red claystone unit (Schmidt, et al., 1996). In BG-1, a thin layer of greenish silt was encountered between the alluvium and red claystone unit at a depth of approximately 42 feet bgs (Appendix B, Photo 38, page B-20). The exact depth interval could not be determined as it only appeared during casing cleanout activities and not in the Sonic core sample due to the sample catcher being damaged by the gravel layer from 40-42 feet bgs. Based on the amount of core recovery above and below the thin sample interval, the accuracy of the depth of the contact would be within approximately one foot.

A green unit was encountered in BG-2 at a depth of approximately 24.5 to 80.5 feet bgs and is composed of interbedded fat clay to lean clay and silty sand (Appendix B; Photos 10, 14, 15, and 17; pages B-6, and B-8 to B-10). The fat clay tended to be olive-brown to yellow-brown to greenish-gray to dark gray in color, laminated to massive, dry, very stiff to hard, cohesive, highly plastic, and contain gypsum crystals (Appendix B, Photo 26, page B-14) and nodules. The silty sand tended to be yellowish-brown to grayish-brown to greenish-gray, fine grained, well sorted or poorly-graded, massive, moist, medium dense, non-cohesive and non-plastic. The descriptions of these green units closely fit the description of the green claystone unit of the Muddy Creek Formation; however, the elevation of the green unit at BG-2 is not as expected based on the mapping by Schmidt (Schmidt, et al., 1996). This is a geologic data gap that will be further investigated as part of the CSM. For the purpose of this report, this green unit is discussed as the green claystone unit of the Muddy Creek Formation.

The green claystone unit may have been previously encountered at other Station boring locations, but the lack of detailed descriptions in the boring logs makes its presence difficult to confirm. Table 3-3 summarizes the depths at which the green claystone unit was encountered during background drilling activities.

Table 3-3 **Depths to Top of Green and Red Claystone Units of the Muddy Creek Formation (ft. bgs)**					
Location	**BG-1**	**BG-2**	**BG-3**	**BG-4**	**BG-6**
Depth to Green Claystone	42	24.5	not present	not present	not present
Depth to Red Claystone	46	80.5	11	0	11

The red claystone unit is described as being salmon and pale reddish brown in color with thin to laminar bedded claystone containing sparse siltstone and very fine sandstone. There is a stark absence of any coarse gravel size material indicative of alluvium deposits. During the background investigations, the red claystone of the Muddy Creek Formation was found to be exposed at the ground surface at BG-4, 11 feet bgs at BG-3 and BG-6, 24.5 feet bgs at BG-2, and 42 feet bgs at BG-1. This formation was penetrated to a maximum depth of 174 feet at BG-4, as illustrated on Figures 4-3 and 4-8 in Appendix A, Photos 52-64 and 65 in Appendix B (pages B-27 to B-34) and the boring logs in Appendix C. A sharp erosional contact was found between the Muddy Creek Formation and the overlying alluvium at BG-1 and BG-2.

The red claystone unit was found to contain three main soil types; fat clay, lean clay, and very fine sand and silt (Appendix B, Photo 14, page B-8). The fat clay tended to be bright red to reddish brown, glossy or waxy, laminated to massive, soft (if below the water table) to very stiff, cohesive, sticky, moderately to highly plastic, and contain silt and gypsum laminations, lenses, or pods (Appendix B, Photos 21-22, page B-12). Individual gypsum crystals were also present. The lean clay tended to be a dull reddish-brown to brown, laminated to massive, dry, hard, non-cohesive, non-plastic to moderately plastic, and contain silt and gypsum laminations, lenses, or pods (Appendix B, Photo 62, page B-32). The very fine sand/silt tended to be thinly bedded to massive, well sorted or poorly-graded, very loose (flowing) to cemented, dry to wet (if below the water table), and non-plastic (Appendix B, Photos 18-20, pages B-10 to B-11). Gravel observed in the Muddy Creek Formation was almost exclusively sandstone (Appendix B, Photo 23, page B-13).

The red claystone unit of the Muddy Creek Formation is exposed in the face of the Mesa located south of the Station and on both sides of the valley. A sharp erosional contact is present in the face of the Mesa, above which are post-Muddy Creek tertiary deposits, consisting of a massive conglomerate unit composed of cemented sand, silt, gravel, and cobbles. The lithologies of the red claystone unit in BG-1 and BG-2 were similar in that the majority of the bedding tended to be massive in size similar to the lithology exposed in the north face of the mesa located south of the Station, and in the boring logs for the mesa groundwater monitoring wells (LMW-1 through LMW-16) installed by Converse Consultants from 1994 through 2012 (Converse Consultants, 1999, 2002, 2007, 2008a, 2009a, 2009b, 2009c, 2011, 2012). In contrast, the bedding in BG-3, BG-4, and BG-6 was mostly laminated to thinly bedded.

The Horse Spring Formation and carbonate formations were not encountered during the background drilling activities because they are present at greater depths.

3.3 Surface Soils

The soils along the Muddy River in the area of the Station have been categorized by Bagley as belonging to the Tuquop-Calico-Overton Series. These soils are described as deep (>3 feet), excessively drained to very poorly drained, near level to moderately sloping soils that are found on flood plains, broad terraces, and alluvial fans along rivers and washes. The soils of the Mesa, Raw Water Ponds and other upland areas at the Station are described as belonging to the Bard-Colorock-Tonopah Series. These soils range from well-drained to excessively drained, near level to strongly sloping, and moderately deep to deep and are found on broad alluvial fans and old terraces (Bagley, 1980).

These soils series have been further broken out into individual soil units and are described in the following paragraphs (Bagley, 1980) for the new and existing background sampling locations. Figure 5 in Appendix A shows surface soil types in the area of the Station.

<u>BG-1, BG-3, BG-4, BG-6, IMW-3</u>: Badlands (BD) – "*This unit consists of severely eroded and gullied land of the Muddy Creek Formation located along river canyon walls and on old terrace escarpments. The highly stratified sand, silt and clay contain a large amount of gypsum and calcium carbonate. Slopes range from 15% to 100% with very rapid run-off creating a very high erosion hazard. This unit is generally barren, not suitable for farming or grazing, and provides very little habitat for wildlife.*"

<u>LMW-7, LMW-9, LMW-10</u>: Bard Gravelly Fine Sandy Loam (BHC) – "*This unit consists of well drained soils found on alluvial fans. The surface layer is typically pink, gravelly fine sand composed of different rock types with a moderately high permeability. The underlying material is an indurate lime-cemented hardpan with a very low permeability. Slopes range from 2% to 15% with slow run-off and a slight erosional hazard. This unit supports sparse vegetation and has limited use for grazing and wildlife habitat.*"

<u>BG-2</u>: Glendale Loam, strongly saline (Gs) – "*This well-drained soil is located on flood plains and low terraces with slopes of 0%-2%. It formed in alluvium derived from mixed rock sources with moderately low permeability. Run-off is slow and the erosion hazard low. These soils are subject to very brief periods of flooding and are affected by excess salt accumulation that supports sparse vegetation and limited grazing and wildlife habitat*."

<u>IMW-2.5</u>: Overton Silty Clay, strongly saline (On) – "*This deep, poorly drained soil is comprised of clayey alluvium formed from sedimentary rock and lacustrine materials on slopes of 0% to 2%. The surface material is typically gray clay and silty clay. The underlying subsoils are gray to pale yellow silty clay with the underlying substratum being pale yellow to reddish-brown stratified silty clay and fine sandy loam. Permeability and run-off is slow with a slight erosional hazard. These soils rarely flood with the water table ranging from 1 to 6 feet bgs. Excessive salt accumulation in these soils supports sparse vegetation and limited grazing and wildlife habitat. This unit is poorly suited for cropland due to the high content of soluble salt, low permeability, and poor drainage.*"

<u>KMW-2</u>: Virgin River Silty Clay, strongly saline (Vn) – "*This deep, somewhat poorly drained, soil is comprised of clayey alluvium formed from mixed sedimentary rock on flat flood plains with*

slopes of 0%-2%. The surface material is typically reddish-brown silty clay. The subsoils are typically light reddish-brown stratified clay loam. The underlying substratum is light reddish-brown stratified fine sand and silt loam. Permeability is low and the run-off is very slow with a slight erosional hazard. These soils rarely flood with the water table ranging from 4 to 6 feet bgs. Highly soluble salt content, clayey texture, slow permeability, high seasonal water table, and lack of available water for irrigation makes this unit poorly suited for crops and livestock grazing. Natural vegetation is sparse and limited to salt-tolerant species such as alkali sacaton, saltbush and mesquite."

Table 3-4 **Soil Characteristics in the Area of the Station (Bagley, 1980)**

Map Symbol	Chemical Engineering and Physical Properties					
	Texture	Unified Class.	Soil Reaction (pH)	Salinity (mmhos/cm)	Depth to Water (ft.)	Depth to Bedrock (ft.)
BD	Gravely, fine sandy loam	SM	7.9-9.0	<2	>6	>5
BHC	Gravely, fine sandy loam	SM	7.9-9.0	<2	>6	>5
Gs	Loam, Stratified clayey-sandy loam	ML, CL-ML, CL-ML, CL	7.9-8.4	>8	>6	>5
On	Silty clay, Stratified silty clayey-sandy loam	ML, CL-ML, CL	7.9-9.0	4-16	1-6	>5
Vn	Silty clay, Stratified clayey-loam Stratified sand-silt	CH, CL-CH, SM	7.9-8.4	>2	4-6	>5

Note – millimhos (mmhos)

3.4 Hydrogeology

The regional hydrogeologic setting is one of a large basin cut into the carbonate bedrock of the WRFS, partly filled with the basin-fill deposits of the Horse Spring and Muddy Creek Formations, and dissected by valleys that in turn are filled with alluvium. Moapa Valley cuts into the Muddy Creek Formation which, for the most part, completely surrounds an approximately 75 foot thick deposit of alluvium clay, sand, silt, and gravel. The shallow alluvial aquifer is bound on the bottom and sides by the mostly impermeable Muddy Creek Formation.

According to the Nevada Division of Water Planning (NDWP) Nevada State Water Plan, "*Principal groundwater aquifers in Nevada are basin-fill aquifers, carbonate-rock aquifers, volcanic-rock aquifers, and volcanic and sedimentary-rock aquifers. The basin-fill aquifers, composed primarily of alluvial, colluvial, and lacustrine deposits, are the major aquifers in the state. Virtually all major groundwater development has been in the basin-fill aquifers with the withdrawals from the upper 500 feet of these aquifers. In eastern and southern Nevada, thick sequences of carbonate rock underlie many of the alluvial basins forming a complex regional aquifer system or systems that are largely undeveloped and not yet fully understood. The carbonate rock aquifer supplies water to numerous springs which are used for irrigation*" (NDWP, 1999).

NVE has been extracting groundwater for use as cooling water at the Station since the 1970s. These wells are located in the Upper Muddy River Valley, Meadow Valley Wash, Weiser Wash, and on the Mesa south of the Station, and are screened in the alluvial aquifer, Muddy Creek aquifer, and carbonate aquifer of the WRFS. Water is transferred from the wells to the Station via an underground pipe line. Historically, NVE produced water from the Muddy Creek Formation in their Meadow Valley Wash and Mesa well fields, though both have been abandoned due to poor water quality and quantity.

Groundwater beneath the Station occurs in the basin fill deposits (alluvial aquifer, Muddy Creek aquifer, and Horse Springs aquifer), and in the underlying carbonate aquifer of the WRFS. During the Hogan Spring drilling project, Pohlmann identified "…*three primary hydrogeological units in the upper Moapa Valley: the Quaternary alluvial fill, the Tertiary Muddy Creek Formation, and the Paleozoic carbonate system*" (Pohlmann et al., 1988). Figure 6 in Appendix A is a schematic geologic cross-section across the Muddy River illustrating geologic units and the degree of folding and faulting that has taken place in the mountain ranges located east and west of the Station. "*The alluvial fill material* [Qs - alluvium on Figure 6] *provides a shallow high-yield aquifer that is recharged from the underlying carbonate aquifer. The Muddy Creek Formation* [Ts on Figure 6] *underlies the alluvial fill in much of the valley and is considered a semi-confining unit The Paleozoic carbonates* [POc and Cc on Figure 6] *extend below and underlie the other units and are part of the regional carbonate aquifer of the [WRFS]. Vertical hydraulic gradients in this area are upward from the carbonate rock aquifer to the alluvial fill aquifer"* (Mayer and Congdon, 2007). The deeper Horse Spring Formation is not shown on Figure 6 as it is regionally discontinuous.

The overall groundwater flow direction at the Station is in an easterly direction. Localized variations exist where water bodies or topographic features influence the flow such as in the vicinity of the Raw Water Ponds, Hogan Wash, and the Mesa.

According to the NDWR database (NDWR, 2013), the closest irrigation supply wells to the Station are located more than one mile to the east with the closest domestic drinking water wells being approximately two miles to the east.

3.4.1 Alluvial Aquifer

The alluvium in the Moapa Valley consists of clay, silt, sand, and gravel, with an approximate thickness of 100 feet, and groundwater at a depth of approximately 20 feet, in the valley near the Station. Based on current data, it appears that the alluvial aquifer is primarily recharged by the losing section of the Muddy River and by several large washes during rain events. A relatively smaller amount of recharge is from upward flow of groundwater through the Horse Spring and Muddy Creek Formations from the underlying carbonate aquifer of the WRFS. A proposed future study of the Muddy River will further evaluate the river and alluvial aquifer interaction.

In general, groundwater at the Station is shallowest adjacent to springs and the Muddy River and increases in depth further from the springs and river and at higher topographic elevations. This may indicate that the springs and Muddy River are sources of groundwater recharge to the alluvial aquifer (Intellus, 1986a).

An unconfined alluvial aquifer has been documented to exist in the upper portion of the Muddy River Valley and in the upper portion of the saturated zone (Mifflin and Associates, 1994). Lenticular gravel deposits that have large transmissivities and pumping cones of depression that migrate slowly and recharge quickly are typical of the unconfined aquifer (Mifflin and Associates, 1993). In contrast, a confined alluvial aquifer is present in the lower portion of the Muddy River Valley and in the deeper portion of the saturated zone (Mifflin and Associates, 1994). The confined alluvial aquifer also contains lenticular gravel deposits that have large transmissivities but the pumping cones of depression migrate rapidly over large areas and recover slowly over several months, except where connected to the underlying carbonate aquifer of the WRFS (Mifflin and Associates, 1993).

Evidence exists that the alluvial aquifer is in close hydraulic connection with the carbonate aquifer of the WRFS in areas where the Muddy Creek Formation is not present; thus the water quality is similar in those areas (Mifflin and Associates, 1993 and 1994). In areas where the Muddy Creek Formation is present, very little groundwater flow exists between the Muddy Creek Formation and the overlying alluvial aquifer except where conduits are present. These conduits could include fractures, faults, or vertically interconnected layers of coarse sediments that would create a preferential pathway for groundwater to flow vertically upwards from deeper parts of the aquifer or an underlying formation. Where conduits do exist, they have a negative impact on the alluvial aquifer's water quality - especially when the alluvial aquifer is over-pumped (Bredehoeft and Hall, 1996). The regional and site geologic maps, Figures 2 and 3 in Appendix A, show faults that have been mapped in the vicinity of the Station. Their existence at the Station and impact on the alluvial aquifer is a data gap that will require additional investigation during the CSM.

Alluvial wells provide high groundwater yields from the unconsolidated sand and gravel and fractured consolidated alluvial and fluvial valley-fill deposits. These unconsolidated sand and gravel deposits have the capacity to store and transmit large quantities of water and have the highest permeability of any of the valley-fill deposits (Kleinfelder, 1998a). Well reports for the NVE water supply and associated monitoring wells located northwest of the Station list yields from the 3-inch diameter monitoring wells ranging from 10 to 110 gallons per minute (gpm) while the yields from the 16-inch diameter water supply wells range from 100 to 1300 gpm. The lithology of the screened interval was described as alluvial clay and gravel (NDWR, 2013).

In comparison, the cemented or consolidated valley-fill deposits tend to have low permeabilities and yield water slowly - unless fractured (Eakin, 1968). As such, transmissivity (T) ranges from 50,000 to 500,000 gallons per day per foot (gpd/ft) and storativity (S) ranges from 0.001 to 0.01 (Bredehoeft and Hall, 1996). Heterogeneous layers of silty clay, sand, and gravel exhibit significant differences between vertical and horizontal permeabilities (Intellus, 1986b).

Previous investigations by Intellus (Intellus, 1986b), Kleinfelder (Kleinfelder, 1998b and Kleinfelder, 2000) and NVE (NPC, 2002) encountered coarse gravel and boulders in Hogan Spring Wash, beneath the Muddy River, and in a buried channel in the northeastern portion of the Station. Thus, the permeability of the alluvium is not homogenous across the Station and

the heterogeneity of the local stratigraphy contributes to higher horizontal groundwater flow rates in areas of coarser sediments and also affects the local surface recharge from precipitation. These continuous zones of directional permeability may represent preferential contaminant migration pathways (Intellus, 1986b).

Intellus completed pump tests on two, 50-60 foot deep, 12-inch diameter wells screened in a coarse sand and gravel deposit on the east side of the Station in 1986 and 1987. Diesel Recovery well #1 (DR-1) tested at a sustained rate of 9.9 gpm in October 1986 (Intellus, 1986c). Diesel Recovery well #2 (DR-2) tested at a sustained rate of 7.8 gpm in February 1987 (Intellus, 1987). During the background well development activities at BG-1S and BG-2S, sustained pumping rates from 4-inch diameter wells screened in the alluvial aquifer ranged from 3 to 6 gpm. Similar results were encountered during the subsequent pump testing of BG-1S with a maximum sustained pumping rate of 9 gpm.

Originally, all monitoring wells at the Station were thought to have been installed in the alluvial aquifer with the exception of those wells on the Mesa that were installed in the Muddy Creek Formation. Based on observations during the background investigations, it has become apparent that some of the existing monitoring wells are actually screened in the Muddy Creek Formation. It is difficult to evaluate the lithology present at many existing monitoring wells because of the limited detail in the available boring logs.

3.4.2 Muddy Creek Aquifer

The Muddy Creek Formation is primarily a lacustrine deposit of claystone with discontinuous deposits of other fine-grained clastics and evaporates (Schmidt, et al. 1996). The formation exceeds 1200 feet in thickness in the center of the Muddy Valley (Schroth, 1987). In general, the formation is described as being impermeable and acts as an aquitard and/or confining unit for the underlying bedrock aquifer, separating the regional carbonate aquifer from the alluvial aquifer. "*The Muddy Creek Formation, which underlies the valley fill in much of the valley, consists of unconsolidated and semi-consolidated fine-grained sediments. The Muddy Creek Formation is less permeable and contains poorer quality water than the overlying alluvial aquifer, and is utilized as a source of groundwater only in the Meadow Valley. In the upper Muddy River Valley, the Muddy Creek Formation is considered a semi-confining unit*" (Mifflin and Associates, 1997). Sulenski speculated that groundwater trapped within discontinuous sand layers of the Muddy Creek Formation resembles isolated small aquifers and when the sand layers become interfingered, groundwater can move vertically and horizontally throughout the formation by a process known as piping (Sulenski, 1973).

Water from the Muddy Creek Formation is usually of poor quality due to the presence of evaporate deposits. Anhydrite, gypsum and halite deposits are associated with the Muddy Creek Formation and range from a few feet to more than 20 feet in thickness. The presence of evaporate minerals has been associated with high total dissolved solids (TDS) concentrations in the Muddy Creek aquifer "*The geology at [the Station] include deposits of the Muddy Creek Formation and Marls of White Narrows graben-fill unit. Both of these deposits include abundant calcite, gypsum and halite. Secondary cementation from calcium carbonate is very common in the deposits and in fault traces. Gypsum in these deposits occurs both as bedding and disseminated. Halite beds are also known to occur, though these*

beds were not directly observed. High values for TDS would be expected for any groundwater that passes through these deposits (Kleinfelder, 2000). Schroth found that extended pumping, especially at higher pumping rates, flushes salts out of the formation sediments and results in a reduction in water quality. As higher quality water zones are exhausted, poor quality water may replace it (Schroth, 1987).

During the Hogan Spring drilling project (Pohlmann et al., 1988), Pohlmann identified three potentially productive aquifer zones at HS-8B (see Figure 2 in Appendix A); a limestone unit and a localized volcanic tuff unit, both of the Horse Springs Formation, and a dolomitic limestone below the Horse Springs Formation of undetermined age. Between the aquifers were semi-confining units that exhibited low discharge and poor water quality (high conductivity indicative of high TDS). The lower half of the Muddy Creek Formation was found to contain poor water quality and quantity (Pohlmann, et al., 1988). This may be a result of "minable" deposits of gypsum, halite, and manganese oxide in the lower section of the Muddy Creek Formation, as mentioned in Section 3.1.3.

During the 1985 DRI exploratory drilling activities, a localized aquifer in a volcanic ash unit of the Horse Spring Formation was encountered at EH-2A (see Figure 2 in Appendix A) (Hess, 1986). Hydraulic testing of EH-2 and EH-2A was completed by DRI in 1986. The T at EH-2 was determined to range between 580 and 600 ft^2/day with a storage coefficient of between 0.00022 and 0.000485. Conductivity ranged from 851 to 5720 micromhos per centimeter (µmhos/cm) and pH ranged from 8.0 to 8.5. At EH-2A, the T was calculated to be 500 ft2/day, and S between 0.0002 and 0.0005. Conductivity ranged from 515 to 5380 µmhos /cm and pH ranged from 7.5 to 8.5 (Johnson et al., 1986).

3.4.3 Carbonate Aquifer of the WRFS

Paleozoic carbonates extend below and surround the basin-fill deposits. These carbonate rocks are part of the regional carbonate aquifer of the WRFS that flows approximately 250 miles from near the White Pine County border in the north to Muddy Springs in south (Eakin, 1968). The WRFS is a regional groundwater system encompassing a series of hydraulically interconnected valleys and mountain ranges underlain by varying thicknesses of limestone. The WFRS is bound by either impermeable clastic and volcanic rocks or by hydrologic divides formed by the mountain ranges. The Muddy River springs are one of the principal discharge points of the WRFS (Eakin, 1968).

Eakin describes the WRFS as very large and transmissive, occupying approximately 7,700 square miles with an estimated regional T of 200,000 gpd/ft. The chemical and physical nature of the carbonate units create barriers to prevent or inhibit the flow of groundwater which causes localized cells of hydraulic discontinuities (Eakin, 1968).

In 1996, The Hydrodynamics Group completed a groundwater model of the Upper Muddy River (Bredehoeft and Hall, 1996). A USGS MODFLOW® steady-state computer model was developed for the carbonate aquifer of the WRFS, the overlying alluvial aquifer, Muddy River and springs to evaluate the interaction between them. The model confirmed that the change in water level from operating the proposed Arrow Canyon Well would be small; however, it would be masked by the seasonal pumping of other wells. The T ranged from

1,000,000 to 7,000,000 gpd/ft with S of 0.00116 for the carbonate aquifer. The model also showed that pumping the Arrow Canyon Well would reduce the flow of the Muddy River and springs by approximately 10% within several years and the reduced flow would continue as long as the well was in operation.

Quarterly monitoring of the Moapa Valley wells by NVE found that from 1991 – 1995 the "*…seasonal pumping cone was being transmitted within the carbonate aquifer nine miles*" (Mifflin, et al., 1997). The T in the carbonate aquifer is estimated to range from 200 square meters per day (m^2/d) to 20,000 m^2/d. Wells located upgradient of the Muddy Springs on average have transmissivities 10 to 20 times greater than the wells located downgradient of the springs. The reduced T of the wells downgradient of the springs may be due to a normal fault that juxtaposes the low-permeability Muddy Creek Formation against the carbonate aquifer (Mayer, et al., 2007). Much of the groundwater flow through the carbonate aquifer occurs along fractures or dissolution conduits (Prudic, et al., 1995). These features also influence the storage coefficient of the aquifer which is estimated to be 0.001 for a carbonate rock and is two to four orders of magnitudes less than the specific yield (Knochenmus, et al., 2007).

NVE has been completing annual groundwater monitoring reports on their water supply wells and the Moapa Valley Water District (MVWD) wells since the early 1990s per the State of Nevada Engineer's Rule 1169. Currently, the MVWD is permitted to cumulatively produce up to 10 cubic feet per second (cfs) of water from the carbonate aquifer of the WRFS from wells MX-6 and Arrow Canyon Wells #1 and #2, approximately 12 miles northwest of the Station (see Figure 2 in Appendix A) (Mifflin, et al., 1997). Water quality data from these wells show TDS ranges from 54 to 568 mg/L (MVWD, 2008). One of the major water quality considerations of the carbonate aquifer is the potential for saline contamination from associated evaporate deposits. In some areas the salinity of the groundwater ranges from 1,000 to 35,000 mg/L of dissolved solids (Dettinger, 1992).

In 2000, Mifflin and Associates completed hydrogeologic and groundwater analyses for the Moapa Paiute Energy Center, a proposed natural gas-fired power plant (Mifflin and Associates, 2001). A USGS MODFLOW® steady-state computer model was developed for the carbonate aquifer of the WRFS. A seven day pump test completed as part of the hydrogeologic study found that a sustained production of 1000 gpm was possible. The pump test results showed hydraulic conductivity (K) of 20 ft/day, transmissivities ranging from 50,000 to 100,000 ft^2/day, a specific yield of 0.03, and an S of 0.008. These results are consistent with those calculated by the USGS for the region, which found sustained pumping rates of 24 to 3,400 gpm and transmissivities from 1,600 to 250,000 ft^2/day, attesting to the variability of the aquifer (Dettinger, et al., 1995). In addition, the carbonate aquifer exhibited unconfined aquifer conditions, evidence of a delayed yield from fracture drainage, and TDS concentrations of 900 to 1,000 mg/L - compared to 600 mg/L at Muddy Springs (Mifflin and Associates, 2001).

Upstream of the Muddy Springs the Muddy River surface water elevation tends to be higher than the adjacent groundwater, indicative of a connected losing stream. From the Muddy Springs downstream to the Warm Springs Bridge, the Muddy River flow increases as is

typical of a connected gaining stream. The Muddy River exhibits characteristics of a disconnected stream between the Warm Springs Bridge and the Narrows. Downstream of the Narrows, the Muddy River again acts like a connected gaining stream (Bredehoeft and Hall, 1996). The hydraulic connection between the Muddy River and the alluvial aquifer at the Station is currently being investigated.

3.4.4 Hydraulic Gradients

In the WRFS, normal faults act as barriers to horizontal groundwater flow and divert flow upward along fault plains to the surface where it is discharged at springs and seeps (Eakin, 1968). Water chemistry from many of the springs in the Upper Muddy River Valley show calcium carbonate rich source water typical of a carbonate aquifer (Intellus, 1986a). Groundwater also moves upward through the Horse Spring and Muddy Creek Formations from the underlying carbonate aquifer. Evidence of this has been detected in the Muddy Spring where concentrations of chloride and sulfate, soluble minerals found in the Muddy Creek Formation, are significantly higher than at other springs in the Upper Muddy River Valley (Intellus, 1986a). However, the degree of hydraulic connection between the carbonate aquifer and overlying Muddy Creek Formation and alluvial aquifers is uncertain and likely varies by location. According to Mifflin and Associates, approximately 51 cfs of groundwater discharges from the WRFS to the Muddy River via springs; approximately 32 cfs discharges from the WRFS directly into the alluvial aquifer and then into the Muddy River as base flow above the Warm Springs Road Bridge; and approximately 19 cfs is discharged from the WRFS through the alluvial aquifer to springs via conduits sealed by calcium carbonate cement (Mifflin and Associates, 1996).

Vertical hydraulic gradients in the vicinity of the Station are generally upward from the carbonate aquifer to the alluvial aquifer (Mayer and Congdon, 2007). During the Hogan Spring drilling project the water level difference between wells HS-8 and HS-8B (see Figure 2 in Appendix A) indicates an upward vertical gradient from the unknown limestone formation (Pohlmann et al., 1988).

The 2002 Revised Hydrogeologic Characterization Report (NPC, 2002) referenced previous investigations completed at the Station by the DRI (Hess, 1986) and Intellus (Intellus, 1986b) indicating upward vertical hydraulic gradients in the alluvial aquifer as a result of confining pressures. These two studies documented an upward vertical gradient at well cluster KMW-1 shallow/medium/deep (S/M/D) in Hogan Wash, KMW-3 (S/M/D) and KMW-4 (S/M/D) in the former dairy southeast of the Station, and at several piezometers previously located in the vicinity of Ponds D, E, F and G. Intellus speculated that confining pressures are indicative of a predominance of silt and clay layers at depth acting as aquitards (Intellus, 1986b). Conversely, a downward vertical gradient was noted at KMW-5 (S/M/D) and KMW-6 (S/M/D) in the former dairy, due to the field being flooded with irrigation water. Similarly, a downward vertical gradient around the Raw Water Ponds is due to mounding caused by leakage from the ponds.

Table 3-5 provides groundwater elevation data collected from the background wells during the quarterly monitoring in 2012. An upward vertical hydraulic gradient was recorded at the BG-1, BG-2, BG-4, IMW-2.5, and KMW-2 well clusters during all four events and a

downward gradient was recorded at the BG-3 and IMW-3 well clusters during all four events. Well cluster BG-6 exhibited a downward vertical gradient during the well development and first and second quarters in 2012, then changed to an upward gradient during the third and fourth quarters. The upward vertical gradient was greatest at BG-2 in Hogan Wash and the least at IMW-2.5, located in the Muddy River flood plain northwest of former Pond 4A. The magnitude of the gradients was consistent at each well cluster between quarterly monitoring events. A review of non-background well clusters KMW-1 and IMW-2, located in Hogan Wash east of BG-2, found upward vertical gradients ranging from 3.0 – 3.5 feet and 1.5 – 2.0 feet, respectively, with the magnitude of the gradient decreasing with increasing distance from Hogan Spring and decreasing distance from the Muddy River. A shallow groundwater contour elevation map for the 2012 4th quarter monitoring event is included as Figure 7 in Appendix A.

Table 3-5 **Groundwater Elevations at Background Well Clusters - 2012**

Well ID	Well Development	1st Quarter (ft. AMSL)	2nd Quarter (ft. AMSL)	3rd Quarter (ft. AMSL)	4th Quarter (ft. AMSL)	Vertical Gradient (ft.)
BG-1S	1585.26	1585.29	1584.92	1583.75	1584.32	Up 0.05 – 0.21
BG-1M	1585.17	1585.32	1585.03	1583.26	1584.32	
BG-1D	1585.31	1585.50	1585.10	1583.96	1584.51	
BG-2S	1592.52	1592.55	1592.33	1591.78	1591.72	Up 5.37 – 5.67
BG-2M	1592.84	1592.83	1592.52	1591.98	1592.10	
BG-2D	1598.10	1597.92	1597.72	1597.35	1597.39	
BG-3S	1558.18	1558.25	1558.31	1558.31	1558.34	Down 1.66 – 1.83
BG-3M	1558.00	1557.98	1558.03	1558.05	1558.03	
BG-3D	1556.52	1556.55	1556.56	1556.54	1556.51	
BG-4S	1579.66	1579.31	1579.37	1579.35	1579.18	Up 2.21 – 2.92
BG-4M	1579.90	1579.27	1579.36	1579.33	1579.25	
BG-4D	1582.58	1581.60	1581.58	1581.67	1581.73	
BG-6S	1564.60	1564.53	1564.63	1563.45	1563.50	Down 0.14 – 0.31 Up 0.71 – 0.98
BG-6M	1563.85	1563.87	1563.94	1563.54	1563.91	
BG-6D	1564.46	1564.38	1564.32	1564.16	1564.48	
IMW-2.5S	--	1587.52	1586.75	1585.30	1586.28	Up 0.08 – 0.13
IMW-2.5D	--	1587.60	1586.88	1585.42	1586.37	
IMW-3S	--	1582.60	1582.29	--	--	Down 0.43-0.44
IMW-3D	--	1582.17	1581.85	--	--	
KMW-2S	--	1590.82	1590.04	1588.81	1589.62	Up 0.16 – 0.17
KMW-2M	--	1590.90	1590.11	1588.89	1589.67	
KMW-2D	--	1590.99	1590.21	1588.98	1589.78	

Note: IMW-3S and IMW-3d not sampled 3rd Quarter and 4th Quarter due to access restrictions

3.4.5 Groundwater Quality

According to the Nevada State Water Plan, "*The quality of groundwater in the unconsolidated deposits in the Basin and Range alluvial aquifers varies from basin to basin. Dissolved solids concentrations range from less than 500 parts per million (ppm) to more than 10,000 ppm in some areas…Locally, saline water is present near thermal springs and basin-fill aquifers containing large amounts of soluble salts.*" (NDWP, 1999).

The Muddy River and associated springs are one of the discharge areas of the WRFS. As groundwater moves upward from the carbonate aquifers of the WRFS, through the basin fill deposits, the groundwater contacts borate minerals in the Horse Spring Formation and evaporate minerals such as gypsum and halite within the Muddy Creek Formation that lead to increasing TDS from dissolution of those minerals. Anhydrite, gypsum and halite deposits in the Muddy Creek Formation range from a few feet to more than 20 feet in thickness. TDS further increases as groundwater is discharged in the Muddy Springs area and subsequently flows down the Muddy River. "*As the discharged water moves through the shallow sediments and the river course in Moapa Valley it is further degraded in part as a result of concentration of minerals by evapotranspiration and in part by further solution of minerals from the soil. Thus, the total solids at the springs is a little over 600 ppm, at the gaging station in section 15 is over 700 ppm, and below the gaging station south of Glendale total solids range from slightly over 1000 ppm to more than 1500 ppm*" (Maxey, et al., 1966).

Pohlmann found water from the Muddy Creek Formation with high TDS concentrations near Hogan Spring in exploration boring HS-8B (see Figure 2 in Appendix A) (Pohlmann, et al., 1988). The upper dolomitic limestone unit produced 40 to 110 gpm with a conductivity ranging from 810 to 1090 µmhos/cm or approximately 570 – 760 mg/L TDS. The lower half of the Muddy Creek Formation was found to contain poor water quality and quantity (Pohlmann, et al., 1988). This may be a result of "minable" deposits of gypsum, halite, and manganese oxide in the lower section of the Muddy Creek Formation, as mentioned in Section 3.1.3.

In the Moapa Valley, water quality in the alluvium and carbonate aquifers is reported by the DRI to be significantly better than the Muddy Creek aquifer due primarily to the presence of evaporate minerals such as anhydrite, gypsum and halite in the Muddy Creek aquifer (Maxey, et al., 1966). They concluded that "*The shallow groundwater in this basin forms a local system bounded by the relatively impermeable Muddy Creek sediments which form a partial hydraulic boundary at the bottom and sides of the [alluvial] sediments. Water moves into this basin primarily from the two large washes to the northwest especially during periods of storm.…Some water may move upward through the Muddy Creek sediments from the regional system but it is believed that only a small quantity may do this. The quality of the water in the [alluvial] beds is reported to be much better than that in the Muddy Creek formation whereas large quantities of water moving through the Muddy Creek into the [alluvial] gravel would quickly degrade the quality of the water in the [alluvial] beds. Also, the low permeability of the Muddy Creek beds is an obstacle to movement of large quantities of water*".

The DRI also concluded that over pumping or extended pumping of wells in the Muddy Creek Formation will result in lower water quality. Schroth found that extended pumping, especially at higher pumping rates, flushes salts out of the formation sediments, resulting in a reduction in water quality. As higher quality water zones are exhausted, poor quality water may replace it (Schroth, 1987).

Heavy pumping of production wells in the Upper Muddy River Well Field by NVE in 1988 and 1989 resulted in a decrease in water quality from at least portions of the Muddy Creek Formation (Mifflin and Associates, 1997). Dettinger reported that in some areas of southern Nevada, aquifers containing evaporates are impacted with saline concentrations ranging from 1,000 to 35,000 mg/L of dissolved solids as a result of water coming in contact with these evaporate minerals (Dettinger, 1992).

During the background groundwater sampling, the TDS concentrations in the alluvial aquifer ranged from 1500 to 4500 mg/L, and in the Muddy Creek aquifer ranged from 1000 to 4800 mg/L, as indicated in Table 3-6. This contradicts, at these locations, the conclusion that the alluvial aquifer has relatively better water quality than the Muddy Creek aquifer, and also illustrates the variability in groundwater quality across the Station. In addition, non-background and non-Mesa Muddy Creek Formation wells IMW-3D and KMW-1D (located in Hogan Wash) had similar TDS concentration in 2012, ranging from 1656 - 1666 mg/L and 1682 - 1802 mg/L respectively. The Muddy Creek Formation water quality at the Station may be of better quality because the top of the formation was sampled and heavy pumping for extended periods of time has not occurred. Background groundwater quality at the Station will be further evaluated in a future report.

Table 3-6 **TDS Concentrations in the Alluvial and Muddy Creek Aquifers**					
Sampling Event	**Aquifer**	**1st Quarter (mg/L)**	**2nd Quarter (mg/L)**	**3rd Quarter (mg/L)**	**4th Quarter (mg/L)**
BG-1S	Alluvial	2100	2100	1900	1500
BG-1M	Muddy Creek	1500	1400	1800	1400
BG-1D	Muddy Creek	1400	1400	1600	1300
BG-2S	Alluvial/Muddy Creek	4300	3800	4500	4000
BG-2M	Muddy Creek	1800	1900	1900	1900
BG-2D	Muddy Creek	1600	1700	1800	1600
BG-3S	Muddy Creek	1100	1200	1200	1200
BG-3M	Muddy Creek	1200	1100	1200	1200
BG-3D	Muddy Creek	1100	1000	1100	1100
BG-4S	Muddy Creek	1800	1700	1700	1800
BG-4M	Muddy Creek	1700	1700	1600	1700
BG-4D	Muddy Creek	1500	1500	1500	1400
BG-6S	Muddy Creek	2400	2400	2600	2500
BG-6M	Muddy Creek	1800	1800	1800	1900
BG-6D	Muddy Creek	1800	1800	1900	1900
IMW-2.5S	Alluvial	2700	2700	2700	2700
IMW-2.5D	Alluvial	2400	2500	2600	2500
IMW-3S	Alluvial	1600	1800	--	--
IMW-3D	Muddy Creek	1700	1700	--	--
KMW-2S	Muddy Creek	2800	3000	2900	3000
KMW-2M	Muddy Creek	2800	3100	3000	2900
KMW-2D	Muddy Creek	2600	2800	2800	2600
LMW-7	Muddy Creek	2400	2500	2600	2100
LMW-9	Muddy Creek	3200	3300	3300	3100
LMW-10	Muddy Creek	4200	4400	4200	4800
LMW-11R	Muddy Creek	--	4300	4400	4500
LMW-12R	Muddy Creek	--	2784	2786	2778 / 2746
LMW-13R	Muddy Creek	--	2862	2950	2930 / 2968
LMW-14R	Muddy Creek	--	3052	3138	3082 / 3066
LMW-15	Muddy Creek	--	2946	3070	3070 / 3070
LMW-16	Muddy Creek	--	2582	2610	2598 / 2562

Note: IMW-3S and IMW-3d not sampled 3rd Quarter and 4th Quarter due to access restrictions LMW-11R, LMW-12R, LMW-13R, LM14R, LMW-15, and LMW-16 are new wells that not available for the1st Quarter sampling event. LMW-12R, LMW-13R, LM14R, LMW-15, and LMW-16 were sampled twice during the 4th Quarter of 2012.

Section 4

Aquifer Testing

4.1 Objectives

The objectives of the aquifer testing were to estimate aquifer characteristics for both the Muddy Creek and alluvial aquifers, evaluate the connection between the two aquifers, and evaluate potential hydraulic connection between the alluvial aquifer and the Muddy River. The Workplan stated that both slug and pump draw-down and recovery tests would be completed on all new background wells. Following the background drilling activities and discussions with NDEP, this aquifer testing approach was revised as documented in a memo to NDEP dated May 24, 2012 (NVE and Stanley Consultants, 2012). The slug testing was originally included in the Workplan primarily to determine expected pumping rates so that pumps could be selected for the aquifer testing. The revised approach eliminated slug testing because the drawdown data obtained during the well development activities provided adequate information to select the pumps for the aquifer testing. It was agreed that testing all of the new wells was not necessary. Step drawdown and recovery tests would be conducted on selected wells prior to conducting constant rate drawdown and recovery tests.

4.2 Testing Procedures

To evaluate potential connection between the alluvial and Muddy Creek aquifers, well clusters were selected with wells completed in both aquifers. There are three background well clusters with wells completed in both aquifers: BG-1 (S, M, D), BG-2 (S, M, D), and IMW-3 (S, D). Due to a relatively high TDS concentration in BG-2S (4300 mg/L), the BG-2S cluster was excluded from consideration to avoid the potential for impacting the underlying Muddy Creek aquifer with typical TDS concentrations of approximately 1600-1800 mg/L. The fact that the TDS concentrations at BG-2 are approximately three times higher in the alluvial aquifer than the underlying Muddy Creek aquifer could indicate the hydraulic separation between the two. This is not an anomaly as similar conditions also exist in non-background well clusters IMW-2 and

KMW-1 located east of BG-2 in Hogan Wash. Access to IMW-3 was not available at the time of the aquifer testing, leaving BG-1 as the only location for testing without potentially impacting the deeper aquifer . BG-1, a three-well cluster with the shallow well completed in the alluvial aquifer and the medium and deep in the Muddy Creek aquifer, was selected for aquifer testing for the aforementioned reasons. Testing this well cluster would provide aquifer characteristics for both the Muddy Creek and alluvial aquifers in the area of BG-1 and evaluate the connection between the two aquifers.

The KMW-2 well cluster is the only background well cluster in close proximity to the Muddy River. All three wells in this cluster are completed in the alluvial aquifer. This well cluster was selected for aquifer testing to evaluate potential hydraulic connection between the alluvial aquifer and the Muddy River and also to provide aquifer characteristics for the alluvial aquifer. Nearby monitoring well MW-6 was also monitored during aquifer testing at this location.

The aquifer testing at the BG-1 and KMW-2 well clusters was completed between July 31 and August 10, 2012. An intial round of static depth to water measurements was collected on July 30, 2012, using an electronic water level meter calibrated to 0.01 foot and referenced to the top of casing (TOC). Site conditions were generally hot and humid during the aquifer testing, with rain events on July 31 and August 1 (BG-1S pumping days). The initial water level data and maximum drawdown observed are provided in Table 4-1.

Table 4-1 **Summary of Aquifer Test Data**

Well	Depth to Water (ft. TOC)	Screen Interval (ft. TOC)	Test Type	Duration (minutes)	Maximum Drawdown (ft. TOC)	Pump Rate (gpm)	Gallons Pumped
BG-1S	29.31	20.74-40.74	Step	291	33.14	5.0-9.0	1678
			Constant	208	31.97	9.0	1812
BG-1M	29.38	55.10-70.10	Step	236	63.32	0.5-1.8	292
BG-1D	28.89	88.07-103.07	Step	430	85.15	1.0-6.5	1632
			Constant	622	83.79	6.5	3106
KMW-2S	13.45	8.48-28.48	Step	263	24.99	1.0-2.5	351
			Constant	321	24.60	2.0	620
KMW-2M	13.31	43.64-53.64	Step	290	15.37	2.5-7.0	1453
KMW-2D	13.22	67.64-77.64	Step	580	25.35	3.0-6.5	3057

During the aquifer tests, In-Situ Level TROLL 700 pressure transducers were used to collect water level measurements to 0.001 foot at programmed time intervals based on a logarithmic scale in general accordance with the Arcadis Aquifer Test Guidance (Arcadis, 2012), and the EPA SOPs in the QAPP and Workplan. Vented pressure sensors were utilized to reduce the effects of atmospheric pressure on the sensor. Readings were collected at a rate of four readings per second for the first 5 minutes, and decreased to one reading per 30 minutes by the end of the test. These readings were downloaded from the transducer with an In-Situ Rugged Reader

datalogger or a field laptop computer. Before starting a test, a 100 pounds per square inch (psi) In-Situ pressure transducer was set a minimum of two feet above the top of the submersible pump. In the observation wells, In-Situ 30 psi transducers were set at the midpoint of the water column. As a QC check, manual depth to water measurements were collected before starting the test and periodically during the test with a Solinst electronic water level indicator. A multi-step draw-down test was conducted on each of the six monitoring wells followed by a recovery test and then a constant rate draw-down and recovery test was attempted. The aquifer pumping was conducted with a 2-inch Grundfos Redi-flo 2 submersible pump in BG-1M, KMW-2S, KMW-2M, and KMW-2D. A 3-inch Grundfos Redi-flo 3 submersible pump was used in BG-1S and BG-1D. While monitoring well BG-1S was pumped, BG-1M and BG-1D were monitored. While BG-1M was pumped, BG-1S and BG-1D were monitored, and while BG-1D was pumped, BG-1S and BG-1M were monitored. The submersible pumps were set approximately two feet above the bottom of the well screen to avoid pumping silt that may have accumulated in the bottom of the wells and could damage the pump. At the BG-1 well cluster, the pumps were powered by a Honda portable gasoline-fired generator. The pump at the KMW-2 well cluster was powered by a Magnum Pro diesel-fired portable generator. KMW-2S, M, and D were pumped while MW-6 was monitored to evaluate the radius of influence during pumping. In addition, the Muddy River water level was monitored at the MR-1 sampling location. Each step was a minimum of one hour and lasted an average of two hours. Pumping rates were selected based on the results of the well development activities and were controlled with a pump rheostat and an in-line valve to maintain a constant pumping rate. An in-line totalizer and stop watch were used to determine pump discharge rates. These rates were periodically checked with a graduated 5-gallon bucket and a stop watch. Pumping rates during the aquifer testing are presented in Table 4-1.

The number of phases or steps in a test were dependant on the pump capacity and the drawdown of the water column. Once equilibrium was reached following the first step test, the pumping rate was increased until equilibrium was reached again, and then the process was repeated until the pumping capacity was reached or the water level in the well reached the depth of the transducer. At that time, the pump was shut off and left in the well for the recovery test. The recovery period was monitored overnight or until the water level in the pumping well had returned to approximately the same static water level measured prior to initiating the test.

Once the step recovery test was complete, the constant rate draw-down and recovery testing was completed at each well location with the exception of BG-1M, KMW-2M and KMW-2D. Because the sustained pumping rates achieved at BG-1M during the step test were low, the decision was made, after consultation with Arcadis, to forgo the constant rate drawdown test. At KMW-2M and KMW-2D, the 2-inch pump was unable to stress the aquifer sufficiently to conduct a long-term constant rate test without damaging the pump. Because the KMW-2 wells are two inches in diameter, it was not possible to use a larger pump. The step test at KMW-2D was extended to approximately 10 hours in an attempt to stress the aquifer.

For the remaining three wells (BG-1S, BG-1D, KMW-2S), an optimum pumping rate for the duration of the constant rate draw-down test was selected based on the results of the step test. Water levels stabilized in approximately 20 minutes. The draw-down portion of the test was complete when the well reached a steady-state condition at the optimum sustained pumping rate for a period of two to ten hours. The pump was then shut off and left in the well until the

recovery test was complete. The recovery period was monitored with a data logger overnight or until the water level in the pumping well had returned to approximately the same static water level measured prior to initiating the test.

The groundwater pumped during the aquifer testing was discharged through a hose into a 6,000-gallon water truck staged adjacent to the test well. The pump or hose was equipped with a check valve to prevent water in the hose from flowing back into the well and biasing the test results. Upon completion of the test, or when the tank became full, Eagle View Contractors hauled the water to one of the E Ponds for disposal. The volumes of water pumped during each test are presented in Table 4-1.

Following completion of the aquifer testing at each well location, the equipment was removed from the wells and washed in an Alconox and tap-water solution with a DI water rinse at the decon pad adjacent to the southeast corner of the 4B-3 Pond.

4.3 Aquifer Performance Testing Results

4.3.1 Hydraulic Connection between Alluvial and Muddy Creek Aquifers

Previous studies suggest that the clay layers in the upper portion of the Muddy Creek Formation act as an aquitard and there is little groundwater flow between the Muddy Creek Formation and the overlying alluvium (Mifflin and Associates, 1993 and 1994). Evidence suggests that the alluvial aquifer is in hydraulic connection with the Muddy Creek Formation where conduits exist or where over-pumping of the alluvial aquifer occurs. Where conduits do exist, they have a negative impact on the alluvial aquifer's water quality, especially when the alluvial aquifer is over-pumped (Bredehoeft and Hall, 1996).This study, as well as previous ones conducted by DRI, have documented that upward vertical gradients exist within the Muddy Creek Formation (Hess, 1986 and Johnson et al., 1986).

Based on the pump test observation data presented in Table 4-2, there appears to be a minor hydraulic connection between the alluvial aquifer and the underlying Muddy Creek aquifer at the BG-1 well cluster. Similarly, there appears to be a minor hydraulic connection between the shallow and deeper zones within the Muddy Creek aquifer. Further evidence that the hydraulic connection is minor between the aquifers is the high TDS concentrations in the shallow alluvial wells at BG-2, IMW-2, and KMW-1 but not in the deep Muddy Creek wells. The soil boring logs show the upper portion of the Muddy Creek Formation exhibits a lesser amount of saturated fine sand and silt zones in BG-1 and BG-2 than the deeper portions of the formation. The clay zones in BG-1 and BG-2 were also more massive than those found in BG-3, BG-4, and BG-6, which were not included in the aquifer testing.

At the KMW-2 well cluster, which is entirely in the alluvial aquifer, there also appears to be a minor hydraulic connection between the shallow and deeper zones of the aquifer as indicated by the percent drawdown from static water conditions. Based on the soil boring logs and data presented in Table 4-2, KMW-2M appears to be completed in a more permeable zone of the alluvial aquifer than KMW-2S and KMW-2D.

Table 4-2 **Observed Water Level Drawdown in Well Clusters During Pump Testing**					
Well ID	**Aquifer**	**Well Use**	**Pump Rate (gpm)**	**Drawdown (ft. TOC)**	**Drawdown (% of static water column)**
BG-1S	Alluvial	Pumping	9	-2.75	-18%
BG-1M	Muddy Creek	Observation	NA	-0.14	-0.3%
BG-1D	Muddy Creek	Observation	NA	-0.05	-0.1%
BG-1M	Muddy Creek	Pumping	1.8	-33.97	-79%
BG-1S	Alluvial	Observation	NA	-0.04	-0.3%
BG-1D	Muddy Creek	Observation	NA	-0.05	-0.1%
BG-1D	Muddy Creek	Pumping	5.5-6.5	-55.16	-72%
BG-1S	Alluvial	Observation	NA	-0.09	-0.6%
BG-1M	Muddy Creek	Observation	NA	-0.32	-0.7%
KMW-2S	Alluvial	Pumping	2.5	-11.40	-75%
KMW-2M	Alluvial	Observation	NA	-0.44	-1.1%
KMW-2D	Alluvial	Observation	NA	-0.15	-0.2%
MW-6	Alluvial	Observation	NA	-0.11	-1.1%
KMW-2M	Alluvial	Pumping	7	-2.27	-5.6%
KMW-2S	Alluvial	Observation	NA	-0.81	-5.3%
KMW-2D	Alluvial	Observation	NA	-0.21	-0.3%
MW-6	Alluvial	Observation	NA	-0.06	-0.6%
KMW-2D	Alluvial	Pumping	6.5	-12.48	-19%
KMW-2S	Alluvial	Observation	NA	-0.23	-1.5%
KMW-2M	Alluvial	Observation	NA	-0.31	-0.8%
MW-6	Alluvial	Observation	NA	-0.14	-1.3%

4.3.2 Alluvial Aquifer - Muddy River Connection

Over several years Mifflin and Associates evaluated the hydrologic impacts from groundwater withdrawals in the Upper Muddy Creek River Valley approximately two to eight miles northwest of the Station (Mifflin and Associates, 1993, 1994, 1997) and concluded that:

- Muddy River flow originates from the alluvial aquifer base flow and spring discharge.
- The alluvial aquifer behaves as an unconfined aquifer in the upper portion of the Muddy River Valley and a confined aquifer in the lower portion of the Upper Muddy River Valley.
- The alluvial aquifer behaves as an unconfined aquifer in the upper portion of the aquifer but acts as a confined aquifer in the deeper portion of the aquifer.
- The Muddy River channel and tributary channels are in hydraulic communication with the unconfined alluvial aquifer but there is no evidence for hydraulic connection between the Muddy River and the confined alluvial aquifer throughout this reach of valley.

- The reach of the Muddy River in Section 16 (approximately four miles northwest of the Station) is in close hydraulic communication with the alluvial aquifer and exhibits characteristics of the gaining stream downstream of the Big Muddy Spring.
- In Section 15, (approximately eight miles northwest of the Station) the Muddy River becomes hydraulically separated from the alluvial aquifer until at least the White Narrows area (approximately four miles northwest of the Station) where it becomes connected again.
- The hydraulic separation between the alluvial aquifer and Muddy River occurs upstream of Warm Springs Bridge, but the exact location where they separate has not been documented.
- Strong pumping cones of depression formed on a seasonal basis in the alluvial aquifer corresponded to variations in Muddy River flow.

This study documents the variability of the alluvial and Muddy Creek aquifers as well as their interactions with the Muddy River throughout the Moapa Valley, including in the area of the Station.

During the aquifer testing at KMW-2, a minimal drawdown was recorded in observation well MW-6 located approximately 380 feet away. This radius of influence could potentially intersect the Muddy River and potentially confirm Mifflin's study. Water quality parameters were monitored in the river and in the pumping well during the aquifer testing, but no significant changes were observed during the test. Even if the radius of influence intersects the Muddy River, it does not necessarily mean water would be extracted from the river. In addition, there may be only a small amount of hydraulic connection that could be hard to observe. Another explanation for the observed fluctuating water levels in MW-6 could be changes in atmospheric conditions during the test, although a vented transducer was used to compensate for barometric pressure changes. A proposed future study of the Muddy River will further evaluate the river and alluvial aquifer interaction.

Section 5

Analytical Results

5.1 Soil Laboratory Analyses

During this investigation, 51 soil samples and six QC samples were submitted to the Veritas Las Vegas, Nevada laboratory for analysis of 51 SRCs. Samples for metals, general chemistry (excluding silica), SVOC, and PAH analyses were subcontracted to ESC in Mt. Juliet, Tennessee. Samples for silica analyses were subcontracted to TestAmerica in Denver, Colorado. Samples for asbestos analyses were subcontracted to Fiberquant in Phoenix, Arizona. All laboratories are certified in the State of Nevada for the analyses conducted. Table 5-1 presents the soil concentration ranges in milligrams per kilogram (mg/kg) for the analytes that were detected and compares them with the results of two background soil investigations completed by the USGS. In all cases where common parameters where analyzed, NVE background soil concentrations were within an order of magnitude of the USGS ranges.

Table 5-1 **Background Soil Concentrations Compared to Regional Soil Concentrations**

Parameter	NVE 2011-2012	USGS – Nevada – 1984 [1]
Metals (mg/kg)		
Aluminum	1,500 – 32,000	700 - >1,000
Antimony	0.58 – 1.3	<1 - 10
Arsenic	0.97 - 140	<0.1 - 100
Barium	7.8 - 250	10 - 5,000
Beryllium	0.022 – 1.6	<1 - 15
Boron	1.2 - 30	<20 - 300
Cadmium	0.043 – 0.48	NA
Calcium	4,000 – 160,000	130 - 330,000
Chromium (hexavalent)	0.92 – 1.8	NA

Table 5-1 **Background Soil Concentrations Compared to Regional Soil Concentrations**		
Parameter	**NVE 2011-2012**	**USGS – Nevada – 1984 [1]**
Metals (mg/kg)		
Chromium (total)	2.6 – 38	1 - 2,000
Cobalt	0.89 – 9.4	<3 - 70
Copper	1.2 - 26	<1 - 700
Iron	2,800 – 26,000	100 - >100,000
Lead	0.76 – 18	<10 - 700
Magnesium	950 – 30,000	200 - >100,000
Manganese	63 – 1,200	<2 - 7,000
Mercury	0.001 - 0.36	<0.01 - 5.1
Molybdenum	0.14 – 12	<3 - 15
Nickel	1.8 – 28	<5 - 700
Potassium	590 - 7,500	2,200 - 65,000
Selenium	0.66 – 11	<0.1 - 5
Silica	390 - 1,300	NA
Silver	0.2 – 0.79	NA
Sodium	60 - 6,100	3,000 - 100,000
Thallium	<1 - 1.6	NA
Titanium	21 – 300	70 - 20,000
Vanadium	5.1 – 54	30 - 500
Zinc	7.3 - 81	28 - 3,500
General Chemistry (mg/kg)		
Ammonia (as N)	2.3 – 17	NA
Chloride	7.6 – 3,800	NA
Fluoride	2.1 – 18	NA
Nitrate (as N)	0.28 – 150	NA
pH	7.8 - 9.2	NA
Phosphates as P	0.38 - 0.72	NA
Sulfate	58 - 16,000	NA
SVOCs (μg/kg)		
Bis(2-ethylhexyl) phthalate	17 – 920	NA

[1] Shacklette and Boerngen, 1984. *Element Concentrations in Soils and Other Surficial Materials in Conterminous United States*, Geological Survey Professional Paper 1270, U. S. Geological Survey, 1984.

Soil chemical analytical results are summarized in Appendix D, Table D-1. Soil data validation reports are discussed in Section 5.1.2. A statistical evaluation of the soil samples collected for chemical analysis is included in Section 6.

In addition, 21 soil samples collected for physical analyses were submitted to Converse Consultants in Las Vegas, Nevada. Converse Consultants performed bulk density, grain size,

permeability, pH, Atterberg limits, moisture content, and TOC tests. Soil physical analytical results are summarized in Appendix D, Table D-2. Copies of the physical analysis laboratory reports are provided in Appendix E.

Soil samples were collected and analyzed for physical characteristics to supplement field observations. Grain size analysis was conducted on bulk disturbed soil samples (generally one to three feet of soil) to determine the percentage of gravel, sand, and silt/clay in the soil. Distribution of the grain sizes was used by Converse Consultants to determine the USCS classification of the soil. Atterberg limits tests were performed on fine-grained soils in accordance with ASTM D 4318-10 (ASTM, 2010). The Atterberg tests determine the plasticity index (PI) of soil; soils containing clay generally have a higher PI, and soils containing silt generally have a lower PI. Gravels and sands are generally non-plastic. The PI of soils at the site ranged from non-plastic to 71 (fat clay). TOC and pH analyses were also conducted on the disturbed samples. TOC at the site ranged from 0.1% to 2.4%, and pH ranged from 7.81 to 9.04.

Dry density, percent moisture, and permeability tests were performed on the undisturbed soil samples collected in brass rings (generally 6" of soil). Permeability ranged from 1.70 x 10^{-9} cm/sec to 8.46 x 10^{-2} cm/sec or 1.47 x 10^{-6} m/d to 73.09 m/d. Table 5-2 summarizes the laboratory results of the soil constant head permeability and flexible wall hydraulic conductivity analyses. The laboratory technician produced the soil descriptions for these samples. The permeability in samples described as fine sand with silt ranged from 8.46 x 10^{-7} to 1.47 x 10^{-2}. The complete results are included in Table D-2.

Table 5-2 **Soil Permeability Summary**

K Values from Laboratory Report (cm/sec)	Soil Descriptions From Laboratory Report
$8.46E^{-2}$ to $7.65\ E^{-5}$	Fine sand, fine to coarse grained sand with clay, fine sand with silt, sand with plastic fines, sand with silt, silty sand with clay pocket, silty sand, silt with sand
$2.08E^{-7}$ to $5.46E^{-9}$	Sandy clay, silty clay, silty sand with lean clay interbeds, silty clay with gravel, clay
$4.06E^{-9}$ to $1.70E^{-9}$	Lean clay

In general, the ASTM D 2488-09a and USCS classifications identified from the grain size analysis were similar to the soil classifications determined by the field geologist. The USCS classifications were based on field observations and laboratory analysis of bulk samples collected from one to three feet of soil. Because the lithology at the site is heterogeneous, it appears that the undisturbed soil collected in the brass rings is different than the soil collected for the bulk sample.

5.1.1 Quality Control Data

During the background soil sampling, six QC samples (three FBs and three EBs) were collected using DI water provided by Veritas. The FBs were collected by pouring DI water into sample containers while in the field in the background sampling areas. The EBs were collected by pouring DI water through a decontaminated split-spoon sampler and into a stainless steel bowl containing a stainless steel sampling utensil and nitrile glove. The FBs

were used to evaluate potential contamination of samples in the field from the atmosphere and the EBs were used to evaluate the adequacy of decontamination. These samples were analyzed for the same parameters as the soil samples.

Table 5-3 provides the data for those parameters that were detected in one or more of the QC samples. Although low levels of some parameters were detected in some QC samples, the concentrations do not indicate QC problems that would influence the data quality.

Table 5-3 **Soil Quality Control Sample Results (mg/L)**

Analyte	BG-FB-1 12/21/2011	BG-EB-1 12/21/2011	BG-FB-2 2/8/2012	BG-EB-2 2/8/2012	BG-FB-3 2/23/2012	BG-EB-3 2/23/2012
Chloride	4.9	5.0	ND	ND	ND	ND
Fluoride	0.12	0.18	ND	ND	ND	ND
Phosphates as P	0.049J	0.034J	0.028 J,T2	0.025 J,T2	0.026J	0.026J
Antimony	ND	ND	ND	0.053	ND	ND
Iron	0.14	ND	ND	ND	ND	ND
Magnesium	ND	0.41	ND	ND	ND	ND
Mercury	ND	ND	0.00003J	0.00002J	ND	ND
Potassium	ND	2.2	ND	ND	ND	ND
Bis(2-ethylhexyl) phthalate	ND	0.0032	ND	0.00083J	ND	ND

Notes: ND – Non- detect, J – Estimated value below the lowest calibration point, T2 – The laboratory analysis was from an unpreserved or improperly preserved sample.

5.1.2 Soil Data Validation

Upon receipt of the Level 4 data packages from the laboratory for background soil analysis, they were forwarded to Ordway and Associates, Inc. for data validation in accordance with the Revised Data Validation Memorandum of Understanding dated March 5, 2010 (NVE, 2010). During the data review process, Ordway and Associates identified some laboratory issues that resulted in revisions to the level 4 data packages. The Technical Data Validation Reports prepared by Ordway and Associates, along with a summary of the issues, were submitted to the NDEP in the *Draft Evaluation of Background Conditions Data Validation Reports for Soil*, dated June 2012 and finalized May 2013 (Stanley Consultants, 2013a). Evaluation of the overall data quality was completed by Stanley Consultants' QC Manager. All data were determined to be usable.

5.1.3 Soil Data Qualitative Objectives

Stanley Consultants completed an assessment of the overall data quality with respect to Comparability, Representativeness, and Completeness as outlined in the QAPP (Stanley Consultants, 2011a).

- **Comparability**: Samples submitted to Veritas by Stanley Consultants were collected using the procedures specified in the QAPP. The soil results reported are adequate to use for statistical analysis and to compare to current screening levels. The reporting

limits for water (QC samples) are adequate to determine the presence of residual contamination.

- **Representativeness:** The field sampling locations and techniques and the laboratory analytical methods were reviewed. The field sampling locations were within acceptable distances from the sampling locations proposed in the Workplan. Field procedures were generally in accordance with the approved Workplan and QAPP with deviations noted in Section 2.3. Field logs and other documentation were reviewed to evaluate the field procedures including sample collection, decontamination procedures, laboratory containers, preservation, packaging, transportation, receipt, handling and storage, COC, and holding times. Integrity of the samples was maintained after collection. Samples were immediately placed on ice and remained cool until they arrived at Veritas. The proper COCs and cooling continued during transport to the subcontracted laboratories. Analytical methods were appropriate to meet the objectives of the sampling event.
- **Completeness:** The completeness goal for the project was for all project data to be 90 percent accepted. Completeness is calculated by dividing the total number of valid results by the total expected. An acceptable analysis is defined as one that is not rejected. The Workplan included four well clusters with five to 10 samples per boring (total of 20 to 40 samples), with 51 analytes per sample. The actual sampling event included the four well clusters plus one additional well cluster. Eight to 12 soil samples were collected for chemical analyses from each of the five deep borings with an additional six to eight samples collected for geotechnical analyses (total of 51 chemical and 21 geotechnical samples). None of the soil data were flagged in the data validation reports as being unusable. Although one parameter was not measured (reported phosphate as P instead of the requested total phosphate), the calculated completeness is greater than 100 percent and the completeness goal has been met.

The objective of the soil sampling effort was to determine background concentrations of SRCs for the Station using standard statistical methods. Although some issues were identified with the laboratory analyses, the field data collected and the laboratory data are of sufficient quality to satisfy the Data Quality Objectives (DQOs) outlined in the QAPP.

5.2 Groundwater Laboratory Analyses

For the background sampling activities, four quarters of groundwater samples were collected from 15 new background wells and eight existing monitoring wells, and two quarters of groundwater samples were collected from two existing monitoring wells. In addition, 49 QC samples including duplicates, FBs, and EBs were collected. All samples were submitted to Veritas Las Vegas, Nevada laboratory for analysis of 53 SRCs and two additional general chemistry parameters needed to conduct a cation-anion balance check. Samples for metals, general chemistry (excluding silica), SVOC, and PAH analyses were subcontracted to ESC in Mt. Juliet, Tennessee. Samples for silica analyses were subcontracted to TestAmerica in Denver, Colorado. Samples for asbestos analyses were subcontracted to Fiberquant in Phoenix, Arizona.

Table 5-4 presents the groundwater concentration ranges for the analytes that were detected in the 2012 background samples (summarized in Table D-3, Appendix D) and compares them with the results of the previous Station background investigation in 2003 and regional alluvial aquifer

concentrations from published sources. In all cases where common parameters were analyzed, NVE background soil concentrations were within an order of magnitude of the USGS ranges.

Table 5-4 **Background Groundwater Concentrations Compared to Previous Station and Regional Groundwater Concentrations**

Parameter	NVE Alluvial and Muddy Creek Aquifers (2012)[1]	Average Station Background Concentration (2003)[2]	Regional Alluvial Aquifer Groundwater Concentrations[3]
Metals (mg/L)			
Aluminum	0.031-0.12	0.32	NA
Arsenic	0.01-0.29	0.162	NA
Barium	0.002-0.067	0.07	0.049-0.34
Beryllium	<0.003	<0.005	<0.0005
Boron	0.4-9.20	1.4	NA
Cadmium	0.0007-0.0051	<0.005	<0.001
Calcium	68-530	NA	33-137
Chromium (total)	0.005-0.12	0.06	NA
Cobalt	<0.002-0.14	NA	<0.003
Copper	0.002-0.007	NA	<0.010
Fluoride	0.05-4.60	NA	0.5-1.2
Iron	0.02-1	0.85	0.01-0.77
Lead	0.002-0.034	ND	<0.010
Magnesium	270-290	165	7.5-70.4
Manganese	0.003-0.360	0.27	0.08 – 0.3
Mercury	<0.000010-000040	ND	NA
Molybdenum	0.0016-0.41	0.033	<0.010- 0.02
Nickel	<0.02	<0.04	NA
Potassium	12-86	NA	1.2-19.9
Selenium	0.01-0.24	0.008	NA
Silica	13-64	NA	14-65
Silver	0.003-0.027	NA	NA
Sodium	100-790	520	34-306
Titanium	<0.01	0.013	NA
Vanadium	0.0025-0.025	0.004	<0.006
Zinc	0.01-0.39	NA	0.006-0.55
General Chemistry (mg/L except for pH)			
Alkalinity - Bicarbonate	66-1200	NA	160-361
Chloride	34-520	520	26-219
Nitrogen, Ammonia(As N)	0.05-0.83	NA	0.06-0.47
Nitrogen, Nitrate (As N))	0.03-10	0.42	NA
pH (field)	7.89-7.77	NA	7.0-8.4
Total Phosphorus	0.02-2.60	0.2[4]	0.01-0.04
Sulfate	390-2900	1072	20-670
Total Dissolved Solids (TDS)	1000-4800	2570	499-1620

[1] Summary of groundwater chemical analytical results from Table D-3 in Appendix D.
[2] Average of IMW-2.5 S and D data from 1996-2003 and KMW-2S, M, and D data from 1998-2003 (NPC, 2003a; NPC, 2003b).
[3] Thomas, et al, 1991, Schroth, 1987. [4] Phosphate

Groundwater data validation reports are discussed in Section 5.2.2. A statistical evaluation of the groundwater samples collected for chemical analysis is included in Section 6.

5.2.1 Quality Control Data

During the background groundwater sampling, 49 QC samples (16 FBs, 16 EBs, and 17 duplicates) were collected. The FBs were collected by pouring DI water provided by Brenntag into sample containers while in the field in the background sampling areas. The EBs were collected by pouring DI water through the decontaminated sampling pump and tubing. Duplicate samples were collected at random monitoring wells and sent to the laboratory as field duplicates. The FBs were used to evaluate potential contamination of samples in the field from sample handling procedures and the atmosphere. EBs were used to evaluate the adequacy of decontamination. The duplicates were used to evaluate the consistency of laboratory results for two similar samples. All QC samples were analyzed for the same parameters as the groundwater samples. Trace amounts of various parameters found in both the FBs and EBs were determined to be artifacts of the DI water and not contamination occurring in the field.

The data for those parameters that were detected in one or more of the QC samples is included in Appendix D. Evaluation of this data is discussed in Section 5.2.3.

5.2.2 Groundwater Data Qualitative Objectives

Stanley Consultants completed an assessment of the overall data quality with respect to Precision, Accuracy, Comparability, Representativeness, and Completeness as outlined in the QAPP (Stanley Consultants, 2011a).

- **Precision:** Laboratory precision was assessed by the third party validation process. None of the groundwater data were flagged in the data validation reports as being unusable. Field precision was evaluated by the relative percent difference (RPD) between duplicated results. As outlined in the QAPP, if the RPD exceeds 30 percent (30%) for organics and 20 percent (20%) for inorganics, the data will be qualified. The field RPDs were exceeded in 69 of the 922 results (7.5%). In most cases the reported values are either at low concentrations near the reporting limit or within a magnitude of each other. These variances may be attributed to the heterogeneity of field samples. LMW-9 and Dup-3 collected on November 28, 2012, had PAHs reported with a RPD of more than 195%. The laboratory determined that the PAH sample collected from LMW-9 was compromised during the analytical process and that the PAH data from Dup-3 passed quality criteria. The PAH values for Dup-3 were used for statistical calculations but the LMW-9 results were identified as potential outliers as discussed in Section 6. Overall, the RPDs of the duplicate results suggest adequate precision between samples, so no field qualifiers were added.
- **Accuracy:** The accuracy of laboratory analysis was assessed by the third party validation process. Field accuracy was assessed through the analysis of field equipment blanks and trip blanks. The analysis of blanks was used to monitor errors associated with the sampling process, field conditions, sample preservation, and sample handling. Although low levels of some parameters were detected in some QC samples, the concentrations do not indicate QC problems that would influence the data quality.

- **Comparability**: Samples submitted to Veritas by Stanley Consultants were collected using the procedures specified in the QAPP. The groundwater results reported are adequate to use for statistical analysis and to develop background concentrations. The reporting limits for water (QC samples) are adequate to determine the presence of residual contamination.
- **Representativeness:** The field sampling locations and techniques and the laboratory analytical methods were reviewed. Field procedures were generally in accordance with the approved Workplan and QAPP with deviations noted in Section 2.3. Field logs and other documentation were reviewed to evaluate the field procedures including sample collection, decontamination procedures, laboratory containers, preservation, packaging, transportation, receipt, handling and storage, COC, and holding times. Integrity of the samples was maintained after collection. Samples were immediately placed on ice and remained cool until they arrived at Veritas. The proper COCs and cooling continued during transport to the subcontracted laboratories. Analytical methods were appropriate to meet the objectives of the sampling event.
- **Completeness:** The completeness goal for the project was for 90% of all planned samples to be collected with the data usable. Completeness is calculated by dividing the total number of valid sample results by the total planned sample results. An acceptable analysis is defined as one that is not rejected. The Workplan included 25 groundwater samples with 55 analytes per sample for a total of 1,375 results. The actual groundwater sampling included four sampling events, with 100 samples collected in total, and 55 analytes per sample for a total of 5,500 results or 400% of the planned results. None of the groundwater data were flagged in the data validation reports as being unusable.

The objective of the groundwater sampling effort was to determine background concentrations of SRCs for the Station using standard statistical methods. Although some issues were identified with the laboratory analyses, all data are usable for meeting this objective. The field data collected and the laboratory data are of sufficient quality to satisfy the DQOs outlined in the QAPP.

5.2.3 Groundwater Data Validation

Upon receipt from the laboratory of the Level 4 data packages for background groundwater analysis, they were forwarded to Ordway and Associates, Inc. for data validation in accordance with the Revised Data Validation Memorandum of Understanding dated March 5, 2010 (NVE, 2010). During the data review process, Ordway and Associates identified some laboratory issues that resulted in revisions to the Level 4 data packages. However, they determined that all data were usable. The Technical Data Validation Reports prepared by Ordway and Associates, along with a CD with the Level 4 laboratory data packages, were submitted to the NDEP as follows:

- First Quarter 2012: *Evaluation of Background Conditions Data Validation Reports for Groundwater, First Quarter 2012* (Stanley Consultants, 2013b). Draft submitted December 18, 2012, and approved by NDEP on March 8, 2013.

- Second Quarter 2012: *Evaluation of Background Conditions Data Validation Reports for Groundwater, Second Quarter 2012* (Stanley Consultants, 2013c). Draft submitted December 19, 2012, and approved by NDEP on March 8, 2013.
- Third Quarter 2012: *Evaluation of Background Conditions Data Validation Reports for Groundwater, Third Quarter 2012* (Stanley Consultants, 2013d). Draft submitted January 14, 2013, and approved by NDEP on March 8, 2013.
- Fourth Quarter 2012: *Evaluation of Background Conditions Data Validation Reports for Groundwater, Fourth Quarter 2013* (Stanley Consultants, 2013e). Draft submitted March 28, 2013, not yet approved.
- Evaluation of the overall data quality was completed by Stanley Consultants' QC Team. All data were determined to be usable.

Section 6

Statistical Data Evaluation

6.1 Soil Statistical Analysis

During the background sampling activities, 51 soil samples were collected from various depths in five soil borings; BG-1, BG-2, BG-3, BG-4, and BG-6; and analyzed for 51 SRCs. The samples were collected from both the alluvium (12 samples) and the Muddy Creek Formation (39 samples). The data were statistically analyzed to establish BTVs for 35 of the 51 SRCs. Because there were no detections of asbestos, biphenyl, or PAHs, BTVs were not established for these parameters. The pH data were not analyzed because it was not necessary to establish a BTV for pH. However, BTVs were established for all of the other general chemistry and metals parameters. Bis(2-ethylhexyl) phthalate was also evaluated since it was detected in four samples.

The 12 soil samples collected from the alluvium included samples collected in well-graded gravel, silty gravel, well-graded sand, poorly-graded sand, silty sand, silt, lean clay, and fat clay. The 39 samples collected from the Muddy Creek Formation were classified as poorly-graded sand, well-graded sand, clayey sand, silt, lean clay, and fat clay. Table 6-1 provides soil classifications for each of the samples in both formations. Note that some samples have more than one soil classification.

Table 6-1 **Geologic and Soil Classifications of Background Soil Samples**

Soil Boring	Depth (ft.)	Alluvium								Muddy Creek Formation					
		Well- graded gravel (GW)	Silty gravel (GM)	Well- graded sand (SW)	poorly-graded sand (SP)	silty sand (SM)	silt (ML)	lean l clay (CL)	fat clay (CH)	poorly-graded sand (SP)	silty sand (SM)	clayey sand (SC)	silt (ML)	lean l clay (CL)	fat clay (CH)
BG-1	0-2								X						
	10						X								
	29	X	X					X							
	40	X													
	43													X	
	46										X			X	
	55													X	
	78													X	
	92										X				
BG-2	0-2				X										
	10				X										
	19					X									
	21					X									
	30														X
	32										X				
	75										X				
	82														X
BG-3	0-2				X	X									
	10					X									
	17													X	
	22													X	
	29									X					
	63									X					
	65									X					
	69													X	
	95									X					
	105												X		
	131										X				
	136										X				
BG-4	0-2													X	
	10											X			
	19													X	
	40													X	
	65											X			
	79													X	
	82												X	X	
	95									X			X	X	
	117											X			
	120										X			X	
	161													X	
	163													X	
BG-6	0-2	X													
	9			X											
	28														X
	53														X
	58										X				
	75										X		X	X	
	87														X
	98										X				
	114												X		X
	127										X		X	X	

6.1.1 Statistical Analysis

6.1.1.1 Statistical Analysis Software

The statistical software tool ProUCL 4.0 (EPA, 2010a) was used to evaluate the background soil data. It was developed for the EPA by Lockheed Martin and is a companion to the EPA guidance document *"Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites"* (EPA, 2002). ProUCL 4.0 includes several statistical methods that can be used, based on the distribution of the data, to calculate UTLs using data sets without any ND results as well as data sets with ND results. To help evaluate which statistical method is most appropriate for a data set, ProUCL 4.0 can also be used to conduct goodness-of-fit (GOF) tests.

6.1.1.2 Process for Determining BTVs

The first step in the data evaluation was to check for different statistical populations, by parameter, for the soil samples. Different populations were expected because of differences in mineral content of different geologic materials, geochemical changes that can occur in the subsurface over time, and observation of plots prepared for some of the parameters. Different data populations may have different means, ranges, and statistical distributions. If the different populations are not evaluated separately, the calculated background concentrations, or BTVs, will not accurately reflect background conditions.

Five methods of grouping the soil data were initially evaluated using ProUCL to determine which populations were most appropriate from a statistical standpoint. Groupings were considered based on 1) the geologic formation (Muddy Creek formation versus alluvium) of the soil samples, 2) the soil classifications (clay versus non-clay), 3) the saturation of the soils, 4) surface soil (0-2 ft bgs) versus non-surface soil (>2 ft bgs), and 5)depth at which the samples were collected (<20 ft bgs versus >20 ft bgs). The depth of 20 feet for a potential division of populations was determined by plotting concentration versus depth for several parameters. Groupings that were discarded after an initial evaluation included saturated versus unsaturated soil and surface soil versus non-surface soil. For the surface soil versus non-surface soil evaluation, the data set for surface soil would consist of only six points, thus limiting the statistical validity of the tests. The three remaining population groupings were considered in more detail, as described in Sections 6.1.2 through 6.1.5.

Table 6-2 **Soil Population Groupings Considered**	
Grouping	**Comments**
Saturated vs. Unsaturated	Results were similar to data grouped by <20 feet bgs vs. > 20 ft. bgs, but differentiation occurred less often. (Discarded after initial evaluation.)
Surface soil (0-2 ft. bgs) vs. Non-surface (>2 ft. bgs)	There were only 6 soil samples collected at depths of 0-2 ft. bgs so statistical validity was too limited. (Discarded after initial evaluation.)
Muddy Creek formation vs. alluvium	Evaluated further in Section 6.1.2
Clay vs. non-clay	Evaluated further in Section 6.1.3
Soil samples from <20 ft bgs vs. soil samples from > 20 ft bgs	Evaluated further in Section 6.1.4

For each of the five data groupings, ProUCL 4.0 was used to determine the statistical distributions (normal, lognormal, gamma, or nonparametric) for each SRC using GOF tests, with a 0.95 confidence coefficient. The GOF test evaluates the level of agreement between the observations and a specific distribution. ProUCL 4.0 uses the Shapiro-Wilk (S-W) test statistic to test for normality and lognormality. The Kolmogorov-Smirnov (K-S) and Anderson-Darling (A-D) tests were used to test for gamma distribution. For sample populations with ND values, distributions were calculated using the Maximum Likelihood Estimate (MLE) or Regression on Order Statistics (ROS) methods. Explanations for each of these methods can be found in the ProUCL Version 4.00.05 Technical Guide (EPA, 2010b).

After the distribution of the SRC in each data grouping was determined, ProUCL's two-sample hypothesis testing capability was used to compare populations. The default null hypothesis was that both populations were the same (e.g., SRC concentrations in the Muddy Creek and alluvium are statistically indistinguishable). The alternate hypothesis, that the populations were not the same, was tested at the 5% significance level. The level of significance is equal to one minus the confidence coefficient. In this case, the confidence coefficient desired is 0.95 so a 0.05 or 5% significance level was the goal when evaluating the data. Depending upon the distribution, the number of ND samples, and the detection limit (DL) of the ND samples, one of the following tests was used to compare the means, shapes, and distributions of the populations:

- Student's t-test (t-test)—used when the distribution of both data sets are normal and variances (how far the numbers are spread from the mean) are equal
- Welch-Satterthwaite test (W-S)—used when the distribution of both data sets are normal and variances are not equal
- Wilcoxon-Mann-Whitney test (WMW)—used when the two data sets have different distributions, there are no more than 40% ND values in either data set, and all the NDs have the same DL

- Gehan test—used when the two data sets have different distributions and there are more than 40% ND values in either of the data sets, or the ND values have varying DLs
- Once the distribution of a background data set was determined, parametric or nonparametric statistical methods were used to calculate background statistics. The upper tolerance limit (UTL) was used to calculate a value that would be greater than 95% of the soil data with a confidence coefficient of 0.95. The 95% UCL calculation in ProUCL 4.0 was not used to determine BTVs because, according to the ProUCL guidance, the 95% UCL should not be used to estimate a BTV (a value in the upper tail of the background data distribution) to be compared with individual site observations. This is because a UCL with a 95% confidence limit of the mean represents an estimate of the population mean (measure of the central tendency of a data distribution), whereas a 95% UTL with 95% coverage represents an estimate of a threshold value in the upper tail of the data distribution. The calculated UTL is the same as the proposed BTV.

Calculation spreadsheets and ProUCL printouts are provided electronically at the end of this report.

6.1.2 Population Evaluation – Geologic Formation

Soil samples were collected from two formations, the alluvium and the Muddy Creek Formation. As shown in Table 6-1, a total of 12 samples were collected in the alluvium; BG-1 (4 samples), BG-2 (4 samples), BG-3 (2 samples), and BG-6 (2 samples). The alluvium was not present at BG-4. A total of 39 samples were collected from the Muddy Creek Formation; BG-1 (5 samples), BG-2 (4 samples), BG-3 (10 samples), BG-4 (12 samples), and BG-6 (8 samples).

6.1.2.1 Distribution

ProUCL 4.0 was used to determine the statistical distributions of the alluvium and Muddy Creek Formation data sets for each SRC. Because thallium had only one detected value, a distribution could not be determined for either the alluvial or Muddy Creek Formation. Antimony, with only two total detections, and bis(2-ethylhexyl) phthalate, with only four total detections, did not have enough detected data collected in the alluvium to determine a distribution, but a distribution could be determined in the Muddy Creek Formation data set. Statistics determined with only a few detected values (less than 4 to 6) are unreliable and ProUCL 4.0 will not perform the calculation.

6.1.2.2 Two-Sample Hypotheses

Comparisons were made between the parameter populations (sample values) of the alluvium and Muddy Creek Formation data sets using ProUCL's two-sample hypothesis testing capability. Of the 35 parameters of interest for which population comparisons were made, seven (beryllium, copper, nickel, nitrate, silica, sodium, and titanium) had statistically different concentrations at the 5% significance level for samples collected in the alluvium versus samples collected in the Muddy Creek Formation. The distribution,

mean, and outliers for the seven parameters with populations differentiated by geologic formation are included in Table 6-3. Outliers are discussed in Section 6.6.

Table 6-3 **Soil Statistical Results for Parameters Differentiated by Geologic Formation**

Parameter	Alluvium			Muddy Creek Formation		
	Distribution	Mean (mg/kg)	Potential Outliers (mg/kg)	Distribution	Mean (mg/kg)	Potential Outliers (mg/kg)
Beryllium	Lognormal	0.12	0.022	Lognormal	0.41	None
Copper	Gamma	4.4	11	Gamma	9.1	None
Nickel	Lognormal	5.4	14	Gamma	9.9	None
Nitrate	Nonparametric	15	150	Lognormal	0.44	1.2
Silica	Normal	590	None	Normal	750	None
Sodium	Nonparametric	1000	6,100	Nonparametric	420	5,400
Titanium	Normal	190	None	Gamma	67	210

6.1.3 Population Evaluation – Soil Classification

For all 35 parameters, the difference between populations collected in clay soil (CL and CH) versus those collected in non-clay soil was evaluated. Because several of the samples had one or two soil classifications in addition to CL or CH, the data set for clay soils was limited to those samples where the only soil classification was CL or CH. As shown in Table 6-1, the 17 samples collected in clay were from BG-1 (3 samples), BG-2 (2 samples), BG-3 (3 samples), BG-4 (6 samples), and BG-6 (3 samples). The 34 samples collected in non-clay soils were BG-1 (6 samples), BG-2 (6 samples), BG-3 (9 samples), BG-4 (6 samples), and BG-6 (7 samples).

6.1.3.1 Distribution

The distributions were determined for the clay and non-clay data sets as described above in Section 6.1.2. In the clay data set; antimony, chromium (hexavalent), silver, and thallium did not have enough detected data to determine a distribution. In the non-clay data set; antimony, bis(2-ethylhexyl) phthalate, selenium and thallium did not have enough detected data to determine a distribution.

6.1.3.2 Two-Sample Hypotheses

Comparisons were made between the parameter populations (sample values) of the clay and non-clay samples using ProUCL's two-sample hypothesis testing capability as described in Section 6.1.2. Of the 35 SRCs of interest for which clay and non-clay population comparisons were made, there were 20 that had different populations at the 5% significance level, as summarized in Table 6-4. The distribution, mean, and potential outliers for these 20 parameters are included in Table 6-4. Outliers are discussed in Section 6.1.6.

Table 6-4 **Soil Statistical Results for Parameters Differentiated by Soil Classification**						
Parameter	**Clay**			**Non-Clay**		
	Distribution	**Mean (mg/kg)**	**Potential Outliers (mg/kg)**	**Distribution**	**Mean (mg/kg)**	**Potential Outliers (mg/kg)**
Aluminum	Normal	15,000	None	Lognormal	6,900	24,000
Ammonia	Lognormal	5.4	17	Lognormal	3.2	5.0
Boron	Normal	17	None	Gamma	7.9	None
Cadmium	Lognormal	0.18	None	Lognormal	0.10	None
Chromium (Total)	Gamma	16	None	Lognormal	8.2	26
Cobalt	Normal	4.9	None	Lognormal	2.7	7.9
Copper	Normal	13	None	Lognormal	5.5	18
Fluoride	Gamma	8.3	None	Lognormal	5.6	16
Iron	Normal	13,000	None	Lognormal	7,600	20,000
Lead	Gamma	9.5	None	Gamma	5.3	None
Magnesium	Normal	10,000	None	Lognormal	6,800	30,000
Manganese	Nonparametric	310	1,200	Gamma	160	520
Mercury	Lognormal	0.030	0.36	Lognormal	0.0043	0.026
Nickel	Normal	14	None	Lognormal	6.1	None
Potassium	Normal	4,300	None	Lognormal	2,000	5,400
Selenium	Lognormal	1.6	11	NS	NS	None
Silica	Gamma	820	None	Lognormal	650	None
Sodium	Nonparametric	970	6,100	Lognormal	330	2,300
Vanadium	Gamma	25	None	Lognormal	15	41
Zinc	Normal	47	None	Nonparametric	25	None

NS - Not enough samples with detections to calculate distribution

6.1.4 Population Evaluation - Depth

For all 35 parameters, the difference between populations collected at depths less than 20 feet bgs versus those collected at greater than 20 feet bgs was evaluated. The depth of 20 feet bgs was chosen after reviewing plots of concentration versus depth for many of the SRCs. The plots indicated shifts in concentration at 2-5 feet bgs and approximately 20 feet bgs. In order to have enough data to form reliable conclusions, the decision was made to make 20 feet bgs the dividing point for shallow and deep soil. The 13 samples collected at shallower depths were from BG-1 (2 samples), BG-2 (3 samples), BG-3 (3 samples), BG-4 (3 samples), and BG-6 (2 samples). The 38 samples collected from depths greater than 20 feet bgs were from BG-1 (7 samples), BG-2 (5 samples), BG-3 (9 samples), BG-4 (9 samples), and BG-6 (8 samples).

6.1.4.1 Distribution

The distributions were determined for the shallow and deep data sets as described above in Section 6.1.2. In the shallow data; antimony, bis(2-ethylhexyl) phthalate, and thallium did not have enough detected data to determine a distribution. In the deep data, antimony and thallium did not have enough detected data to determine a distribution.

6.1.4.2 Two-Sample Hypotheses

Of the 35 parameters of interest for which sample value comparisons were made based on depth, there were only five that had different populations at the 5% significance level. The distribution, mean, and potential outliers for the five parameters with populations differentiated by depth are included in Table 6-5. Outliers are discussed in Section 6.1.6.

Table 6-5 **Soil Statistical Results for Parameters Differentiated by Depth**

Parameter	< 20 ft Bgs			> 20 ft Bgs		
	Distribution	Mean (mg/kg)	Potential Outliers (mg/kg)	Distribution	Mean (mg/kg)	Potential Outliers (mg/kg)
Chloride	Gamma	750	None	Normal	87	None
Nitrate	Nonparametric	16	150	Lognormal	0.43	1.2
Sodium	Lognormal	1400	6,100	Lognormal	250	750
Sulfate	Gamma	3,600	None	Nonparametric	620	16,000
Titanium	Gamma	150	None	Lognormal	78	280

6.1.5 Population Evaluation - Undifferentiated Data

The data for the parameters that were not differentiated above were evaluated to determine the distribution, mean, and outliers. These data are summarized in Table 6-6.

Table 6-6 **Soil Statistical Results for Parameters With Undifferentiated Data**

Parameter	Distribution	Mean (mg/kg)	Potential Outliers (mg/kg)
Antimony	Nonparametric	0.60	5.0
Arsenic	Lognormal	18	140
Barium	Lognormal	66	None
Bis(2-ethlyhexyl) phthalate	Lognormal	0.036	0.92
Calcium	Gamma	54,000	160,000
Chromium (Hexavalent)	Lognormal	1.3	1.8
Molybdenum	Nonparametric	1.3	12
Phosphates as P	Lognormal	0.56	None
Silver	Lognormal	0.33	0.79
Thallium	NS	NS	26

NS --Not enough samples with detections to calculate distribution or mean

6.1.6 Outliers

Potential outliers, measurements that are extremely large or small relative to the rest of the data, were identified by either the Dixon test (25 or less measurements) or Rosner test (more than 25 measurements) using the ProUCL 4.0 software. For data sets with ND values, one-half the DL was used for ND values in the outlier calculations. Typically, outliers represent

low probability observations coming from the tails of the data. For this statistical evaluation, one high tail and one low tail potential outlier were identified for each SRC in each population grouping. The potential outliers had less than a 5% probability of being from the population under evaluation. Because all of the data were validated and determined to be usable and no inconsistencies were identified in the sample collection procedures, no potential outliers were eliminated from the data sets.

6.1.7 Background Threshold Values

Once the distribution of the soil population groupings was determined, parametric or nonparametric statistical methods were used to calculate background statistics. The UTL was used to calculate a value that would be greater than 95% of the soil data with a confidence coefficient of 0.95. Because of differences in the background data sets, several statistical methods were used to determine the 95% UTL with 95% coverage:

- For parametric data sets (normal, lognormal, and gamma distributions) with NDs, the NDs were estimated using ROS.
- For data sets with a gamma distribution, including those with NDs estimated using ROS, ProUCL 4.0 determines the UTL using a normal approximation to the gamma distribution based upon Wilson-Hilferty (WH) and/or Hawkins-Wixley (HW) approximations.
- For nonparametric data sets with ND data, ProUCL 4.0 recommends using the nonparametric Kaplan-Meier (KM) estimation method to determine UTLs.

Calculated UTLs were compared with existing screening levels because the higher of these two concentrations would be used when evaluating impacts at the Station. Tables 6-7, 6-8 and 6-9 provide the recommended BTVs for those parameters with UTLs exceeding either the NDEP leaching basic contaminant level (LBCL) or EPA soil screening level (SSL). Screenings levels based on soil contaminants leaching to groundwater are the lowest screening levels for soil contamination. The following parameters have screening levels higher than calculated BTVs so they are not included in these tables:

- Ammonia
- Beryllium
- Bis(2-ethylhexyl) phthalate
- Fluoride
- Lead
- Silver
- Thallium
- Titanium
- Vanadium
- Zinc

The tables divide the parameters into those with populations differentiated by soil classification (clay vs. non-clay), depth, or populations with no differentiation. The parameters with populations that were differentiated by formation (alluvium or Muddy Creek) either did not exceed an LBCL or SSL, or they also were differentiated by soil classification or depth. Therefore, no results are presented differentiated by formation. Sodium was differentiated by all three methods, but the differentiation by depth seemed most appropriate because of likely salt accumulation due to evapotranspiration. This is consistent with the observed differentiation by depth for chloride, sulfate, and nitrate also. BTVs are also provided for parameters that do not have an NDEP or EPA screening level. For some parameters that had ND values in the data set, the estimation methods used in PRO UCL 4.0

to account for NDs led to a calculated BTV lower than the DL in the data set. Histograms for the recommended BTVs are provided in Appendix F, and calculation spreadsheets are provided electronically at the end of this report.

Table 6-7 **Recommended BTVs for Parameters Differentiated by Soil Classification**

Parameter	Clay (mg/kg)	Non-clay (mg/kg)	NDEP LBCL[1] (mg/kg)	EPA SSL[2] (mg/kg)
Aluminum	35,000	22,000	75	23,000
Boron	39	18	23.4	9.9
Cadmium	0.80	0.25	0.4	0.38*
Chromium (Total)	49	23	NA	180,000*
Cobalt	10	8.1	0.495	0.21
Copper	29	19	45.8	22
Iron	29,000	20,000	7.56	270
Magnesium	21,000	29,000	973	NA
Manganese	1,200	410	1.3	21
Mercury	0.16	0.014	0.104	0.033
Nickel	30	20	7	20*
Potassium	9,700	5,700	NA	NA
Selenium	5.6	NS	0.3	0.26*
Silica	1,200	1,000	NA	NA

NS -Not enough samples with detections to calculate BTV
NA –Not applicable
* - EPA MCL-Based SSL.
[1]NDEP LBCL (DAF1): NDEP Leaching BCL Dilution Attenuation Factor of 1 (LBCL DAF1)-- Developed by NDEP for use at the BMI Complex and Common Areas in Henderson Nevada specifically for the soil leaching to groundwater migration pathway, and for certain constituents (January 2013).
[2]EPA Risk-based SSL (except where marked with an asterisk): EPA SSL (Risk-Based)-- Soil concentrations derived for individual chemicals of concern from standardized sets of equations. These equations combine EPA chemical toxicity data with parameters defined by assumed future land uses and exposure scenarios, including receptor characteristics and potential exposure pathways. The soil leaching to groundwater SSL (Risk-Based) may be used when NDEP has not determined a LBCL for a particular parameter (November, 2012).

Table 6-8 **Recommended BTVs for Parameters Differentiated by Depth**

Parameter	0-20 ft. bgs (mg/kg)	>20 ft. bgs (mg/kg)	NDEP LBCL[1] (mg/kg)	EPA SSL[2] (mg/kg)
Chloride	6,200	180	NA	NA
Nitrate	120	0.89	7.0	140
Sodium	17,000	770	NA	NA
Sulfate	30,000	6,000	NA	NA

NA –Not applicable
[1]NDEP LBCL (DAF1): NDEP Leaching BCL Dilution Attenuation Factor of 1 (LBCL DAF1)-- Developed by NDEP for use at the BMI Complex and Common Areas in Henderson Nevada specifically for the soil leaching to groundwater migration pathway, and for certain constituents (January 2013).
[2]EPA Risk-based SSL: EPA SSL (Risk-Based)-- Soil concentrations derived for individual chemicals of concern from standardized sets of equations. These equations combine EPA chemical toxicity data with parameters defined by assumed future land uses and exposure scenarios, including receptor characteristics and potential exposure pathways. The soil leaching to groundwater SSL (Risk-Based) may be used when NDEP has not determined a LBCL for a particular parameter (November, 2012)

Table 6-9 **Recommended BTVs for Parameters With Undifferentiated Populations**			
Parameter	**BTV for All Depths and All Soil Classifications (mg/kg)**	**NDEP LBCL[1] (mg/kg)**	**EPA SSL[2] (mg/kg)**
Antimony	0.80	0.30	0.27
Arsenic	90	1	0.0013
Barium	280	82	82*
Calcium	140,000	NA	NA
Chromium (Hexavalent)	1.9	2	0.00059
Molybdenum	6.3	3.69	1.6
Phosphates as P	0.99	NA	NA

Note: DL greater than BTVs. DL would be used as action level.
[1]NDEP LBCL (DAF1): NDEP Leaching BCL Dilution Attenuation Factor of 1 (LBCL DAF1)-- Developed by NDEP for use at the BMI Complex and Common Areas in Henderson Nevada specifically for the soil leaching to groundwater migration pathway, and for certain constituents (January 2013).
[2]EPA Risk-based SSL (except where marked with an asterisk): EPA SSL (Risk-Based)-- Soil concentrations derived for individual chemicals of concern from standardized sets of equations. These equations combine EPA chemical toxicity data with parameters defined by assumed future land uses and exposure scenarios, including receptor characteristics and potential exposure pathways. The soil leaching to groundwater SSL (Risk-Based) may be used when NDEP has not determined a LBCL for a particular parameter (November, 2012)
* - EPA MCL-Based SSL.

6.2 Groundwater Statistical Analysis

Groundwater data from 32 monitoring wells were used for statistical analysis as summarized on Table 6-10. Four sets of groundwater samples were collected from the 15 new background wells and eight existing groundwater monitoring wells; two sets of groundwater samples were collected from two existing monitoring wells (IMW-3 wells) in 2012 specifically for the background evaluation. The IMW-3 wells could only be sampled twice due to BLM access restrictions. In order to improve the statistical power of the BTV calculations, additional data that was not in the Workplan was added for statistical analysis, which included:

- four sets of groundwater samples from the new background wells and existing monitoring wells (only one set of groundwater samples was included in the Workplan);
- available historical groundwater data collected between 2008 and 2012 for the 10 existing groundwater monitoring wells;
- available historical groundwater data collected between 2011 and 2012 for LMW-11; and
- the six non-AOC Mesa Pond Wells (four sampling events in 2012).

The statistical data is summarized in Appendix F.

Table 6-10 **Groundwater Data Used for Statistical Analysis**

Classification	Monitoring Well	Sampling Event																			
		2008 1st Quarter	2008 2nd Quarter	2008 3rd Quarter	2008 4th Quarter	2009 1st Quarter	2009 2nd Quarter	2009 3rd Quarter	2009 4th Quarter	2010 1st Quarter	2010 2nd Quarter	2010 3rd Quarter	2010 4th Quarter	2011 1st Quarter	2011 2nd Quarter	2011 3rd Quarter	2011 4th Quarter	2012 1st Quarter	2012 2nd Quarter	2012 3rd Quarter	2012 4th Quarter
New Background Well[a,b]	BG-1S																	X	X	X	X
	BG-1M																	X	X	X	X
	BG-1D																	X	X	X	X
	BG-2S																	X	X	X	X
	BG-2M																	X	X	X	X
	BG-2D																	X	X	X	X
	BG-3S																	X	X	X	X
	BG-3M																	X	X	X	X
	BG-3D																	X	X	X	X
	BG-4S																	X	X	X	X
	BG-4M																	X	X	X	X
	BG-4D																	X	X	X	X
	BG-6S																	X	X	X	X
	BG-6M																	X	X	X	X
	BG-6D																	X	X	X	X
Existing Monitoring Well	IMW-2.5S[a]							X	X	X	X	X	X	X	X	X	X	X[b]	X[b]	X[b]	X[b]
	IMW-2.5D[a]								X		X		X		X		X	X[b]	X[b]	X[b]	X[b]
	IMW-3S[a]	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X[b]	X[b]		
	IMW-3D[a]		X		X				X		X		X		X		X	X[b]	X[b]		
	KMW-2S[a]	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X[b]	X[b]	X[b]	X[b]
	KMW-2M[a]		X		X				X		X		X		X		X	X[b]	X[b]	X[b]	X[b]
	KMW-2D[a]		X		X				X		X		X		X		X	X[b]	X[b]	X[b]	X[b]
	LMW-7[a]	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X[b]	X[b]	X[b]	X[b]
	LMW-9[a]	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X[b]	X[b]	X[b]	X[b]
	LMW-10[a]	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X[b]	X[b]	X[b]	X[b]
	LMW-11													X		X	X	X			
Mesa Pond Well[1]	LMW-11R																	X[b]	X[b]	X[b]	X[b]
	LMW-12R																		X	X	X[2]
	LMW-13R																		X	X	X[2]
	LMW-14R																		X	X	X[2]
	LMW-15																		X	X	X[2]
	LMW-16																		X	X	X[2]

Notes: Not all parameters were analyzed during every sampling event. LMW-11R is a replacement well for LMW-11, installed in 2012

[1] New wells installed in 2012. Data collected for NVE use only (not reported to NDEP).

[2] Two samples analyzed in 4th quarter 2012

[a] Well included in Workplan as groundwater monitoring well to sample for background activities

[b] Data validated according to Workplan and QAPP

The statistical software tool ProUCL 4.0 (EPA, 2010a) used to evaluate the background soil data was also used to evaluate the background groundwater data.

The first step in the evaluation of data was to check for different statistical populations, by parameter, for the groundwater samples. Different populations were expected with groundwater samples collected in different geologic settings and that are spatially separated. During migration, groundwater chemistry is impacted by chemical reactions between the groundwater and geologic materials; mixing of water from different sources including groundwater, surface water, precipitation, and human impacts (wells), and different rates of evaporation and transpiration. The groundwater data were first divided into two groupings: those samples collected from wells screened in the alluvial aquifer, and those screened in the Muddy Creek aquifer as identified in Table 6-11. The alluvial aquifer populations were compared with the Muddy Creek aquifer populations, including the Mesa Pond wells, to see if they were statistically different at the 95% confidence level.

Table 6-11 **Well Grouping for Statistical Analysis as Two Groupings**

Well Grouping	New Background Wells	Existing Monitoring Wells
Alluvial Aquifer Wells	BG-1S BG-2S	IMW-2.5S IMW-2.5D IMW-3S KMW-2S KMW-2M KMW-2D
Muddy Creek Aquifer Wells	BG-3S BG-4S BG-6S BG-1M BG-2M BG-3M BG-4M BG-6M BG-1D BG-2D BG-3D BG-4D BG-6D	IMW-3D LMW-7 LMW-9 LMW-10 LMW-11(abandoned) LMW-11R LMW-12R LMW-13R LMW-14R LMW-15 LMW-16

During the comparison, it was noted that for many parameters the groundwater data from BG-2D, BG-2M, LMW-7, LMW-9, LMW-10, and LMW-11R, did not appear to be the same population as the other Muddy Creek aquifer wells when the data sets were compared visually or when graphed. The same was true of BG-2S in comparison with the other alluvial wells. Additionally, histograms for the Muddy Creek aquifer data appeared to have two distinct populations. Because of these observations, the groundwater characteristics were examined more closely.

Stiff diagrams were used to evaluate the groundwater geochemistry and to look for indications of similar groundwater characteristics. Stiff diagrams provide a visual presentation and comparison of the major cation (calcium, magnesium, potassium, and sodium) and anion (bicarbonate, carbonate, chloride, and sulfate) concentrations in different water sources. In plotting the data, sodium and potassium concentrations are combined (potassium concentrations are relatively small) as are carbonate and bicarbonate. The computer software program AqQA (AqQA®, 2006) was used to generate Stiff diagrams for the wells used in the groundwater background evaluation. In addition, the software identified the predominant water types for the wells and completed checks to see if the cations and anions were in balance. Groundwater monitoring data from the second quarter of 2012 was used in this analysis because a larger number of wells were sampled in this quarter and the data contained the greatest number of samples where the cation-anion balance had no more than a 5% difference. Although not

included in this report, stiff diagrams utilizing groundwater monitoring data from the first quarter of 2013 were evaluated for consistency with the second quarter of 2012. The stiff diagrams between the two events are similar. In addition, verify review of the data indicated that the second quarter 2012 data is representative. The groundwater data in pivot table format is included electronically at the end of this report. Tabular output from the AqQA program is included in Appendix G.

The AqQA program generated three distinct geometric shapes based on the groundwater chemistry. The results of this analysis indicated the background groundwater could be classified into three different predominant water types: sodium-sulfate, calcium-sulfate, and magnesium-sulfate. Because slight differences in the predominate cation or anion can cause a change in the water type, the overall shapes of the stiff diagrams were used to group the wells into three groupings (Muddy Creek-Mesa, Muddy Creek-North, and alluvial) rather than the initial two groupings (Muddy Creek and alluvial). For example, the Muddy Creek- Mesa wells are either calcium-sulfate, sodium-sulfate, or magnesium sulfate water types. These wells appear as "anvil" shaped Stiff diagrams in Figure 8. The concentrations of the cations (magnesium, calcium, sodium/potassium) are similar overall, with slight differences in the predominate cation. Although this difference in the predominant cation can change the water type, the shape remains similar in the mesa area wells so they were grouped together as Muddy Creek - Mesa wells. The Muddy Creek – Mesa wells also have the highest concentrations of magnesium, calcium, sodium/potassium, and sulfate when compared to the other groupings. The higher concentrations of these components in the Muddy Creek – Mesa grouping may indicate the groundwater source is the underlying carbonate aquifer and the groundwater from that aquifer is migrating vertically upwards through the Horse Springs volcanic ash, limestone, and Muddy Creek Formations while dissolving the soluble evaporate minerals present in the formations along the way (Pohlmann, 1988). The longer the flow path through the Horse Springs and Muddy Creek Formations, the more mineralized the groundwater becomes (Mifflin and Associates, 2001).

In contrast, the Muddy Creek – North wells are sodium-sulfate type, but with lower concentrations of sodium and calcium than the Muddy Creek - Mesa wells, resulting in "K" shaped Stiff diagrams in Figure 8. This groundwater geochemistry may be a more neutral or non-dominant type because of groundwater migrating vertically upwards from the underlying WRFS Formation directly into the Muddy Creek Formation, avoiding the Horse Springs Formation.

The alluvial wells are also sodium sulfate-type with slightly more sodium and sulfate when compared to the Muddy Creek-North and Muddy Creek - Mesa aquifer wells, resulting in an "hour-glass" shaped Stiff diagram in Figure 8. The water sources of the alluvial aquifer are believed to be a combination of discharges from the Muddy Springs, Muddy River, Muddy Creek Formation and the underlying carbonate formation (Maxey, 1996, Pohlmann, 1996; Mifflin and Associates, 1996). Mifflin found evidence that the alluvial aquifer is in close hydraulic connection with the carbonate aquifer where the Muddy Creek Formation is not present (Mifflin and Associates, 1993 and 1994). In areas where the Muddy Creek Formation is present, groundwater can flow upward into the overlying alluvial aquifer via conduits, resulting in a negative impact on the alluvial aquifer's water quality (Bredehoeft and Hall, 1996). *"As the discharged water moves through the shallow sediments and the river course in Moapa*

Valley it is further degraded in part as a result of concentration of minerals by evapotranspiration and in part by further solution of minerals from the soil " (Maxey, et al., 1966). This would change a neutral or non-dominant type Stiff diagram representing the Muddy Springs water quality to the hour-glass shaped Stiff diagrams of the alluvial aquifer.

As illustrated in Figure 8, the Stiff diagrams indicated that those Muddy Creek wells located on the Mesa; LMW-7, LMW-9, LMW-10, and LMW-11R; as well as wells BG-2S, 2M, and 2D, located in Hogan Wash at the toe of the mesa, have a similar geochemical make-up that is distinct from the wells not located on, or adjacent to, the mesa.

Based on a combination of the statistical population analyses, knowledge of the geology, and the geochemistry information, the groundwater data were segregated into three groupings: 1) alluvial aquifer wells, 2) Muddy Creek aquifer – North wells (wells north of the Muddy River), and 3) Muddy Creek aquifer - Mesa wells (wells south of the Muddy River). Table 6-12 provides the final groupings for the wells.

For each of the data groupings, ProUCL 4.0 was used to determine the statistical distributions (normal, lognormal, gamma, or nonparametric) for each SRC using GOF tests, with a 0.95 confidence coefficient. This process was the same as that used for the background soil data.

Table 6-12 **Final Well Grouping for Groundwater Statistical Analysis**

Well Grouping	New Background Wells	Existing Monitoring Wells	Mesa Pond Wells
Alluvial Aquifer	BG-1S	IMW-2.5S KMW-2M IMW-3S IMW-2.5D KMW-2S KMW-2D	
Muddy Creek Aquifer – North	BG-3S BG-3M BG-3D BG-4S BG-4M BG-4D BG-6S BG-6M BG-6D BG-1M BG-1D	IMW-3D	
Muddy Creek Aquifer - Mesa	BG-2S BG-2D BG-2M	LMW-7 LMW-9 LMW-10 LMW-11R LMW-11 (abandoned)	LMW-12R LMW-14R LMW-13R LMW-15 LMW-16

After the distribution of the SRC in each data grouping was determined, ProUCL's two-sample hypothesis testing capability was used to compare populations (sample values). The alluvial population was first compared to the Muddy Creek – North population, then the Muddy Creek - Mesa population. After that, the Muddy Creek - North population was compared to the Muddy Creek - Mesa population. The default null hypothesis was that both populations in each comparison were the same (e.g., SRC concentrations in the Muddy Creek - North and alluvial wells are statistically indistinguishable). The alternate hypothesis, that the populations were not the same, was tested at the 5% significance level. The level of

significance is equal to one minus the confidence coefficient. In this case, the confidence coefficient desired is 0.95 so a 0.05 or 5% significance level was the goal when evaluating the data. Depending upon the distribution, the number of ND samples, and the DL of the ND samples, a test was selected to compare the means, shapes, and distributions of the populations in the same manner as was done for the soil background data.

6.2.1 Population Evaluation

Based on statistical, geologic, and geochemical evaluations, the groundwater sample data sets for population evaluation were divided into three groupings, 1) alluvial aquifer wells, 2) Muddy Creek aquifer – North wells, and 3) Muddy Creek aquifer - Mesa wells. Parametric or nonparametric statistical methods were used to calculate background statistics for the data sets in the same manner that was used for the soil background. Calculation spreadsheets and ProUCL printouts are provided electronically at the end of this report.

6.2.1.1 Distribution

ProUCL 4.0 was used to determine the statistical distributions of the alluvial, Muddy Creek - North, and Muddy Creek - Mesa data sets for 43 of the 55 parameters included in the groundwater background sampling. It was not necessary to establish a BTV for pH. Eleven parameters had too few detected values to determine the distribution for any of the three groupings:

- asbestos
- alkalinity-carbonate
- biphenyl,
- benzo(a)anthracene
- benzo(a)pyrene
- benzo(b)fluoranthene
- benzo(g,h,i)perylene
- benzo(k)fluoranthene
- chrysene
- fluoranthene
- indeno (1,2,3-cd) pyrene

For lead and mercury, the data collected from the alluvial aquifer had too few detected values to determine the distribution. Statistics determined with only a few detected values (less than four to six) are unreliable and ProUCL 4.0 will not perform the calculation.

6.2.1.2 Two-Sample Hypotheses

Comparisons were made between the parameter populations (sample values) of the alluvial, Muddy Creek - North, and Muddy Creek - Mesa data sets using ProUCL's two-sample hypothesis testing capability. Of the 43 parameters of interest for which population comparisons were made:

- Thirty had statistically different concentrations at the 5% significance level for one or more of the three well groupings.
- Thirteen parameters demonstrated no differentiation between the well groupings.

Of the 13 parameters with no differentiation, six were organic compounds not found in the natural environment, so differentiation by aquifer would not be expected. Of the remaining seven, there was a much higher percentage of ND values than for the 30 inorganic parameters with differentiated populations. The prevalence of ND values in the undifferentiated populations is a contributing factor in the inability to detect a statistically significant differentiation. Table 6-13 summarizes the parameter evaluation. The distribution, mean, and

potential outliers for each parameter are included in Tables 6-14 and 6-15. Outliers are discussed in Section 6.2.2.

Table 6-13 **Groundwater Parameter Summary**

Parameter Group	Number of SRC parameters	Background Parameters	Statistical Evaluation			Evaluation Summary	
			Evaluated	Too few detects	Not evaluated	Populations Statistically different	No differentiation
Metals	27	27	27	--	--	21	6
Asbestos	1	1	--	1	--	--	--
General Chemistry	10	12[1]	10	1	1[3]	9	1
TPH	4	--	--	--	--	--	--
PCBs	7	--	--	--	--	--	--
PAH/SVOC	16	15[2]	6	9	--	--	6
Dioxin	2	--	--	--	--	--	--
VOCs	63	--	--	--	--	--	--
Aldehydes	2	--	--	--	--	--	--
Total	**132**	**55**	**43**	**11**	**1**	**30**	**13**

[1] In addition to the general chemistry SRCs, carbonate and bicarbonate were analyzed in background samples for cation/anion balance purposes
[2] Benzo(j)Fluoranthene listed as SRC; however, laboratory is unable to analyze for this parameter
[3] pH not evaluated because not necessary to establish background pH

Table 6-14 **Groundwater Statistical Results for Parameters with Distinct Populations for One or More Well Groupings: Alluvial, Muddy Creek - North, and Muddy Creek - Mesa Wells**

Parameter	Alluvial Wells			Muddy Creek - North Wells			Muddy Creek - Mesa Wells		
	Distribution	Mean (mg/L)	Potential Outliers (mg/L)	Distribution	Mean (mg/L)	Potential Outliers (mg/L)	Distribution	Mean (mg/L)	Potential Outliers (mg/L)
Alkalinity, bicarbonate	Nonparametric	450	1200	Gamma	160	None	Gamma	140	None
Aluminum	Lognormal	0.061	None	Lognormal	0.054	0.12	Lognormal	0.049	None
Antimony	Normal	0.025	None	Normal	0.015	None	Lognormal	0.020	0.061
Arsenic	Nonparametric	0.12	None	Lognormal	0.027	0.22	Lognormal	0.023	0.13
Barium	Lognormal	0.020	None	Lognormal	0.030	None	Gamma	0.018	0.046
Boron	Nonparametric	1.3	4.2	Normal	0.69	None	Nonparametric	3.3	None
Cadmium	Lognormal	0.0018	None	Lognormal	0.0023	None	Lognormal	0.0013	0.0051
Calcium	Nonparametric	130	None	Nonparametric	130	None	Gamma	320	None
Chloride	Nonparametric	340	None	Gamma	240	None	Nonparametric	330	None
Chromium, Total	Lognormal	0.0013	None	NA	NA	None	Nonparametric	0.028	None
Chromium, Hexavalent	Lognormal	0.0045	None	Lognormal	0.0047	0.006	Lognormal	0.022	None
Cobalt	Nonparametric	0.0057	None	Lognormal	0.0040	0.012	Normal	0.0078	None
Fluoride	Normal	3.6	None	Nonparametric	1.2	None	Normal	2.2	None
Lead	NA	NA	0.004	Lognormal	0.0051	0.017	Lognormal	0.0083	0.034
Magnesium	Nonparametric	140	None	Nonparametric	76	None	Nonparametric	150	290
Manganese	Nonparametric	0.14	None	Lognormal	0.062	None	Lognormal	0.044	0.51
Mercury	NS	NS	None	NS	NS	0.00002	Lognormal	0.000025	None
Molybdenum	Nonparametric	0.038	0.47	Lognormal	0.015	0.078	Gamma	0.11	0.41
Nickel	Lognormal	0.0033	0.016	Lognormal	0.0067	None	Lognormal	0.0031	0.024
Nitrogen as Ammonia	Normal	0.25	None	Lognormal	0.083	None	Lognormal	0.072	0.16
Nitrogen as Nitrate	Nonparametric	1.1	78	Normal	0.14	None	Nonparametric	4.0	None
Phosphorous, Total as P	Nonparametric	0.23	2.4	Lognormal	0.073	0.33	Nonparametric	0.47	2.6
Potassium	Lognormal	38	None	Lognormal	26	None	Lognormal	59	None
Selenium	Lognormal	0.021	0.20	Lognormal	0.031	0.19	Lognormal	0.047	0.24
Silica	Normal	55	None	Lognormal	17	None	Nonparametric	19	None
Silver	Normal	0.0072	None	Normal	0.0060	0.011	Lognormal	0.010	None
Sodium	Nonparametric	470	None	Nonparametric	230	None	Nonparametric	410	None
Sulfate	Nonparametric	1100	None	Lognormal	730	None	Nonparametric	1800	None
Thallium	Normal	0.053	None	Lognormal	0.022	0.07	Normal	0.077	None
TDS	Nonparametric	2500	None	Nonparametric	1600	None	Normal	3200	None

Notes: NS - Not enough detected values to make a determination of BTV
NA –Not applicable

Table 6-15 **Groundwater Statistical Results for Parameters with Populations Undifferentiated by Alluvial, Muddy Creek - North, or Muddy Creek - Mesa Well Locations**			
Parameter	**Distribution**	**Mean (mg/L)**	**Potential Outliers (mg/L)**
Acenaphthene	Nonparametric	0.000018	0.00018
Anthracene	Lognormal	0.000014	0.0000080
Beryllium	Normal	0.00075	None
Bis(2-ethylhexyl)phthalate	Nonparametric	0.0011	0.018
Copper	Lognormal	0.0039	None
Iron	Lognormal	0.081	1.0
Naphthalene	Nonparametric	0.068	1.1
Nitrogen as Nitrite	Nonparametric	0.029	0.16
Phenanthrene	Nonparametric	0.000016	0.00010
Pyrene	Lognormal	0.000024	0.0.000054
Titanium	Lognormal	0.0031	0.05
Vanadium	Nonparametric	0.0039	0.025
Zinc	Nonparametric	0.029	0.11

6.2.2 Outliers

Potential outliers were identified in the same manner as for the background soil data. The PAH data from LMW-9 was determined by the laboratory to be compromised during laboratory handling. NVE took the laboratory's recommendation and used the PAH results from DUP-3, which was a duplicate of LMW-9. Because all of the other groundwater data were determined to be usable and no inconsistencies were identified in the sample collection procedures, no other potential outliers were eliminated from the data sets.

6.2.3 Background Threshold Values

Once the distribution of the background groundwater data set was determined, the BTVs were calculated in the same manner as for the background soil data.

Calculated UTLs were compared with existing screening levels because the higher of these two concentrations would be used when evaluating impacts at the Station. Tables 6-16 and 6-17 provide the recommended BTVs for those parameters with UTLs exceeding either the NDEP BCL for residential water, EPA Region 9 regional screening level (RSL), or primary MCL. The following parameters have screening levels higher than calculated BTVs so they are not included in these tables:

- Acenaphthene
- Anthracene
- Barium
- Beryllium
- Bis(2-ethylhexyl) phthalate
- Cadmium
- Copper
- Iron
- Mercury
- Nickel
- Nitrite
- Phenanthrene
- Pyrene
- Silver
- Zinc

The tables divide the parameters into those with populations differentiated by well groupings (alluvial, Muddy Creek - North, Muddy Creek - Mesa) or populations with no differentiation.

BTVs are also provided for parameters that do not have an NDEP or EPA screening level. Histograms and data used for the recommended BTVs are provided in Appendix F, and calculation spreadsheets are provided electronically at the end of this report.

Table 6-16 **Recommended Groundwater BTVs for Parameters with Three Distinct Populations: Alluvial, Muddy Creek – North, and Muddy Creek - Mesa Wells**

Parameter	Alluvial (mg/L)[1]	Muddy Creek - North (mg/L)	Muddy Creek - Mesa (mg/L)
Alkalinity-Bicarbonate	1200	260	310
Aluminum	0.13	0.10	0.080
Antimony	0.031	0.038	0.060
Arsenic	0.26	0.11	0.12
Boron	1.8	0.99	8.9
Calcium	170	190	480
Chloride	420	370	510
Chromium, Total	0.0048	NS	0.10
Chromium, Hexavalent	0.0082	0.0063	0.15
Cobalt	0.014	0.010	0.015
Fluoride	4.6	3.5	4.1
Lead	NS	0.016	0.036
Magnesium	190	110	270
Manganese	0.37	0.37	0.35
Molybdenum	0.053	0.068	0.39
Nitrogen as Ammonia	0.83	0.14	0.16
Nitrate	17	0.41	10
Phosphorous	2.4	0.21	2.1
Potassium	62	56	110
Selenium	0.10	0.15	0.19
Silica	68	22	38
Sodium	720	450	790
Sulfate	1400	1200	2800
Thallium	0.080	0.070	0.11
TDS	3200	2500	4700

Notes: NS - Not enough detected values to make a determination of BTV
[1]Alluvial BTVs are provided for reference only; not for use in remedial decision-making at this time.

Table 6-17 **Recommended Groundwater BTVs for Parameters With Undifferentiated Populations**

Parameter	All Locations (mg/L)
Naphthalene	0.42
Titanium	0.013
Vanadium	0.0085

Section 7

Conclusions and Recommendations

The objectives of this report are to (1) statistically determine groundwater and soil BTVs for the Station, (2) estimate aquifer characteristics for both the Muddy Creek and alluvial aquifers, (3) evaluate the hydraulic connection between the two aquifers, and (4) evaluate potential hydraulic connection between the alluvial aquifer and the Muddy River. Adequate soil and groundwater data have been collected to establish background soil concentrations and background groundwater concentrations for the Muddy Creek-North and the Muddy Creek – Mesa for use during implementation of the AOC. Because of NDEP concerns regarding the appropriateness of some wells used to establish alluvial groundwater BTVs, the alluvial groundwater BTVs will not be used for remedial decision making at this time. The alluvial groundwater BTVs may be revisited in the future in an amendment to this Background Conditions Report.

General aquifer characteristics for both the Muddy Creek and alluvial aquifers were evaluated, but additional aquifer testing would be required to more precisely determine aquifer characteristics.

Based on pump test observation data, there appears to be a minor amount of hydraulic connection between the alluvial aquifer and the underlying Muddy Creek aquifer at the BG-1 well cluster. Similarly, there appears to be minor hydraulic connection between the shallow and deeper zones within the Muddy Creek aquifer. Further evidence that the hydraulic connection is minor between the aquifers is the high TDS concentrations in the shallow alluvial wells at BG-2, IMW-2, and KMW-1 but not in the deep Muddy Creek wells. At the KMW-2 well cluster, which is entirely in the alluvial aquifer, there also appears to be a minor hydraulic connection between the shallow and deeper zones of the aquifer as indicated by the percent drawdown from static water conditions. Hydraulic connection between the alluvial and Muddy Creek aquifers may be further evaluated during future aquifer testing.

During the aquifer testing at KMW-2, drawdown was recorded in observation well MW-6 located approximately 380 feet away. This radius of influence would intersect the Muddy River and potentially confirm results reported by others that indicated there is a connection between the Muddy River and the alluvial aquifer. Water quality parameters were monitored in the river and in the pumping well during the aquifer testing, but no significant changes were observed during the test. Even if the radius of influence intersects the Muddy River, it does not necessarily mean water would be extracted from the river. Additional aquifer testing in wells closer to the Muddy River would be needed to confirm the connection between the alluvial aquifer and the Muddy River in the area of the Station.

Section 7.1 Soil Background Concentrations

During the background sampling activities, 51 soil samples were collected from various depths in five soil borings, and analyzed for 51 SRCs. The samples were collected from both the alluvium and Muddy Creek Formation. The data were statistically analyzed to establish BTVs for 35 of these parameters. Because there were no detections of asbestos, biphenyl, or PAHs, BTVs were not established for these parameters. The pH data were not analyzed because it was not necessary to establish a BTV for pH. However, BTVs were established for all of the general chemistry and metals parameters. Bis(2-ethylhexyl) phthalate was also evaluated since it was detected in four samples. Background concentrations were not established for TPH, PCBs, dioxins, VOCs, aldehyde, diols, or radionuclides. Radionuclides were excluded for per the August 11, 2009, conference call between NDEP, NVE, LFR (ARCADIS), and Stanley Consultants. TPH, PCBs, dioxins, VOCs, aldehyde, and diols are generally related to human activity, and therefore would not be applicable as background concentrations.

The soil data collected from background locations was evaluated, and the data were divided into four statistical populations as shown on Table 7-1. For each parameter, a BTV was calculated using the 95% UTL with 95% coverage. Recommended BTVs and applicable NDEP and EPA screening levels are presented in Table 7-2. BTVs were not recommended for 10 parameters where the calculated BTVs were below relevant screening levels because the higher screening levels would be used for remediation decision-making. BTVs were recommended for 24 parameters based on the most appropriate statistical population. BTV recommendations for 14 parameters were based on soil classification (clay vs. non-clay) while BTV recommendations for three parameters were based on depth (less than 20 feet bgs vs. greater than 20 feet bgs). BTV recommendations for seven parameters were based on grouping all of the data together because the parameter populations were not statistically differentiated by geologic formation, soil classification, or depth. No BTV recommendations were based on geologic formation because the parameters with populations differentiated by formation (alluvium vs. Muddy Creek) either didn't exceed a screening level, or they also were differentiated by soil classification or depth. The application of the BTVs to remediation decision-making should be evaluated on a case-by-case basis.

Table 7-1 **Soil Statistical Populations**				
Parameter	**Differentiated between the Alluvial and Muddy Creek**	**Differentiated by soil classification**	**Differentiated by sample depth (< 20 ft. bgs vs. > 20 ft. bgs)**	**Parameters with undifferentiated populations**
General Chemistry				
Ammonia		X		
Chloride			X	
Fluoride		X		
Nitrate	X		X	
Phosphates as P				X
Sulfate			X	
Metals				
Aluminum		X		
Antimony				X
Arsenic				X
Barium				X
Beryllium	X			
Boron		X		
Cadmium		X		
Calcium				X
Chromium (hexavalent)				X
Chromium (total)		X		
Cobalt		X		
Copper	X	X		
Iron		X		
Lead		X		
Magnesium		X		
Manganese		X		
Mercury		X		
Molybdenum				X
Nickel	X	X		
Potassium		X		
Selenium		X		
Silica	X	X		
Silver				X
Sodium	X	X	X	
Thallium				X
Titanium	X		X	
Vanadium		X		
Zinc		X		
SVOCs				
Bis(2-ethylhexyl) phthalate				X

Table 7-2 Comparison of Soil Recommended BTVs and Current Screening Levels

Parameter Name	Recommended BTVs					EPA MCL-based SSL - November 2012[1]	EPA Risk-based SSL - November 2012[2]	EPA RSL Industrial Soil - November 2012[3]	NDEP BCL Outdoor Worker - January 2013[4]	NDEP LBCL (DAF 1) - January 2013[5]	NDEP LBCL (DAF 20) - January 2013[6]
	Clay	Non-Clay	0-20 ft. bgs	>20 ft. bgs	All Depths and All Soil Classifications						
Asbestos(MFL>10um)											
Asbestos	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA
General Chemistry											
pH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
General Chemistry (mg/kg)											
Ammonia	SL	SL	SL	SL	SL	NA	NA	NA	100,000	NA	NA
Chloride	NS	NS	6,200	180	NS	NA	NA	NA	NA	NA	NA
Fluoride	SL	SL	SL	SL	SL	NA	93	41,000	41,000	NA	NA
Nitrate	SL	SL	120	SL	SL	NA	NA	1,600,000	100,000	7.0	140
Phosphates as P	NS	NS	NS	NS	0.99	NA	NA	NA	NA	NA	NA
Sulfate	NS	NS	30,000	6,000	NS	NA	NA	NA	NA	NA	NA
Metals (mg/kg)											
Aluminum	35,000	22,000	NS	NS	NS	NA	23,000	990,000	100,000	75	1500
Antimony	NS	NS	NS	NS	0.8	0.27	0.27	410	454	0.3	6
Arsenic	NS	NS	NS	NS	90	0.29	0.0013	1.6	1.77	1	20
Barium	NS	NS	NS	NS	280	82	120	190,000	100,000	82	1640
Beryllium	SL	SL	SL	SL	SL	3.2	13	2000	2230	3	60
Boron	39	18	NS	NS	NS	NA	9.9	200,000	100,000	23.4	467
Cadmium	0.8	0.25	NS	NS	NS	0.38	0.52	800	1,100	0.4	8
Calcium	NS	NS	NS	NS	140,000	NA	NA	NA	NA	NA	NA
Chromium (hexavalent)	NS	NS	NS	NS	1.9	NA	0.00059	5.6	1360	2	40
Chromium (total)	49	23	NS	NS	NS	180,000	NA	NA	NA	NA	NA
Cobalt	10	8.1	NS	NS	NS	NA	0.21	300	337	0.495	9.9
Copper	29	19	NS	NS	NS	46	22	41,000	42,200	45.8	915
Iron	29,000	20,000	NS	NS	NS	NA	270	720,000	100,000	7.56	151
Lead	SL	SL	SL	SL	SL	14	NA	800	800	NA	NA
Magnesium	21,000	29,000	NS	NS	NS	NA	NA	NA	100,000	973	19,500
Manganese	1,200	410	NS	NS	NS	NA	21	23,000	24,900	1.3	26.1
Mercury	0.16	0.014	NS	NS	NS	0.1	0.033	43	341	0.104	2.09
Molybdenum	NS	NS	NS	NS	6.3	NA	1.6	5100	5680	3.69	73.7
Nickel	30	20	NS	NS	NS	NA	20	20,000	21,800	7	140
Potassium	9,700	5,700	NS	NS	NS	NA	NA	NA	NA	NA	NA
Selenium	5.6	NS	NS	NS	NS	0.26	0.4	5100	5680	0.3	6
Silica	1,200	1,000	NS	NS	NS	NA	NA	18,000,000	NA	NA	NA
Silver	SL	SL	SL	SL	SL	NA	0.6	5100	5680	2	40
Sodium	NS	NS	17,000	770	NS	NA	NA	NA	NA	NA	NA
Thallium	SL	SL	SL	SL	SL	0.14	0.011	10	74.9	0.4	8
Titanium	SL	SL	SL	SL	SL	NA	NA	NA	100,000	146,000	2,920,000
Vanadium	SL	SL	SL	SL	SL	NA	78	5200	5680	300	6000
Zinc	SL	SL	SL	SL	SL	NA	290	310,000	100,000	620	12,400
PAHs (µg/kg)											
Acenaphthene	NS	NS	NS	NS	NS	NA	4100	33,000,000	2,560,000	29,000	580,000
Anthracene	NS	NS	NS	NS	NS	NA	42,000	170,000,000	9,920,000	590,000	11,800,000
Benzo(a)anthracene	NS	NS	NS	NS	NS	NA	10	2100	2340	80	1600
Benzo(a)pyrene	NS	NS	NS	NS	NS	240	3.5	210	234	400	8000
Benzo(b)fluoranthene	NS	NS	NS	NS	NS	NA	35	2100	2340	200	4000
Benzo(g,h,i)perylene	NS	NS	NS	NS	NS	NA	NA	NA	34,100,000	NA	NA
Benzo(k)fluoranthene	NS	NS	NS	NS	NS	NA	350	21,000	23,400	2000	40,000
Chrysene	NS	NS	NS	NS	NS	NA	1100	210,000	234,000	8000	160,000
Fluoranthene	NS	NS	NS	NS	NS	NA	70,000	22,000,000	24,400,000	210,000	4,200,000
Indeno(1,2,3-cd)pyrene	NS	NS	NS	NS	NS	NA	200	2100	2340	700	14,000
Naphthalene	NS	NS	NS	NS	NS	NA	0.47	18,000	17,400	4000	80,000
Phenanthrene	NS	NS	NS	NS	NS	NA	NA	NA	24,500	NA	NA
Pyrene	NS	NS	NS	NS	NS	NA	9500	17,000,000	19,300,000	210,000	4,200,000
SVOC (µg/kg)											
Biphenyl	NS	NS	NS	NS	NS	NA	8.7	210,000	56,800,000	NA	NA
Bis(2-ethylhexyl) phthalate	SL	SL	SL	SL	SL	1400	1,100	120,000	137,000	180,000	3,600,000

Notes:

NA Not Applicable; NS Not enough detected values to make a determination of BTV; SL - Screening level higher than BTV.

Footnotes:

[1]***EPA MCL-based SSL***: *EPA Soil Screening Level (SSL) (MCL-Based)*—Maximum Contaminant Level (MCL) based soil contaminant concentrations below which no further action or study regarding the soil at a site is warranted under the Comprehensive Environmental Response, Compensations, and Liability Act (CERCLA). This soil screening level was determined by EPA to be protective of groundwater. The soil leaching to groundwater SSL (Risk-Based) may be used when NDEP has not determined a Leaching Basic Comparison Level (LBCL) for a particular parameter (November, 2012).

[2]***EPA Risk-based SSL***: *EPA SSL (Risk-Based)*-- Soil concentrations derived for individual chemicals of concern from standardized sets of equations. These equations combine EPA chemical toxicity data with parameters defined by assumed future land uses and exposure scenarios, including receptor characteristics and potential exposure pathways. The soil leaching to groundwater SSL (Risk-Based) may be used when NDEP has not determined a LBCL for a particular parameter (November, 2012).

[3]***EPA RSL Industrial Soil***: *EPA Regional Screening Level (RSL) (Industrial Soil)*-- Generic screening levels based on default exposure parameters and factors that represent Reasonable Maximum Exposure (RME) conditions for human long-term/chronic exposures and are based on the methods outlined in EPA's Risk Assessment Guidance for Superfund, Part B Manual (1991) and Soil Screening Guidance documents (1996 and 2002). The Industrial Soil RSL is protective of the human health of outdoor workers (November, 2012).

[4]***NDEP BCL Outdoor Worker***: *NDEP Basic Comparison Level (BCL) (Outdoor Industrial/Commercial Worker)*-- Screening level determined by NDEP for the BMI Complex to be protective of the human health of outdoor workers from the *Updated User's Guide and Tables* (January, 2013).

[5]***NDEP LBCL (DAF1)***: *NDEP Leaching BCL Dilution Attenuation Factor of 1 (LBCL DAF1)*-- Developed by NDEP for use at the BMI Complex and Common Areas in Henderson Nevada specifically for the soil leaching to groundwater migration pathway, and for certain constituents (January 2013).

[6]***NDEP LBCL (DAF20)***: *NDEP Leaching BCL Dilution Attenuation Factor of 20 (LBCL DAF20)*-- Developed by NDEP for use at the BMI Complex and Common Areas in Henderson Nevada specifically for the soil leaching to groundwater migration pathway, and for certain constituents (January 2013).

Section 7.2 Groundwater Background Concentrations

Groundwater data from 32 monitoring wells were used for statistical analysis as summarized on Table 6-10. Four sets of groundwater samples were collected from the 15 new background wells and ten existing groundwater monitoring wells in 2012 specifically for background evaluation, with the exception of the IMW-3 wells which could only be sampled twice due to BLM access restrictions. In order to improve the statistical power of the BTV calculations, additional data that was not in the Workplan was added for statistical analysis, which included:

- four sets of groundwater samples from the new background wells and existing monitoring wells (collecting only one set of groundwater samples was discussed in the Workplan),
- available historical groundwater data collected between 2008 and 2012 for the 10 existing groundwater monitoring wells;
- available historical groundwater data collected between 2011 and 2012 for LMW-11; and
- the six non-AOC Mesa Pond Wells (four sampling events in 2012).

Samples were analyzed for 55 parameters; 53 of the 132 SRCs and two additional general chemistry parameters (carbonate and bicarbonate) needed to conduct cation-anion balance checks. Background concentrations were not established for TPH, PCBs, dioxins, VOCs, aldehyde, diols, or radionuclides. Radionuclides were excluded per the August 11, 2009, conference call among NDEP, NVE, LFR (ARCADIS), and Stanley Consultants. TPH, PCBs, dioxins, VOCs, aldehyde, and diols are generally related to human activity, and therefore would not be applicable as background concentrations.

The samples were collected from both the alluvial and Muddy Creek aquifers. The data were statistically analyzed to establish BTVs for 43 of these parameters. Because there were no detections of asbestos, alkalinity-carbonate, biphenyl, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, and indeno (1,2,3-cd)pyrene, BTVs were not established for these 11 parameters. It was not necessary to establish a BTV for pH. For lead and mercury, the data collected from the alluvial aquifer had too few detected values to determine the distribution.

The groundwater data collected from background locations was evaluated, and the data were divided into three groupings, although some parameters were not differentiated in all three groupings as shown on Table 7-3. For each parameter, a BTV was calculated using the 95% UTL with 95% coverage. Recommended BTVs and applicable NDEP and EPA screening levels, as well as drinking water MCLs, are presented in Table 7-4. The previous 2003 NDEP Action Levels established for Station groundwater are also provided for reference. BTVs were not recommended for 15 parameters where the calculated BTVs were below relevant screening levels because the higher screening levels would be used for remediation decision-making. BTV recommendations for 25 parameters were based on three distinct populations (alluvial, Muddy Creek – North, and Muddy Creek - Mesa), and BTV recommendations for 3 parameters were based on grouping all of the data together because the parameter populations were not statistically differentiated by grouping.

Because of NDEP concerns regarding the appropriateness of some wells used to establish alluvial groundwater BTVs, the alluvial groundwater BTVs will not be used for remedial decision making at this time. The alluvial groundwater BTVs may be revisited in the future in an amendment to

this Background Conditions Report. The application of the Muddy Creek-North and Muddy Creek-Mesa groundwater BTVs to remediation decision-making should be evaluated on a case-by-case basis.

Table 7-3 **Groundwater Statistical Populations**		
Parameter	**Three Distinct Populations: Alluvial, Muddy Creek - North, and Muddy Creek - Mesa**	**Undifferentiated Populations**
General Chemistry		
Alkalinity, bicarbonate	X	
Nitrogen, Ammonia (as N)	X	
Chloride	X	
Fluoride	X	
Nitrate	X	
Nitrite		X
Phosphorous, Total (as P)	X	
Silica	X	
Sulfate	X	
TDS	X	
Metals		
Aluminum	X	
Antimony	X	
Arsenic	X	
Barium	X	
Beryllium		X
Boron	X	
Cadmium	X	
Calcium	X	
Chromium (hexavalent)	X	
Chromium (total)	X	
Cobalt	X	
Copper		X
Iron		X
Lead	X	
Magnesium	X	
Manganese	X	
Mercury	X	
Molybdenum	X	
Nickel	X	
Potassium	X	
Selenium	X	
Silica	X	
Silver	X	
Sodium	X	
Thallium	X	
Titanium		X
Vanadium		X
Zinc		X
SVOCs		
Bis(2-ethylhexyl) phthalate		X
PAHs		
Acenaphthene		X
Anthracene		X
Naphthalene		X
Phenanthrene		X
Pyrene		X

Table 7-4 **Comparison of Groundwater Recommended BTVs and Current Screening Levels**

Parameter Name	Recommended BTVs			NDEP Action Level for Reid Gardner Station (2003)	Current Screening Levels			
	Alluvial (mg/L)[1]	Muddy Creek – North (mg/L)	Muddy Creek - Mesa (mg/L)		EPA RSL - Tap Water - November 2012[2]	NDEP BCL - Residential Water - January 2013[3]	Federal/ Nevada Primary MCL[4]	Nevada Secondary MCL[5]
Asbestos (MFL>10um)								
Asbestos	NS	NS	NS	NA	NA	NA	7	NA
General Chemistry (units listed below)								
Alkalinity - Bicarbonate (mg/L)	1200	260	310	NA	NA	NA	NA	NA
Alkalinity - Carbonate (mg/L)	NS	NS	NS	NA	NA	NA	NA	NA
Chloride (mg/L)	420	370	510	520	NA	NA	NA	400
Nitrogen, Ammonia(As N) (mg/L)	0.83	0.14	0.16	NA	NA	0.209	NA	NA
Nitrogen, Nitrate(As N) (mg/L)	17	0.41	10	10	25	10	10	NA
Nitrogen, Nitrite(As N) (mg/L)	SL	SL	SL	NA	1.6	1	1	NA
pH	NA	NA	NA	NA	NA	NA	NA	6.5-8.5
Phosphorus, Total (As P)(mg/L)	2.4	0.21	2.1	0.2*	NA	NA	NA	NA
Sulfate (mg/L)	1400	1200	2800	1070	NA	NA	NA	500
Total Dissolved Solids(residue, filterable) (mg/L)	3200	2500	4700	2570	NA	NA	NA	1000
Metals (mg/L)								
Aluminum, Dissolved	0.13	0.10	0.080	0.32	16	0.05	NA	0.2
Antimony, Dissolved	0.031	0.038	0.060	NA	0.006	0.006	0.006	NA
Arsenic, Dissolved	0.26	0.11	0.12	0.16	0.000045	0.01	0.01	NA
Barium, Dissolved	SL	SL	SL	2	2.9	2	2	NA
Beryllium, Dissolved	SL	SL	SL	0.004	0.016	0.004	0.004	NA
Boron, Dissolved	1.8	0.99	8.9	1.4	3.1	7.3	NA	NA
Cadmium, Dissolved	SL	SL	SL	0.005	0.0069	0.005	0.005	NA
Calcium, Dissolved	170	190	480	NA	NA	NA	NA	NA
Chromium, Dissolved	0.0048	NS	0.10	0.1	NA	NA	0.1	NA
Chromium, hexavalent	0.0082	0.0063	0.15	NA	0.000031	0.1	NA	NA
Cobalt, Dissolved	0.014	0.010	0.015	NA	0.0047	0.011	NA	NA
Copper, Dissolved	SL	SL	SL	NA	0.62	1.3	1.3	1
Fluoride, Dissolved	4.6	3.5	4.1	NA	0.62	4	4	2
Iron, Dissolved	SL	SL	SL	0.85	11	0.3	NA	0.6
Lead, Dissolved	NS	0.016	0.036	0.015	NA	0.015	0.015	NA
Magnesium, Dissolved	190	110	270	165	NA	207	NA	150
Manganese, Dissolved	0.37	0.37	0.35	0.27	0.32	0.02	NA	0.1
Mercury, Dissolved	NS	NS	SL	0.002	0.00063	0.002	0.002	NA
Molybdenum, Dissolved	0.053	0.068	0.39	0.03	0.078	0.183	NA	NA
Nickel, Dissolved	SL	SL	SL	0.7	0.3	0.73	NA	NA
Potassium, Dissolved	62	56	110	NA	NA	NA	NA	NA
Selenium, Dissolved	0.10	0.15	0.19	0.05	0.078	0.05	0.05	NA
Silica, Dissolved	68	22	38	NA	NA	NA	NA	NA
Silver, Dissolved	SL	SL	SL	NA	0.071	0.1	NA	0.1
Sodium, Dissolved	720	450	790	520	NA	NA	NA	NA
Thallium, Dissolved	0.080	0.070	0.11	NA	0.00016	0.002	0.002	NA
Titanium, Dissolved	0.013	0.013	0.013	0.01	NA	146	NA	NA
Vanadium, Dissolved	0.0085	0.0085	0.0085	0.004	0.078	0.183	NA	NA
Zinc, Dissolved	SL	SL	SL	NA	4.7	11	NA	5
PAHs (µg/L)								
Acenaphthene	SL	SL	SL	NA	400	6.24	NA	NA
Anthracene	SL	SL	SL	NA	1300	6.25	NA	NA
Benzo(a)anthracene	NS	NS	NS	NA	0.029	0.0921	NA	NA
Benzo(a)pyrene	NS	NS	NS	NA	0.0029	0.2	0.2	NA
Benzo(b)fluoranthene	NS	NS	NS	NA	0.029	0.0921	NA	NA
Benzo(g,h,i)perylene	NS	NS	NS	NA	NA	1100	NA	NA
Benzo(k)fluoranthene	NS	NS	NS	NA	0.29	0.921	NA	NA
Chrysene	NS	NS	NS	NA	2.9	9.21	NA	NA
Fluoranthene	NS	NS	NS	NA	630	1460	NA	NA
Indeno(1,2,3-cd)pyrene	NS	NS	NS	NA	0.029	0.0921	NA	NA
Naphthalene (PAH)	0.42	0.42	0.42	NA	0.14	0.143	NA	NA
Phenanthrene	SL	SL	SL	NA	NA	6.22	NA	NA
Pyrene	SL	SL	SL	NA	87	6.22	NA	NA
SVOC (µg/L)								
Biphenyl	NS	NS	NS	NA	0.83	1830	NA	NA
Bis(2-ethylhexyl) phthalate	SL	SL	SL	NA	4.8	6	6	NA

Notes:
NA - Not Applicable
NS - Not enough detected values to make a determination of BTV
SL - Screening level higher than BTV.
*Phosphate
Footnotes:
[1]Alluvial BTVs are provided for reference only; not for use in remedial decision-making at this time.
[2]**EPA Tap Water:** EPA Regional Screening Level (RSL) (Tap Water)-- Generic screening levels based on default exposure parameters and factors that represent Reasonable Maximum Exposure (RME) conditions for human long-term/chronic exposures and are based on the methods outlined in EPA's Risk Assessment Guidance for Superfund, Part B Manual (1991). The Tap Water RSL takes into account human exposure from direct ingestion of water and inhalation from exposure to vapors during showering or other activities (November 2012).
[3]**NDEP BCL - Residential Wat**er: NDEP Basic Comparison Level (Residential Water)—Screening level determined by NDEP for the BMI Complex to be protective of exposure through residential water use. Residential water takes into account human exposure through ingestion of water and inhalation from exposure to vapors during showering or other activities. Source: Updated User's Guide and Tables (January 2013).
[4]**Federal/Nevada Primary MCL:** Primary Maximum Contaminant Level (MCL) -- Federal standards adopted by Nevada that apply to public water systems. Primary standards protect public health by limiting the levels of contaminants in drinking water.
[5]**Nevada Secondary MCL:** Nevada Secondary MCL-- Secondary standards are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water as defined by NAC 445A.455.

Section 8

References

AqQA®, 2006. RockWare AqQA® Version 1.1.1, July 22, 2006. AqQA, LLC.

AQTESOLV®, 2007. AQTESOLV® for Windows Version 4.50 Professional, Developed by Glenn M. Duffield, HydroSOLVE Inc.

ARCADIS, 2012. *Aquifer Test Guidance*, distributed via e-mail 3/21/12.

ASTM, 2005. *D5521 - 05 Standard Guide for Development of Groundwater Monitoring Wells in Granular Aquifers.*

ASTM, 2009. *D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).*

ASTM, 2010. *ASTM D4318-10 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.*

Bagley, D.L., 1980. *Soil Survey of Virgin River Area, Nevada-Arizona, Parts of Clark and Lincoln Counties, Nevada and Part of Mohave County, Arizona.* U.S. Department of Agriculture, Soil Conservation Service.

BLM, 2011. U.S. Bureau of Land Management Right of Way Grant Numbers N-88975 and N-88975-02.

Bouwer, H. and R.C. Rice, 1976. "*A Slug Test Method for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells*", Water Resources Research, Vol. 12, No. 3.

Bredehoeft, J. and Hall, P., 1996. G*round Water Model Upper Muddy River, Nevada.* Prepared for Mifflin and Associates on behalf of Nevada Power Company. December 1996.

Converse Consultants, 1986a. *Borrow Source Study Laydown Evaporation Pond Area*. August 11, 1986.

Converse Consultants, 1986b. *Geotechnical Investigation Laydown Area Evaporation and Storage Ponds, Units 1, 2, & 3*. September 2, 1986.

Converse Consultants, 1998. *Ground Water Level Monitoring Program, Moapa, Nevada, 1997 Formal Annual Report*. Project number 97-33147-01, March 2, 1998.

Converse Consultants, 1999. *Preliminary Findings: Partially Completed Field Investigation, Fly Ash Disposal Landfill Expansion Project*. October 6, 1999.

Converse Consultants, 2002. *Results of Monitoring Well Installation and Development, Fly Ash Landfill*. Reid Gardner Power Plant, Moapa, Nevada. March 11, 2002.

Converse Consultants, 2004. *Geotechnical and Dewatering Investigation, Pond 4A Closure, Reid Gardner Station*, Clark County, Nevada, July 2004.

Converse Consultants, 2007. *Geotechnical Data Report 320-Acre Mesa Flyash Storage, Reid Gardner Station, Clark County, Nevada*, Converse Project No. 06-33180-01 Task 3. February 20, 2007.

Converse Consultants, 2008a. *Solids Disposal Landfill, Reid Gardner Station;* July 8, 2008.

Converse Consultants, 2008b. *Geotechnical Evaluation, Raw Water Pond, Reid Gardner Station, Clark County, Nevada*. Converse Project Number 08-33223-01, October 8, 2008.

Converse Consultants, 2009a. *Geotechnical Investigation, Future Mesa Landfill Expansion Area, Reid Gardner Station, Clark County, Nevada*, June 17, 2009.

Converse Consultants, 2009b. *Geotechnical Investigation, Mesa Evaporation Ponds, Reid Gardner Station, Clark County, Nevada*, May 4, 2009.

Converse Consultants, 2009c. *Geotechnical Investigation, South Lateral Landfill Expansion, Reid Gardner Station, Clark County, Nevada*, June 2, 2009.

Converse Consultants, 2011. *Results of the Mesa Area Replacement Monitoring Well Installation, Development and Geotechnical Laboratory Testing Services, Flyash Landfill, Reid Gardner Station, Clark County, Nevada*, August 2011.

Converse Consultants, 2012. *Well Completion Report, Mesa Monitoring Wells, NV Energy, Reid Gardner Station, Moapa, Nevada*, Converse Project No. 11-35104-01. April 10, 2012.

DAQEM, 2011. *Dust Control Permit for Construction Activities Including Surface Grading and Trenching, Permit Number 40662*, December 16, 2011.

Dettinger, et al., 1995. "*Distribution of Carbonate-Rock Aquifers and the Potential for their Development, Southern Nevada and Adjacent Parts of California, Arizona, and Utah*", U.S. Geological Survey, Water Resources Investigations Report 91-4146.

Dettinger, M.D., 1992. "*Geohydrology of Areas Being Considered for Exploratory Drilling and Development of the Carbonate-Rock Aquifers in Southern Nevada – Preliminary Assessment*", U.S. Geological Survey, Water Resources Investigations Report 90-4077.

Dicke, S.M, 1990. *Stratigraphy and Sedimentology of the Muddy Creek Formation, Southeastern Nevada* (M.S. Thesis), Lawrence, University of Kansas.

Dougherty, D.E and D.K. Babu, 1984. "*Flow to a Partially Penetrating Well in a Double-Porosity Reservoir*", Water Resources Research, Vol. 20, No. 8.

Eakin, T.E., 1964. *"Ground-Water Appraisal of Coyote Spring and Kane Spring Valleys and Muddy River Spring Area, Lincoln and Clark Counties, Nevada*". Ground-Water Resources - Reconnaissance Series, Report 25. February 1964.

Eakin, T.E., 1968. *"A Regional Interbasin Groundwater System in the White River Area of Southeastern Nevada*". Water Resources Research, Vol. 2.

ENSR International, 2005. *Conceptual Site Model, Kerr-McGee Facility, Henderson, Nevada*. Document Number 04020-023-100, February 2005.

EPA, 2002. *Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites*. EPA 540-R-01-003-OSWER 9285.7-41. September 2002.

EPA, 2010. *Regional Screening Level (RSL) Summary Table*, Mid-Atlantic Risk Assessment Generic Tables, November, 2012.

EPA, 2010a. ProUCL Version 4.00.05, *Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations.* National Exposure Research Lab, EPA, Las Vegas, Nevada, May 2010.

EPA, 2010b. ProUCL Version 4.00.05, *Technical Guide (Draft).* EPA/600/R0-7/041 May 2010.

Freeze, Allan M., Cherry, John A., 1979. *Groundwater*, Prentice Hall Inc., 1979.

Gardner, L.R., 1968. *The Quaternary Geology of Moapa Valley, Clark County Nevada, A Thesis in Geology.* Pennsylvania State University, The Graduate School, Department of Geology and Geophysics.

Halford, Keith J., Kuniansky, Eve L., 2002. *Documentation of Spreadsheets for Analysis of Aquifer-Test and Slug-Test Data*, U.S. Geological Survey Open-File Report 02-197, 2002. et al., 2002.

Hess, J.W., 1986. *Summary of Deep Drilling Activities at NPC Reid Gardner Facility, Clark County, Nevada October 1985- May 1986*, Desert Research Institute, Water Resources Center, October 1986.

Hvorslev, M.J., 1951. "*Time Lag and Soil Permeability in Ground-Water Observations*", *Bulletin No. 36, Waterways Experiment Station,* Corps of Engineers, U.S. Army, Vicksburg, Mississippi.

Intellus Corporation, 1986a. *Hydrogeologic Study of the Reid Gardner Power Plant Region,* Project Number 832922, March 1986.

Intellus Corporation, 1986b. *Hydrogeologic Study of the Reid Gardner Power Plant Region, Final Report.* Project Number 832922, September 1986.

Intellus Corporation, 1986c. *Product Recovery Testing at the Reid Gardner Power Plant, Moapa, Nevada.* Project Number 750100, November 1986.

Intellus Corporation, 1987. *Product Recovery Testing at the Reid Gardner Power Plant, Moapa, Nevada and Investigation of a Weathered Diesel Plume Adjacent to the Reid Gardner Station. Contract* Number 750101, April 1987.

Johnson, C., Brick, C. and Tyler, S. , 1986. *Construction, Development, and Testing of NPC Wells EH-2 and EH-2A, Interim Report.* Desert Research Institute, Water Resources Center, August 18, 1986.

Kleinfelder, 1992. *Hydrogeologic Study of Surface Impoundments, Nevada Power Company, Reid Gardner Station,* June 24, 1992.

Kleinfelder, 1993. *Borrow Area Evaluation Proposed Sanitary Landfill Cover,* August 16, 1993.

Kleinfelder, 1996. *Geotechnical Investigation Evaporation Ponds D and E ,* June 6, 1996.

Kleinfelder, 1998a. *1997 Hydrologic Impacts from Groundwater Withdrawals in the Upper Muddy River Valley, Nevada.* Prepared for Nevada Power Co. July 6, 1998.

Kleinfelder, 1998b. *Hydrogeologic Assessment, Reid Gardner Station, Moapa, Nevada. Project Number 31-216481-505*, July 8, 1998.

Kleinfelder, 2000. *Hydrogeologic Site Characterization-2000, Reid Gardner Station, Moapa, Nevada,* December 7, 2000.

Knochenmus, Lari A., Laczniak, Randell J., Moreo, Michael T., Sweetkind, Donald S., Wilson, J.W., Thomas, James M., Justet, Leigh, Hershey, Ronald L., Earman, Sam, Lyles, Brad F., and Lundmark, Kevin W., 2007. *Water Resources of the Basin and Range Carbonate-Rock Aquifer System*, Scientific Investigation Report 2007-5261, U.S. Geological Survey, 2007.

Kowallis, Bart J., Everett, Brent H., 1986. "*Sedimentary Environments of the Muddy Creek Formation near Mesquite, Nevada*". Utah Geological Association Publication 15, 1986.

Kresic, Neven, 2007. *Hydrogeology and Groundwater Modeling, Second Edition*, CRC Press, 2007.

Kurtz, Andy, 2005. Memorandum to Frank Putman, *Wind Rivers Resources, LLC & Virgin Valley Water District Application to Transport Water Out-of State.* Arizona Department of Water Resources Hydrology Division, June, 14, 2005.

Longwell, C.R., Pampeyan, E.H., Bowyer B., and Roberts, R.J., 1965. *"Geology and Mineral Deposits of Clark County, Nevada"*, Nevada Bureau of Mines and Geology, Bulletin 62.

Maxey, G.B., Mindling, A.L., and Domenico, P.A., 1966. *Ground Water in Upper Muddy River Basin*, Desert Research Institute, Center for Water Resources Research.

Mayer, T.D., and Congdon, R.D., 2007. *"Evaluating Climate Variability and Pumping Effects in Statistical Analyses"*, GroundWater, March-April 2008.

Mifflin and Associates, 1993. *1992 Hydrologic Impacts from Ground-Water Withdrawals in the Upper Muddy River Valley, Nevada.* Mifflin and Associates, Prepared for Nevada Power Co., April 1993.

Mifflin and Associates, 1994. *1993 Hydrologic Impacts from Ground-Water Withdrawals in the Upper Muddy River Valley, Nevada.* Mifflin and Associates, Prepared for Nevada Power Co., April 1994.

Mifflin and Associates, 1996. *1995 Hydrologic Impacts from Ground-Water Withdrawals in the Upper Muddy River Valley, Nevada.* Mifflin and Associates, Prepared for Nevada Power Co., March, 1996.

Mifflin and Associates, 1997. *1996 Hydrologic Impacts from Ground-Water Withdrawals in the Upper Muddy River Valley, Nevada.* Mifflin and Associates, Prepared for Nevada Power Co., January, 1997.

Mifflin and Associates, 2001. *Hydrogeologic and Groundwater Modeling Analyses for the Moapa Paiute Energy Center*, Moapa Indian Reservation, Clark County. Nevada, Mifflin and Associates, February 2001.

MVWD, 2008. Water Supply Analytical Data and well location map.

NDEP and NVE, 2008. *Nevada Division of Environmental Protection, Administrative Order on Consent (AOC)*, February 22, 2008.

NDEP, 1996. *Guidance Document for Design of Groundwater Monitoring Wells, Nevada Division of Environmental Protection*, Technical Publication WTS-4, 1996.

NDEP, 2003. Letters, Shannon Harbour, Nevada Division of Environmental Protection, *"Background Water Quality Data for the Reid Gardner Generating Station, Moapa, Nevada (dated June 25, 2003)"* September 8, 2003, and *"Additional Background Water Quality Data for the Reid Gardner Generating Station, Moapa, Nevada (dated October 23, 2003)"* October 23, 2003.

NDEP, 2011. Letter. Shannon Harbour, P.E., *"NDEP Response to NVE Letter Re: Change of Contracted Laboratory; Approval Requested"*, September 1, 2011.

NDEP, 2012. Letter. Shannon Harbour, P.E., *"NDEP Response to NVE E-mail Re: Laboratory Concurrence Requested"*, January 6, 2012.

NDEP, 2013. *User's Guide and Background Technical Document for Nevada Division of Environmental Protection Basic Comparison Levels for Human Health for the BMI Complex and Common Areas,* Revision 10, January, 2013.

NDWP, 1999. Nevada Division of Water Planning, *Nevada State Water Plan*. Nevada Division of Water Planning, 1999.

NDWR, 2013. Nevada Division of Water Resources online well log database http://water.nv.gov/data/welllog/.

NPC, 2002. *Reid Gardner Station Revised Hydrogeologic Characterization Report* Volumes 1 and 2, Nevada Power Company, February, 20, 2002.

NPC, 2003a. Letter, David Phillips, Nevada Power Company to Shannon Harbour, Nevada Division of Environmental Protection, *"Background Water Quality Data for the Reid Gardner Generating Station, Moapa, Nevada"* June 25, 2003.

NPC, 2003b. Letter, David Phillips, Nevada Power Company to Shannon Harbour, Nevada Division of Environmental Protection *"Additional Background Water Quality Data for the Reid Gardner Generating Station, Moapa, Nevada"* October 1, 2003.

NVE and Stanley Consultants, 2012. *NV Energy Reid Gardner Station Revised Site-Specific Aquifer Testing Outline,* Memo to NDEP, May 24, 2012.

NVE, 2008a. *First Quarter 2008 Groundwater Monitoring and Remediation Report,* May, 2008.

NVE, 2008b. *Second Quarter 2008 Groundwater Monitoring and Remediation Report,* August, 2008.

NVE, 2008c. *Third Quarter 2008 Groundwater Monitoring and Remediation Report,* November, 2008.

NVE, 2009a. *Fourth Quarter 2008 Groundwater Monitoring and Remediation Report,* February, 2009.

NVE, 2009b. *First Quarter 2009 Groundwater Monitoring and Remediation Report,* May, 2009.

NVE, 2009c. *Second Quarter 2009 Groundwater Monitoring and Remediation Report,* August, 2009.

NVE, 2009d. *Third Quarter 2009 Groundwater Monitoring and Remediation Report,* November, 2009.

NVE, 2010a. *Revised Data Validation Memorandum of Understanding*, Memo to NDEP, March 5, 2010.

NVE, 2010b. *Fourth Quarter 2009 Groundwater Monitoring and Remediation Report,* March, 2010.

NVE, 2010c. *First Quarter 2010 Groundwater Monitoring and Remediation Report,* May, 2010.

NVE, 2010d. *Second Quarter 2010 Groundwater Monitoring and Remediation Report,* August, 2010.

NVE, 2010e. *Third Quarter 2010 Groundwater Monitoring and Remediation Report,* November, 2010.

NVE, 2011a. *Fourth Quarter 2010 Groundwater Monitoring and Remediation Report,* February 2011.

NVE, 2011b. *First Quarter 2011 Groundwater Monitoring and Remediation Report,* May, 2011.

NVE, 2011c. *Second Quarter 2011 Groundwater Monitoring and Remediation Report,* August, 2011.

NVE, 2011d. *Third Quarter 2011 Groundwater Monitoring and Remediation Report,* November, 2011.

NVE, 2012. *Fourth Quarter 2011 Groundwater Monitoring and Remediation Report,* February 2012.

OEPA, 2006. *Technical Guidance Manual for Ground Water Investigations*, State of Ohio Environmental Protection Agency, Division of Drinking Water and Ground Water, December 2006

Pohlmann, K.F., and Wert, B.L., 1992. *Lewis Wellfield Testing,* Desert Research Institute, Water Resources Center, February 1992.

Pohlmann, K.F., Morris, T.M., Sullivan, K.E., and Wert, B.L., 1988. *Hogan Spring Drilling Project, Final Report*. Desert Research Institute, Water Resources Center, January 1988.

Prudic, D., Harrill, J., Burbey, T., 1995. *Conceptual Evaluation of Regional Ground-Water Flow in the Carbonate-Rock Province of the Great Basin, Nevada, Utah, and Adjacent States,* Regional Aquifer-System Analysis, Great Basin, Nevada-Utah. U.S. Geological Survey Professional Paper 1409-D.

Schmidt, D.L., Page, W.R., and Workman, J.B., 1996. *Preliminary Geologic Map of the Moapa West Quadrangle, Clark County, Nevada*: U.S. Geological Survey Open File Report of 96-521.

Schroth, B.K., 1987. *Water Chemistry Reconnaissance and Geochemical Modeling in the Meadow Valley Wash Area, Southern Nevada*. Desert Research Institute, Water Resources Center, April 20, 1987.

Shacklette, H. T. and J. G Boerngen, 1984. *Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States*, Geological Survey Professional Paper 1270, U. S. Geological Survey, Alexandria, VA, 1984.

Stanley Consultants, 2010. *Evaluation of Background Conditions Work Plan,* January 2010, errata December 2012.

Stanley Consultants, 2011a. *Generic Quality Assurance Project Plan, AOC Implementation Activities,* May 2008, revised November 2011.

Stanley Consultants, 2011b. *Evaluation of Background Conditions Health & Safety Plan,* April 2011.

Stanley Consultants, 2012. *Draft Evaluation of Background Conditions Data Validation Reports for Soil,* June 2012.

Stanley Consultants, 2013a. *Evaluation of Background Conditions Data Validation Reports for Soil,* May 2013.

Stanley Consultants, 2013b. *Evaluation of Background Conditions Data Validation Reports for Groundwater, First Quarter 2012,* May 2013.

Stanley Consultants, 2013c. *Evaluation of Background Conditions Data Validation Reports for Groundwater, Second Quarter 2012,* May 2013.

Stanley Consultants, 2013d. *Evaluation of Background Conditions Data Validation Reports for Groundwater, Third Quarter 2012,* May 2013.

Sulenski, R.J., 1973. *Geologic Field Report of the Proposed Evaporite Ponds near Moapa, Clark County, Nevada,* June 14, 1973.

Theis, C.V., 1935. *"The Relation Between the Lowering of the Piezometric Surface and the Rate and Duration of Discharge of a Well Using Groundwater Storage"*, Transactions, American Geophysical Union, Vol. 16.

Thomas, J.M, Lyles, B.F., Carpenter, L.A., 1991. *Chemical and Isotopic Data from Water from Wells, Springs, and Streams in Carbonate-Rock Terrain of Southern and Eastern Nevada and Southeastern California*, 1985-88, U.S. Geological Survey Open File Report 89-422.

Warner, S., 2003. *Using GPS to Quantify Three Dimensional Storage and Aquifer Deformation in the Virgin River Valley, NV*. Masters of Science in Geoscience Thesis, Virgin Polytech Institute and State University, January 2003.

Williams, Van S. 1996. *Preliminary Geologic Map of the Mesquite Quadrangle, Clark and Lincoln Counties, Nevada and Mohave Counties, Arizona:* 1996, U.S. Geological Survey Open-File Report 96-676.

Section 9

Acronyms and Abbreviations

A-D	Anderson-Darling
AMSL	above mean sea level
AOC	Administrative Order on Consent
ASTM	American Society for Testing and Materials
BCL	basic comparison level
bgs	below ground surface
BLM	Bureau of Land Management
btoc	below top of casing
BTVs	background threshold value
cfs	cubic feet per second
CH	fat clay
CL	lean clay
cm	centimeter
COC	Chain-of-Custody
CSM	conceptual site model
DAQEM	Clark County Department of Air Quality and Environmental Management
DI	de-ionized
DL	detection limit
DQO	Data Quality Objective
DRI	Desert Research Institute
EA	environmental assessment
EB	equipment blank
EPA	United States Environmental Protection Agency
ESC	ESC Lab Sciences

FB	field blank
FONSI	Finding of No Significant Impact
ft.	feet
GM	silty gravel
GOF	goodness-of-fit
gpd/ft	gallons per day per foot
gpm	gallons per minute
GW	well-graded gravel
HASP	Health and Safety Plan
HDPE	high density polyethylene
HW	Hawkins-Wixley
K	Hydraulic Conductivity
KM	Kaplan-Meier
K-S	Kolmogorov-Smirnov
LBCL	Leaching Basic Comparison Level
µg/kg	microgram per kilogram
µmhos/cm	micromhos per centimeter
m/d	meters per day
m^2/day	square meters per day
m^2/hr	square meters per hour
mg/kg	milligram per kilogram
mg/L	milligram per liter
ML	silt
MLE	Maximum Likelihood Estimate
mmhos	millimhos
MVWD	Moapa Valley Water District
MW	megawatt
NA	not applicable
NAC	Nevada Administrative Code
ND	non-detect
NDEP	Nevada Division of Environmental Protection
NDWP	Nevada Division of Water Planning
NDWR	Nevada Division of Water Resources
NPC	Nevada Power Company
NS	no standard
NVE	NV Energy
OGI	OGI Environmental Consultants
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PI	Plasticity Index
POD	Plan of Development
ppm	parts per million

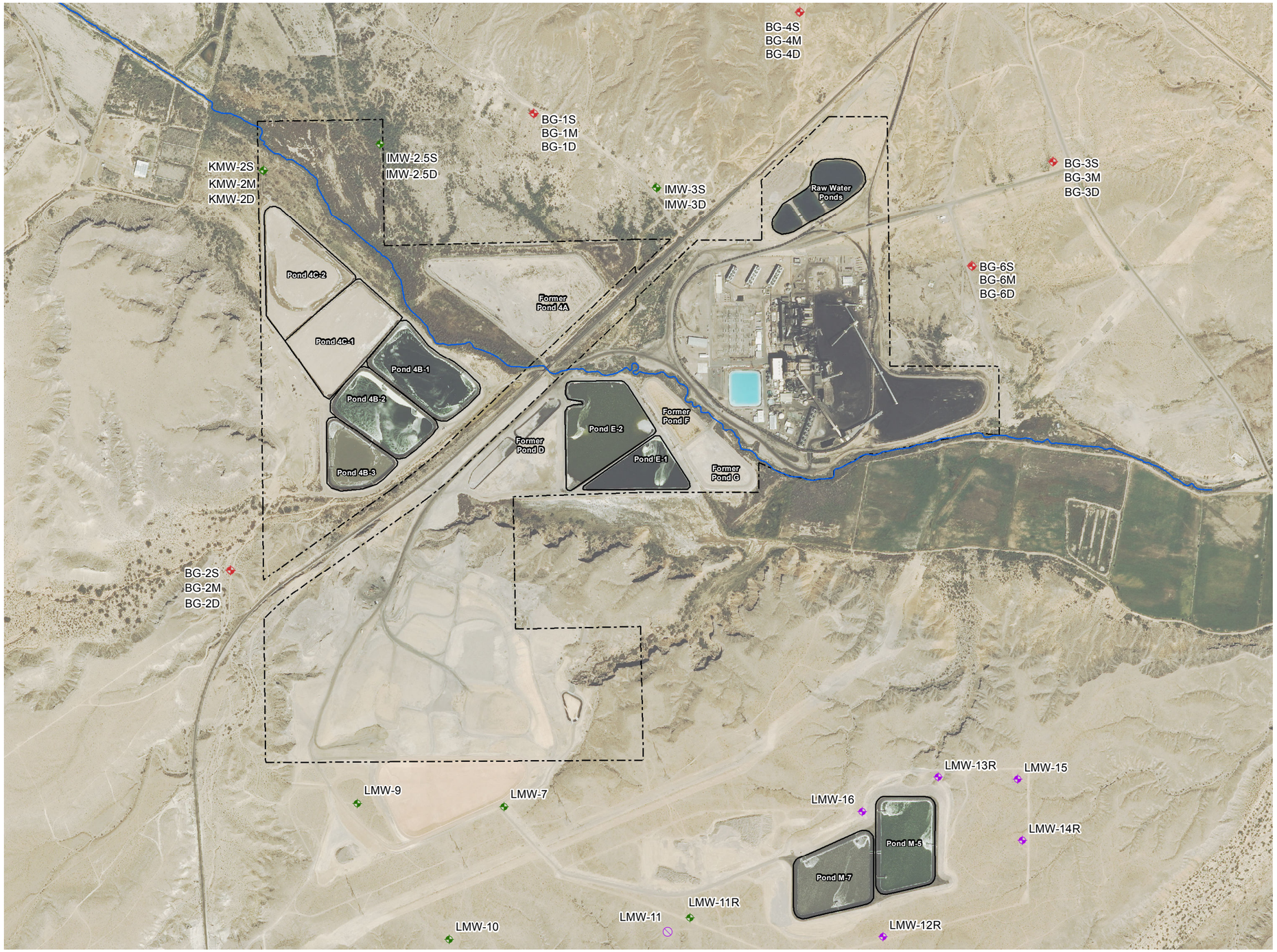
psi	pounds per square inch
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
QC	quality control
ROS	regression on order statistics
ROW	right-of-way
RSL	Regional Screening Level
S	storativity
SC	clayey sand
SM	silty sand
SNHD	Southern Nevada Health District
SNWA	Southern Nevada Water Authority
SOP	Standard Operating Procedure
SP	poorly-graded sand
SRC	site-related chemical
SSL	Soil Screening Level
Station	Reid Gardner Generating Station
SVOC	Semi-Volatile Organic Compound
SW	well-graded sand
S-W	Shapiro-Wilk
SWCA	SWCA Environmental Consultants
T	transmissivity
TDS	Total Dissolved Solids
TOC	Top of Casing
TOC	Total Organic Content
TPH	Total Petroleum Hydrocarbons
t-test	Student's t-test
UCL	upper confidence limit
USCS	Unified Soil Classification System
USGS	United States Geological Survey
UTL	Upper Tolerance Limit
Veritas	Veritas Laboratories
VOC	Volatile Organic Compound
WH	Wilson-Hilferty
WMU	Waste Management Unit
WMW	Wilcoxon-Mann-Whitney
Workplan	Evaluation of Background Conditions Workplan
WRFS	White River Flow System
W-S	Welch-Satterthwaite

Appendix A

Figures

Figure 1 – Background Sampling Locations
Figure 2 - Regional Geologic Map
Figure 3 - Site Geology Map
Figure 4 - Cross Sections Overview
- **Figure 4.1 -Cross Section A-A'**
- **Figure 4.2 -Cross Section A'-A''**
- **Figure 4.3 -Cross Section A''-A'''**
- **Figure 4.4 -Cross Section B-B'**
- **Figure 4.5 -Cross Section B'-B''**
- **Figure 4.6 -Cross Section B''-B'''**
- **Figure 4.7 -Cross Section B'''-B''''**
- **Figure 4.8 -Cross Section C-C'**
- **Figure 4.9 -Cross Section C'-C''**
- **Figure 4.10 -Cross Section D-D'**
- **Figure 4.11 -Cross Section D'-D''**
- **Figure 4.12 -Cross Section D''-D'''**
- **Figure 4.13 -Cross Section D'''-D''''**
- **Figure 4.14 -Cross Section E-E'**
- **Figure 4.15 -Cross Section E'-E''**
- **Figure 4.16 -Cross Section E''-E'''**
- **Figure 4.17 -Cross Section E'''-E''''**

Figure 5 - Surface Soil Types
Figure 6 - Schematic Regional Geologic Cross-Section
Figure 7 - Shallow Groundwater Elevation Contour Map
Figure 8 - Stiff Diagrams



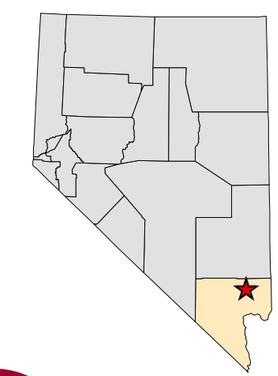
Legend

Background Sampling Location
- Groundwater Sampling Location
- Soil and Groundwater Sampling Location

Mesa Pond Sampling Location
- Actively Monitored
- Abandoned
- Muddy River
- Pond Outline
- Property Boundary

1,100 550 0 1,100 2,200 Feet

Notes:
1. Aerial imagery provided by USDA-FSA Aerial Photography Field Office; published 11/15/2013; photographs taken Spring 2013
2. Well clusters consist of three wells (S,M,D)



Stanley Consultants INC.

July 2014

BACKGROUND SAMPLING LOCATIONS
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 1

REV	No.	REVISION DESCRIPTION	DATE	DRWN	CHKD	APVD
1		Submittal to NDEP	5/12/14	JO/CC	AE	RLS
0		Submittal to NDEP	9/23/13	JO/CC	AE	RLS

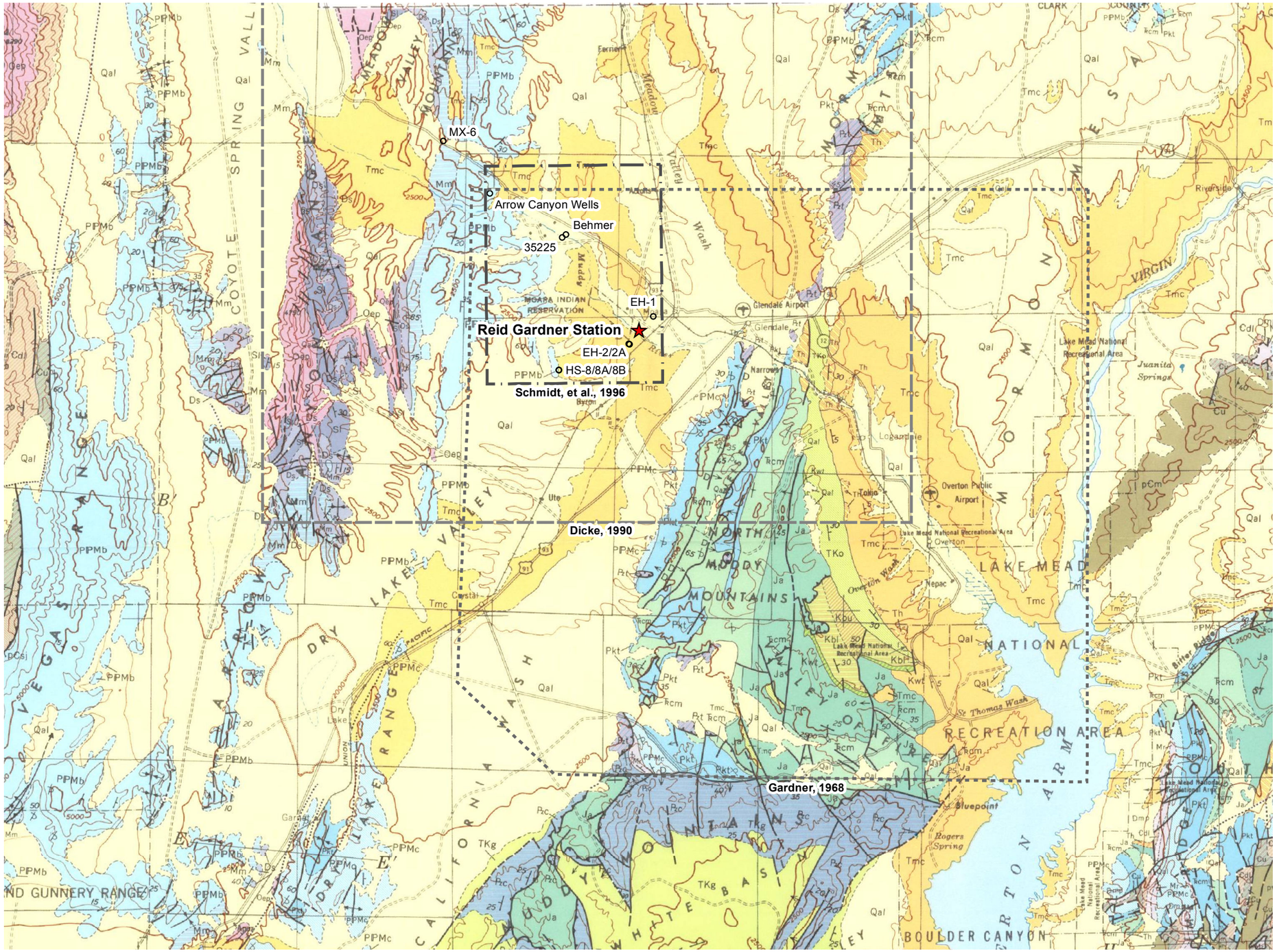
0 1 in.
At full size
1 inch = 1,100 feet

NVEnergy

20618.09.22

REV. 1

\\cyis1\Projects_F\20618_03_NVE_RGS_AOC_Imp09\Active\14-GIS\GIS\WorkingData\Mxd\Background\ebc_report\Fig1_SamplingLocations.mxd © STANLEY CONSULTANTS



Legend

Geologic Map Unit

- Qal - Alluvium
- Tmc - Muddy Creek Formation
- Th - Horse Spring Formation
- TKo - Overton Fanglomerate
- TKg - Gale Hills Formation
- Kbu/Kbl - Baseline Sandstone Angular Unconformity
- Ja - Aztec sandstone
- Trcm - Chinle and Moenkopi Formations, undivided
- Pkt - Kaibab, Toroweap, and Coconino Formations, and red beds, undivided
- PPMb - Bird Spring Formation
- Mm - Monte Cristo Limestone
- Ds - Sultan Limestone
- Sl - Lone Mountain Dolomite
- Oep - Ely Springs Dolomite, Eureka Quartzite, and Pogonip Group, undifferentiated
- pCu - Precambrian rocks
- PzC - Paleozoic carbonate rocks

Historic Study Area

- Gardner, 1968
- Dicke, 1990
- Schmidt, et al., 1996

Rock Lines

- Contact - known
- Normal fault - known
- Normal fault - approximately located
- Normal fault - concealed

Attitudes

- Horizontal bedding
- Inclined bedding - showing strike and dip
- Vertical bedding - showing strike
- Overturned bedding - showing strike and dip
- Inclined dike - showing strike and dip
- Vertical dike - showing strike

Line Points

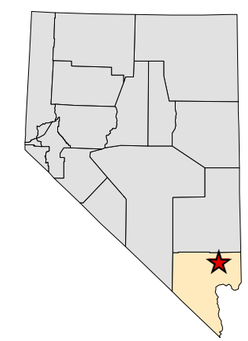
- Fault ball - ball on downthrown side
- Fault dip - showing dip angle
- Slickensides - showing trend and plunge
- Vertical Fault

Well Locations

- Drill Hole

4 2 0 4 8 Miles

Notes:
1. Geologic Map of Clark County, Nevada by C.R. Longwell, E.H. Pampeyan, and Ben Bowyer, 1955, revised 1964; obtained from the Nevada Bureau of Mines and Geology online collection
2. The following historic study area is out of the map extent and is not shown on this figure: "Williams, 1996"



Stanley Consultants INC.

July 2014

REV	No.	REVISION DESCRIPTION	DATE	DRWN	CHKD	APVD
1		Submittal to NDEP	5/12/14	JO/CC	AE	RLS
0		Submittal to NDEP	9/23/13	JO/CC	AE	RLS

0 1 in.
At full size
1 inch = 4 miles

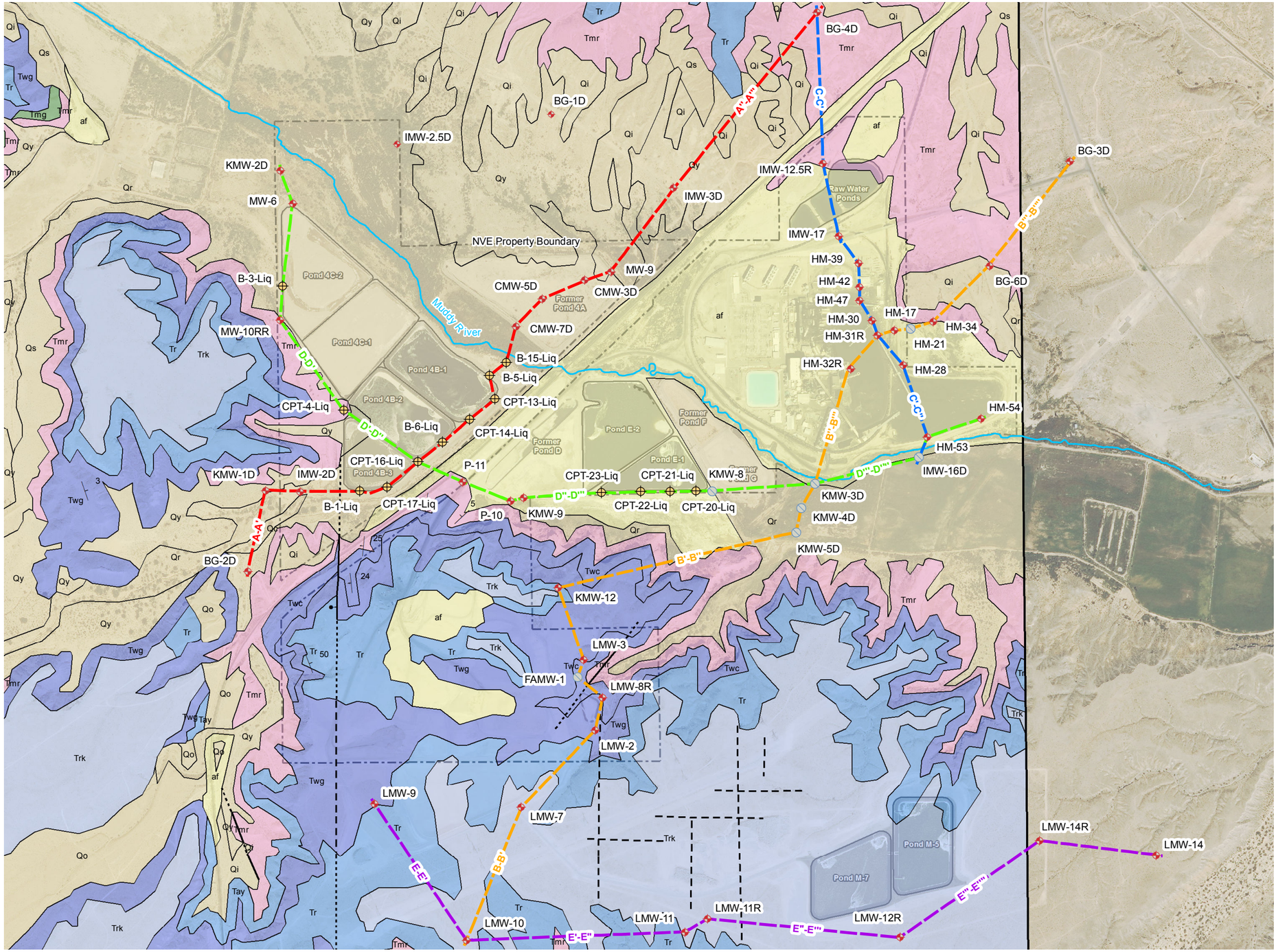
NVEnergy

20618.09.22

REV. 1

REGIONAL GEOLOGIC MAP
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 2

\\lcy-fs1\Projects_F\20618_03_NVE_RGS_AOC_Imp09\Active\14-GIS\GIS\WorkingData\Mxd\Background\ebc-report\Fig2_RegionalGeologicMap.mxd ©STANLEY CONSULTANTS



Legend

Background Cross-Section Wells
- Monitoring Well
- Inactive / Abandoned / Destroyed
- Liquefaction Borings / CPTs
- Muddy River
- Property Boundary
- Pond Outline

Background Cross-Sections
- A-A'-A"-A'''
- B-B'-B"-B'''-B''''
- C-C'-C"
- D-D'-D"-D'''-D''''
- E-E'-E"-E'''-E''''

Geologic Map Unit
- af - Artificial fill
- Qc - Channel alluvium
- Qs - Slope wash and talus deposit
- Qr - Recent terrace alluvium
- Qy - Young terrace alluvium
- Qi - Intermediate trace alluvium
- Qo - Old terrace alluvium
- Trk - Young Tertiary calcrete
- Tr - Regrade gravel of Moapa
- Tay - Yellow basal sand
- Twg - Marl of White Narrows; Graben-fill unit
- Twc - Marl of White Narrows; Channel-fill unit
- Tmg - Muddy Creek Formation; Green claystone
- Tmr - Muddy Creek Formation; Red claystone

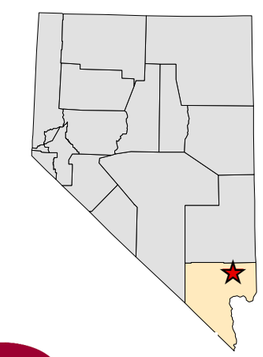
Rock Lines
- Contact - known
- Normal fault - known
- Normal fault - approximately located
- Normal fault - concealed

Attitudes
- Horizontal bedding
- Inclined bedding - showing strike and dip
- Vertical bedding - showing strike
- Overturned bedding - showing strike and dip
- Inclined dike - showing strike and dip
- Vertical dike - showing strike

Line Points
- Fault ball - ball on downthrown side
- Fault dip - showing dip angle
- Slickensides - showing trend and plunge
- Vertical Fault

1,100 550 0 1,100 2,200 Feet

Notes:
1. Aerial imagery provided by USDA-FSA Aerial Photography Field Office; published 11/15/2013; photographs taken Spring 2013
2. Moapa West Geologic Map (USGS OFR96-521) obtained from Nevada Bureau of Mines and Geology online collection (Schmidt, et al, 1996); detailed geologic data is not available for Moapa East



Stanley Consultants INC.

July 2014

REV	No.	REVISION DESCRIPTION	DATE	DRWN	CHKD	APVD
1		Submittal to NDEP	5/12/14	JO/CC	AE	RLS
0		Submittal to NDEP	9/23/13	JO/CC	AE	RLS

0 1 in.
At full size
1 inch = 1,100 feet

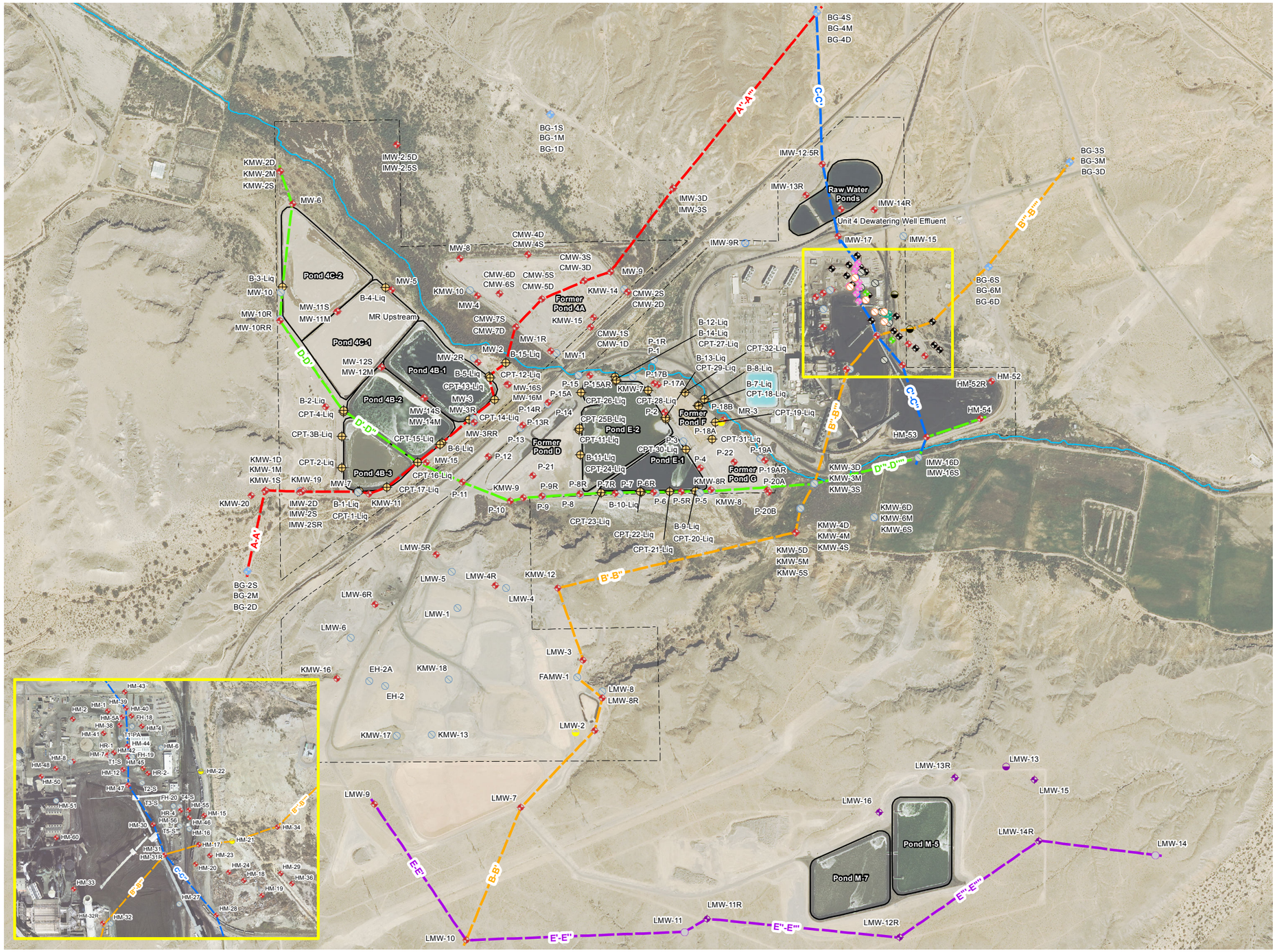
NVEnergy

20618.09.22

REV. 1

SITE GEOLOGY MAP
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 3

\\cvfs1\Projects_F\20618_03_NVE_RGS_AOC_Imp09\Active\14-GIS\GIS\WorkingData\Mxd\Background\bc_report\Fig3_SiteGeologyMap.mxd © STANLEY CONSULTANTS



Legend

- Property Boundary
- Muddy River
- Pond Outline
- Liquefaction Borings / CPTs
- A-A'-A"-A'''
- B-B'-B"-B'''-B""
- C-C'-C"
- D-D'-D"-D'''-D""
- E-E'-E"-E'''-E""

GMR Monitoring Locations
- Sampled or Gauged
- Damaged
- Dry
- Abandoned / Destroyed

Background Wells
- Sampled or Gauged
- Damaged
- Dry
- Abandoned / Destroyed

Mesa Pond Wells
- Sampled or Gauged
- Damaged
- Dry
- Functional - Not Sampled
- Abandoned / Destroyed

Former Remediation Trench
- Abandoned / Destroyed

Passive Recovery
- Sampled or Gauged
- Damaged
- Dry
- Abandoned / Destroyed

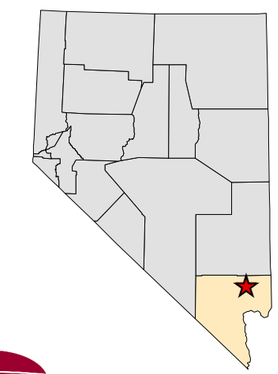
Vapor Extraction
- Sampled or Gauged
- Damaged
- Dry
- Abandoned / Destroyed

Dewatering
- Sampled or Gauged
- Damaged
- Dry
- Abandoned / Destroyed

Free Product Gauging
- Sampled or Gauged
- Damaged
- Dry
- Abandoned / Destroyed

1,100 550 0 1,100 2,200 Feet

Notes:
1. Main map aerial imagery provided by USDA-FSA Aerial Photography Field Office; published 11/15/2013; photographs taken Spring 2013
2. Inset map aerial imagery provided by USDA-FSA Aerial Photography Field Office; published 2/22/2011; photographs taken late Spring 2010
3. Sampling locations current as of 3rd Quarter 2012



Stanley Consultants INC.

July 2014

CROSS SECTIONS OVERVIEW
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 4

REV	No.	REVISION DESCRIPTION	DATE	DRWN	CHKD	APVD
1		Submittal to NDEP	5/12/14	CC	JO/AE	RLS
0		Submittal to NDEP	9/23/13	CC	JO/AE	RLS

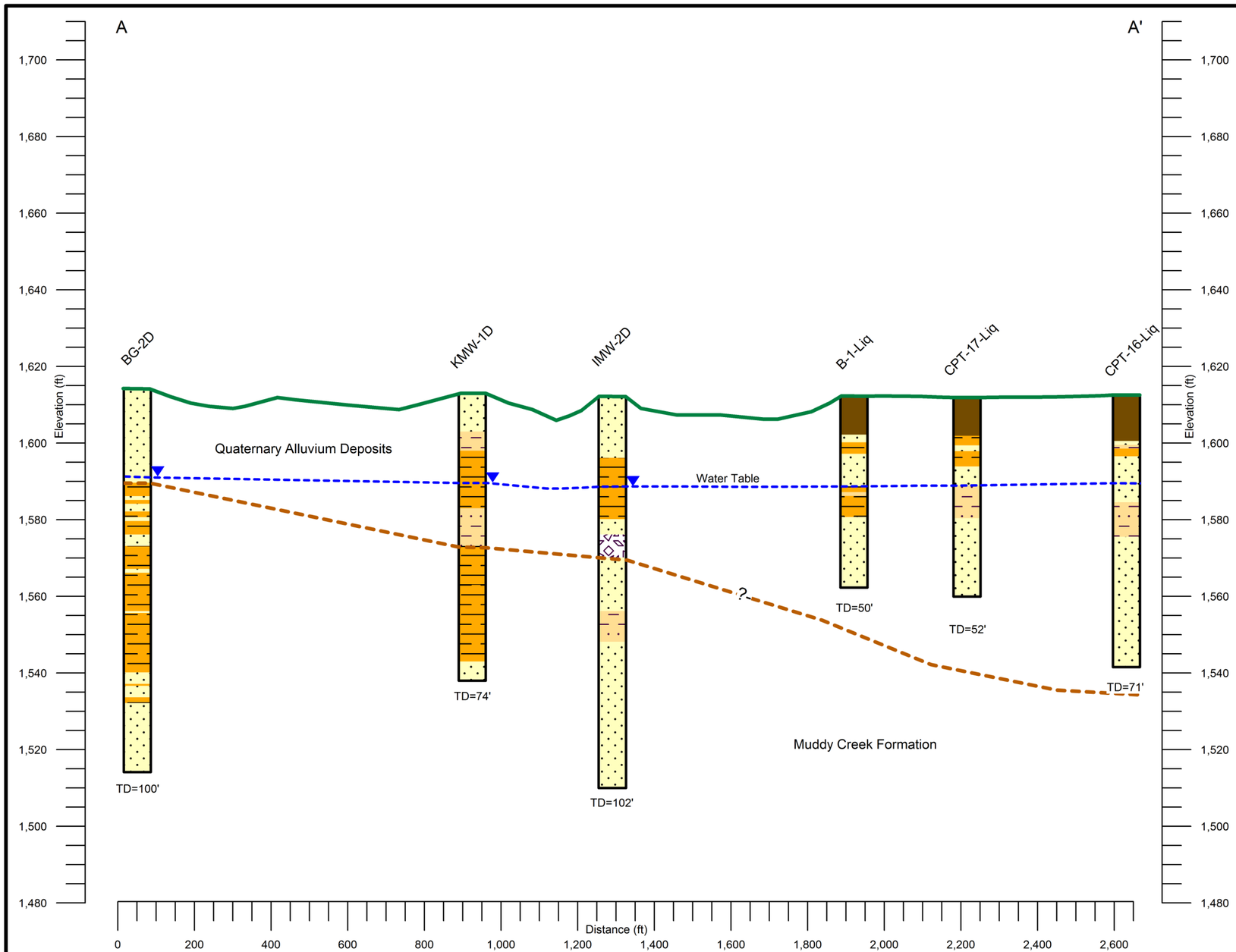
0 1 in.
At full size
1 inch = 1,100 feet

NVEnergy

20618.09.22

REV. 1

\\lcx-fs1\Projects_F\20618.03 NVE RGS AOC Imp09\Active\14-GIS\GIS\Working\Data\Mxd\Background\etc report\Fig4 CrossSectionsOverview.mxd © STANLEY CONSULTANTS



LEGEND

- Fill
- Gravel
- Sand
- Silt
- Clay
- Conglomerate
- Ground Surface
- Estimated Potentiometric Surface
- Estimated Top of Muddy Creek Formation
- Groundwater Elevation (2012 - 3rd Quarter)

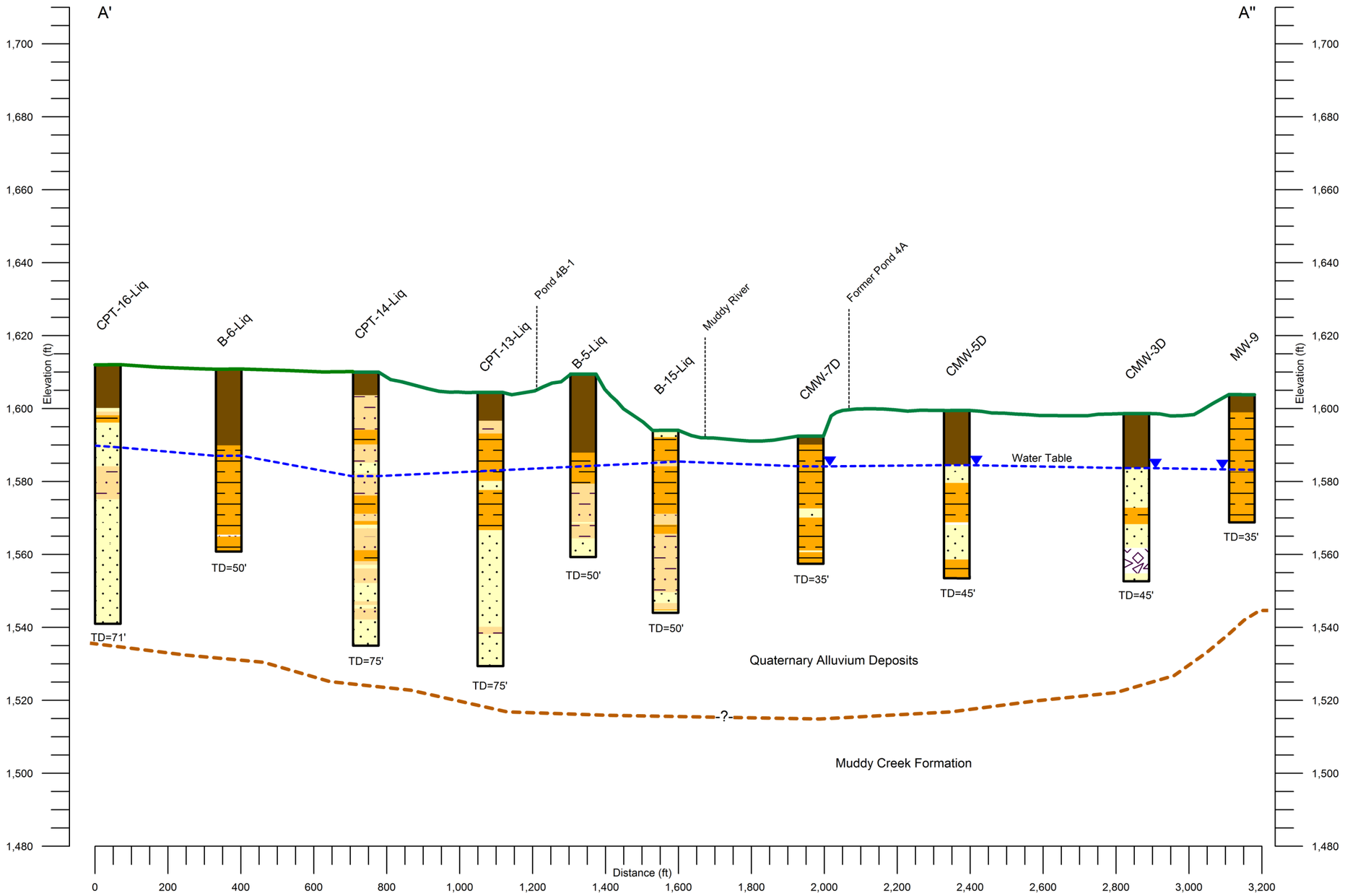
REV	No.	DATE	DRWN	CHKD	APVD	REVISION DESCRIPTION
1		5/12/14	CC	JO	RLS	Submittal to NDEP
0		9/23/13	CC	JO	RLS	Submittal to NDEP

NVEnergy

Stanley Consultants

July 2014

CROSS SECTION A-A'
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 4-1



REV	No.	DATE	DRWN	CHKD	APVD	REVISION DESCRIPTION
1		5/12/14	CC	JO	RLS	Submittal to NDEP
0		9/23/13	CC	JO	RLS	Submittal to NDEP

LEGEND

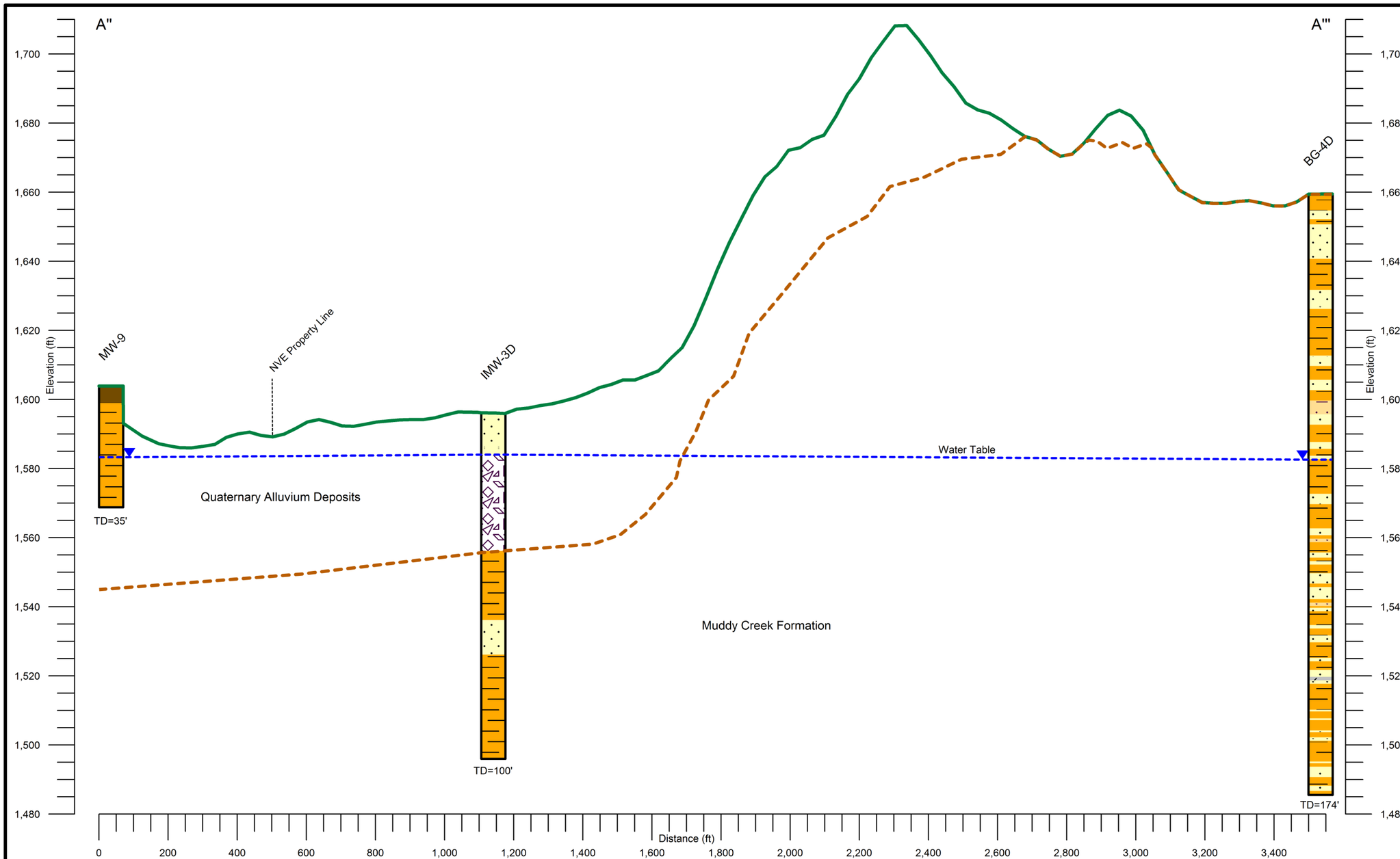
- Fill
- Gravel
- Sand
- Silt
- Clay
- Conglomerate
- Ground Surface
- Estimated Potentiometric Surface
- Estimated Top of Muddy Creek Formation
- Groundwater Elevation (2012 - 3rd Quarter)

NVEnergy

Stanley Consultants

July 2014

CROSS SECTION A'-A"
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 4-2



LEGEND

- Fill
- Gravel
- Sand
- Silt
- Clay
- Conglomerate
- Ground Surface
- Estimated Potentiometric Surface
- Estimated Top of Muddy Creek Formation
- Groundwater Elevation (2012 - 3rd Quarter)

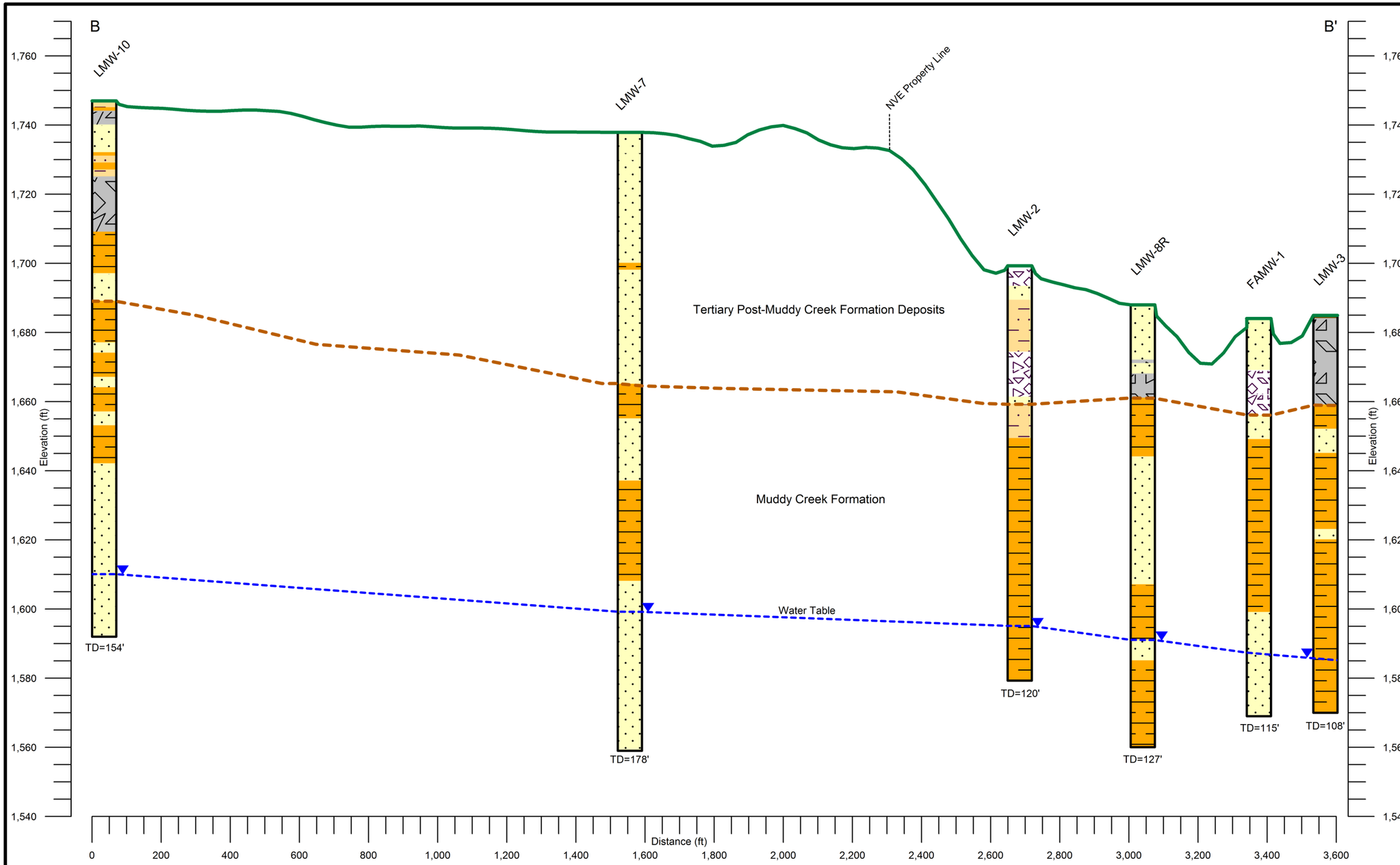
REV	No.	DATE	DRWN	CHKD	APVD	REVISION DESCRIPTION
1		5/12/14	CC	JO	RLS	Submittal to NDEP
0		9/23/13	CC	JO	RLS	Submittal to NDEP

NVEnergy

Stanley Consultants

July 2014

CROSS SECTION A"-A'''
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 4-3



LEGEND

- Fill
- Gravel
- Sand
- Silt
- Clay
- Conglomerate
- Ground Surface
- Estimated Potentiometric Surface
- Estimated Top of Muddy Creek Formation
- Groundwater Elevation (2012 - 3rd Quarter)

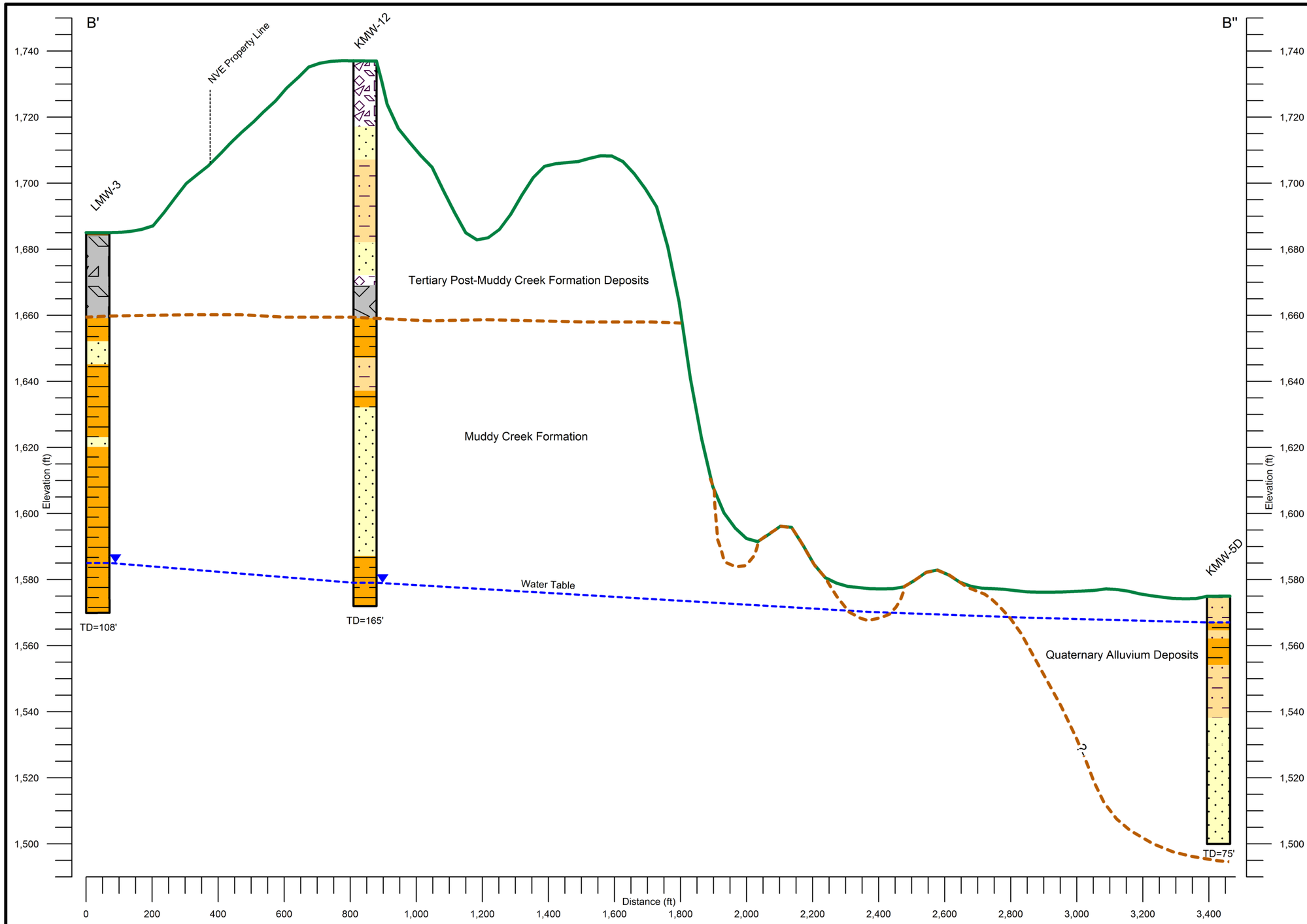
REV	No.	DATE	DRWN	CHKD	APVD	REVISION DESCRIPTION
1		5/12/14	CC	JO	RLS	Submittal to NDEP
0		9/23/13	CC	JO	RLS	Submittal to NDEP

NVEnergy

Stanley Consultants

July 2014

CROSS SECTION B-B'
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 4-4



LEGEND

- Fill
- Gravel
- Sand
- Silt
- Clay
- Conglomerate
- Ground Surface
- Estimated Potentiometric Surface
- Estimated Top of Muddy Creek Formation
- Groundwater Elevation (2012 - 3rd Quarter)

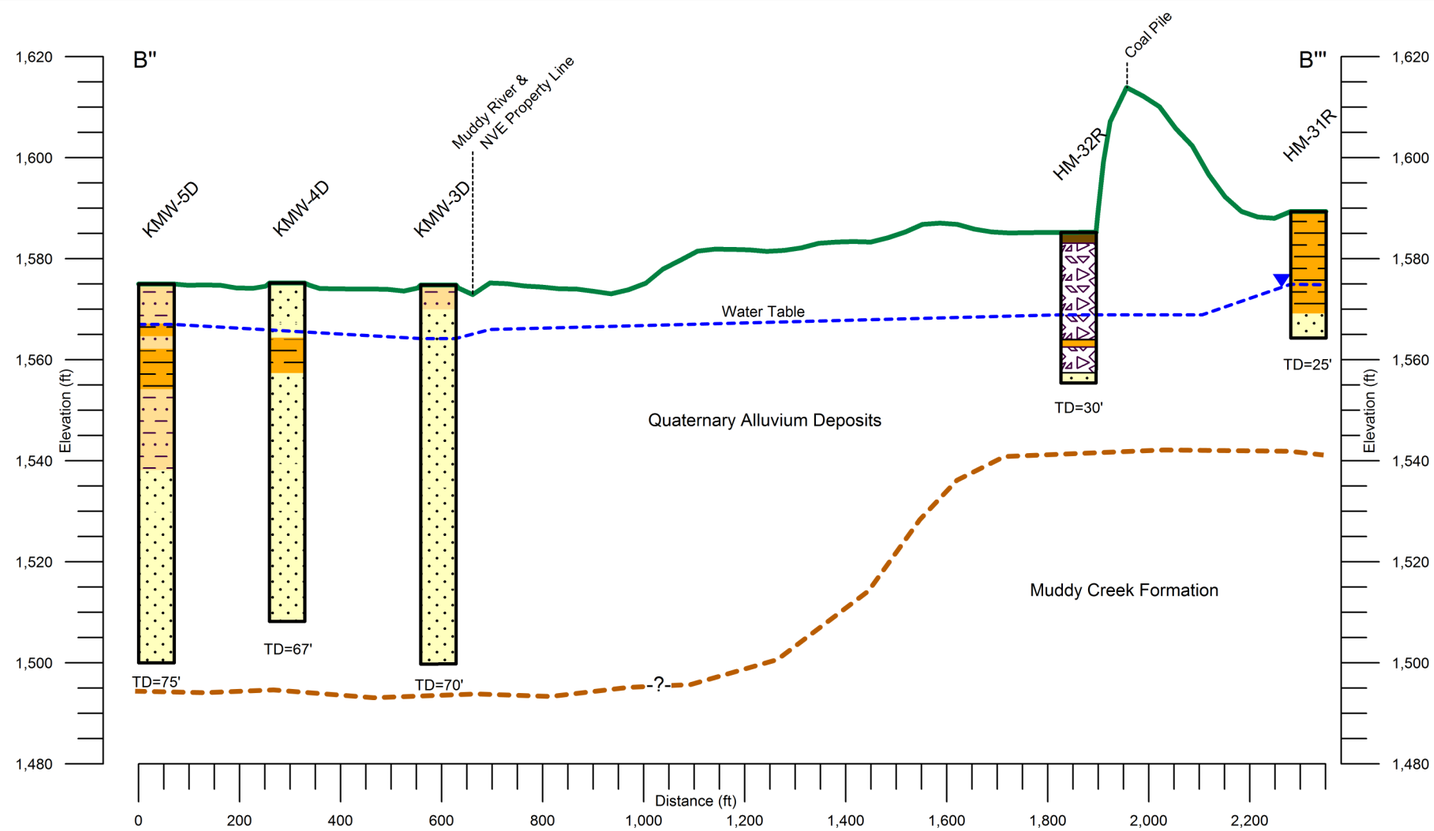
REV	No.	DATE	DRWN	CHKD	APVD	REVISION DESCRIPTION
1		5/12/14	CC	JO	RLS	Submittal to NDEP
0		9/23/13	CC	JO	RLS	Submittal to NDEP

NVEnergy

Stanley Consultants

July 2014

CROSS SECTION B'-B''
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 4-5



REV	No.	DATE	DRWN	CHKD	APVD	REVISION DESCRIPTION
1		5/12/14	CC	JO	RLS	Submittal to NDEP
0		9/23/13	CC	JO	RLS	Submittal to NDEP

LEGEND

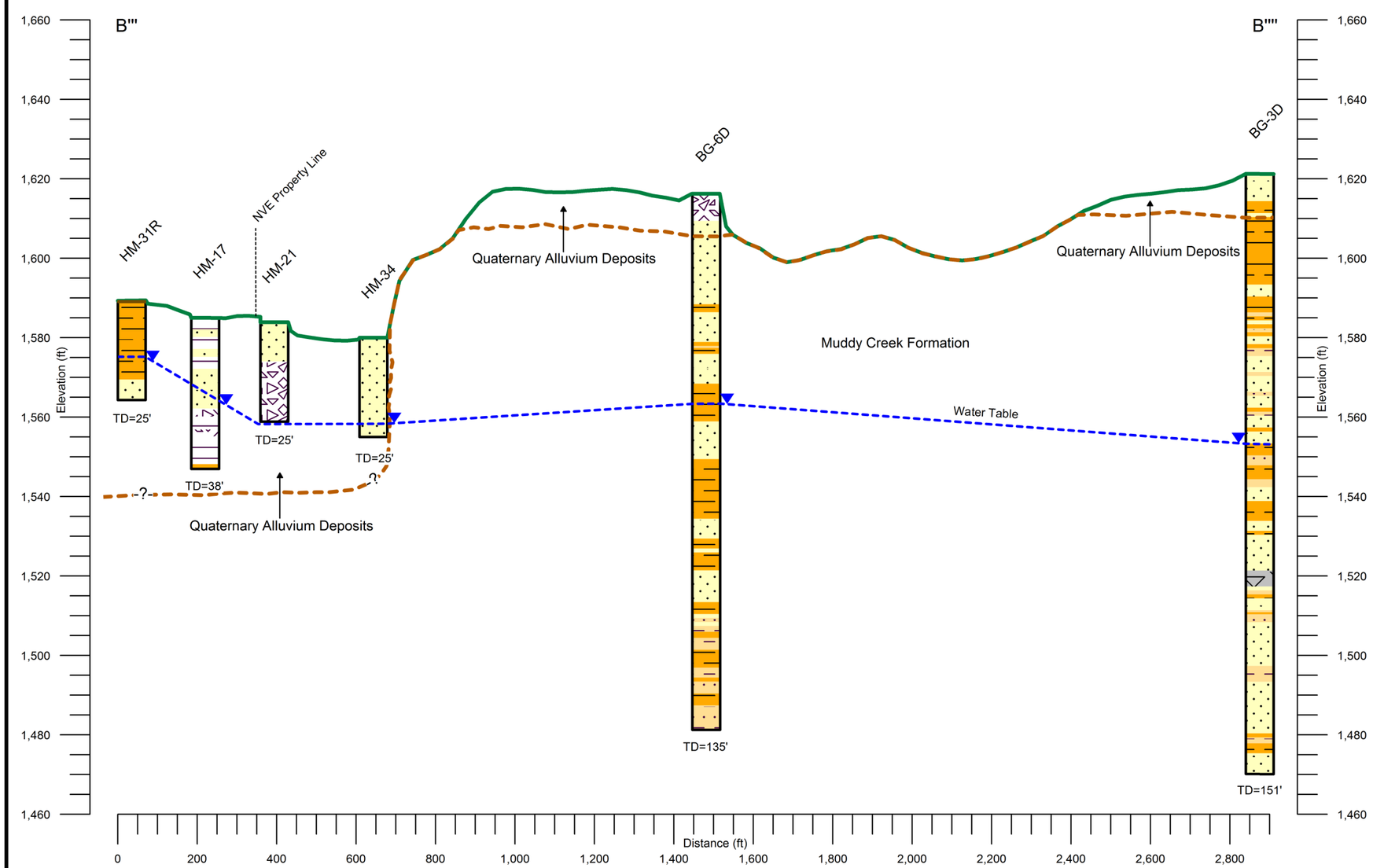
- Fill
- Gravel
- Sand
- Silt
- Clay
- Conglomerate
- Ground Surface
- Estimated Potentiometric Surface
- Estimated Top of Muddy Creek Formation
- Groundwater Elevation (2012 - 3rd Quarter)

NVEnergy

Stanley Consultants

July 2014

CROSS SECTION B"-B'''
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 4-6



REV	No.	DATE	DRWN	CHKD	APVD	REVISION DESCRIPTION
1		5/12/14	CC	JO	RLS	Submittal to NDEP
0		9/23/13	CC	JO	RLS	Submittal to NDEP

LEGEND

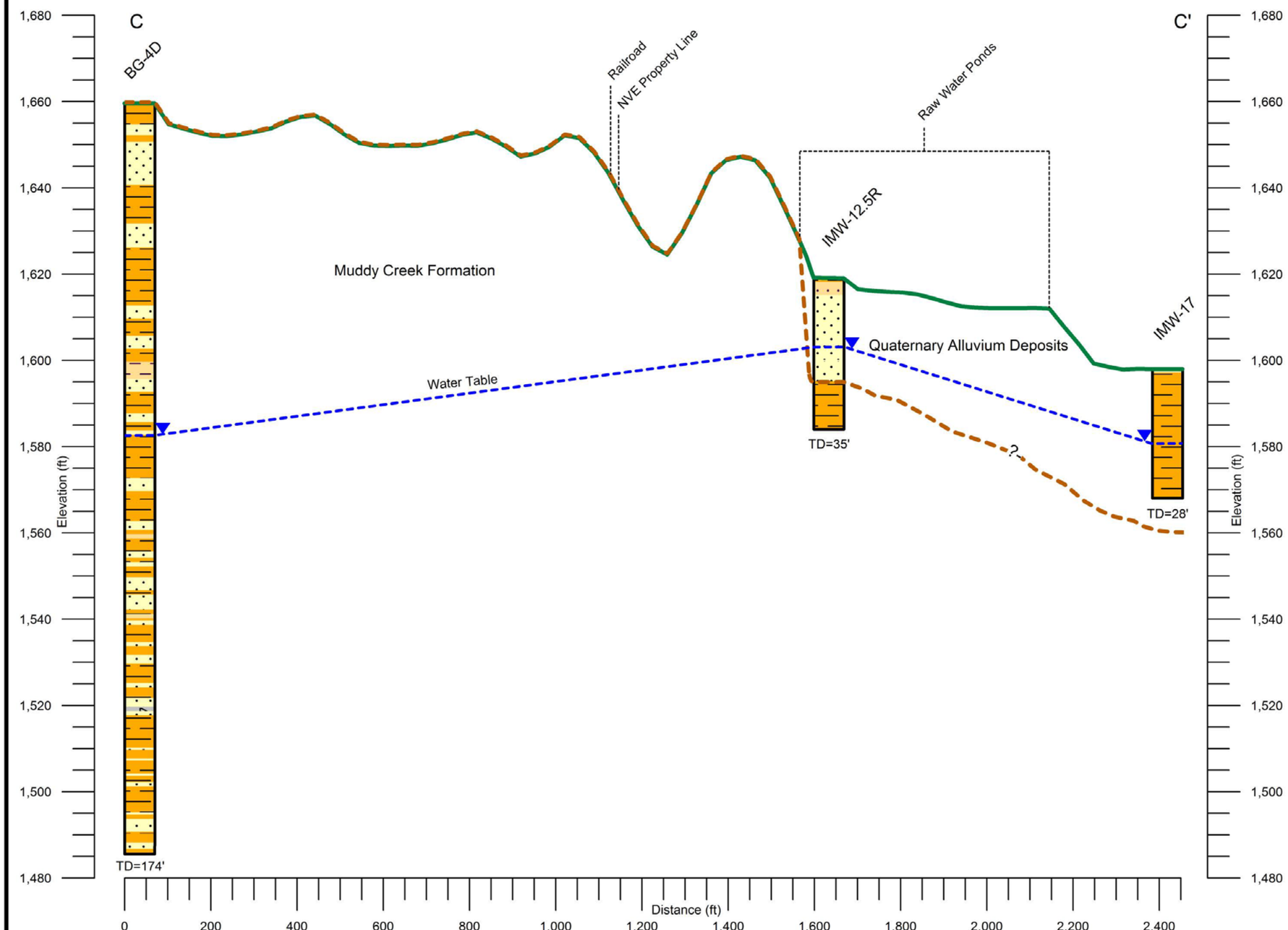
- Fill
- Gravel
- Sand
- Silt
- Clay
- Conglomerate
- Ground Surface
- Estimated Potentiometric Surface
- Estimated Top of Muddy Creek Formation
- Groundwater Elevation (2012 - 3rd Quarter)

NVEnergy

Stanley Consultants

July 2014

CROSS SECTION B'''-B''''
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 4-7



REV	No.	DATE	DRWN	CHKD	APVD	REVISION DESCRIPTION
1		5/12/14	CC	JO	RLS	Submittal to NDEP
0		9/23/13	CC	JO	RLS	Submittal to NDEP

LEGEND

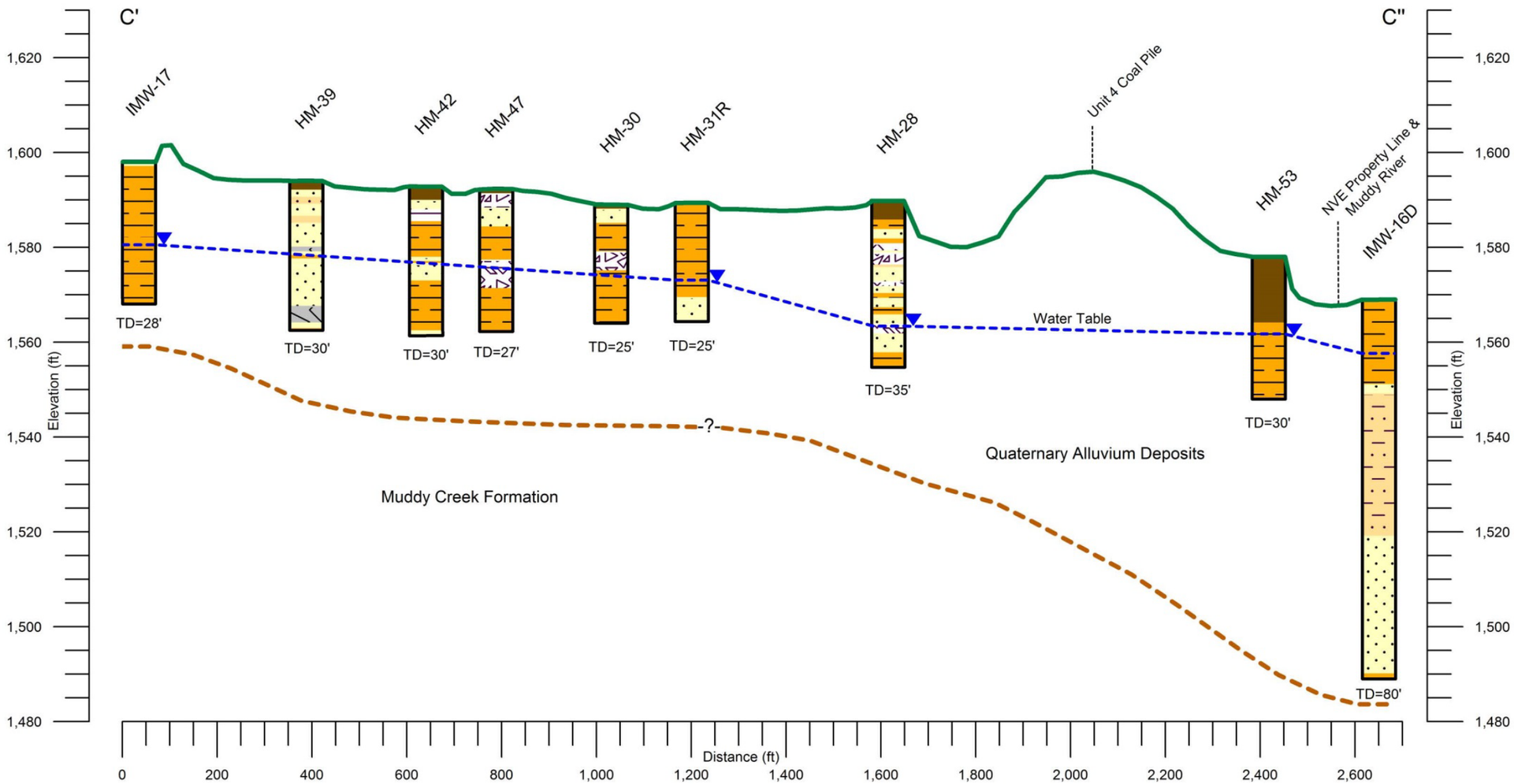
- Fill
- Gravel
- Sand
- Silt
- Clay
- Conglomerate
- Ground Surface
- Estimated Potentiometric Surface
- Estimated Top of Muddy Creek Formation
- Groundwater Elevation (2012 - 3rd Quarter)

NVEnergy

Stanley Consultants

July 2014

CROSS SECTION C-C'
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 4-8



REV	No.	DATE	DRWN	CHKD	APVD	REVISION DESCRIPTION
1		5/12/14	CC	JO	RLS	Submittal to NDEP
0		9/23/13	CC	JO	RLS	Submittal to NDEP

LEGEND

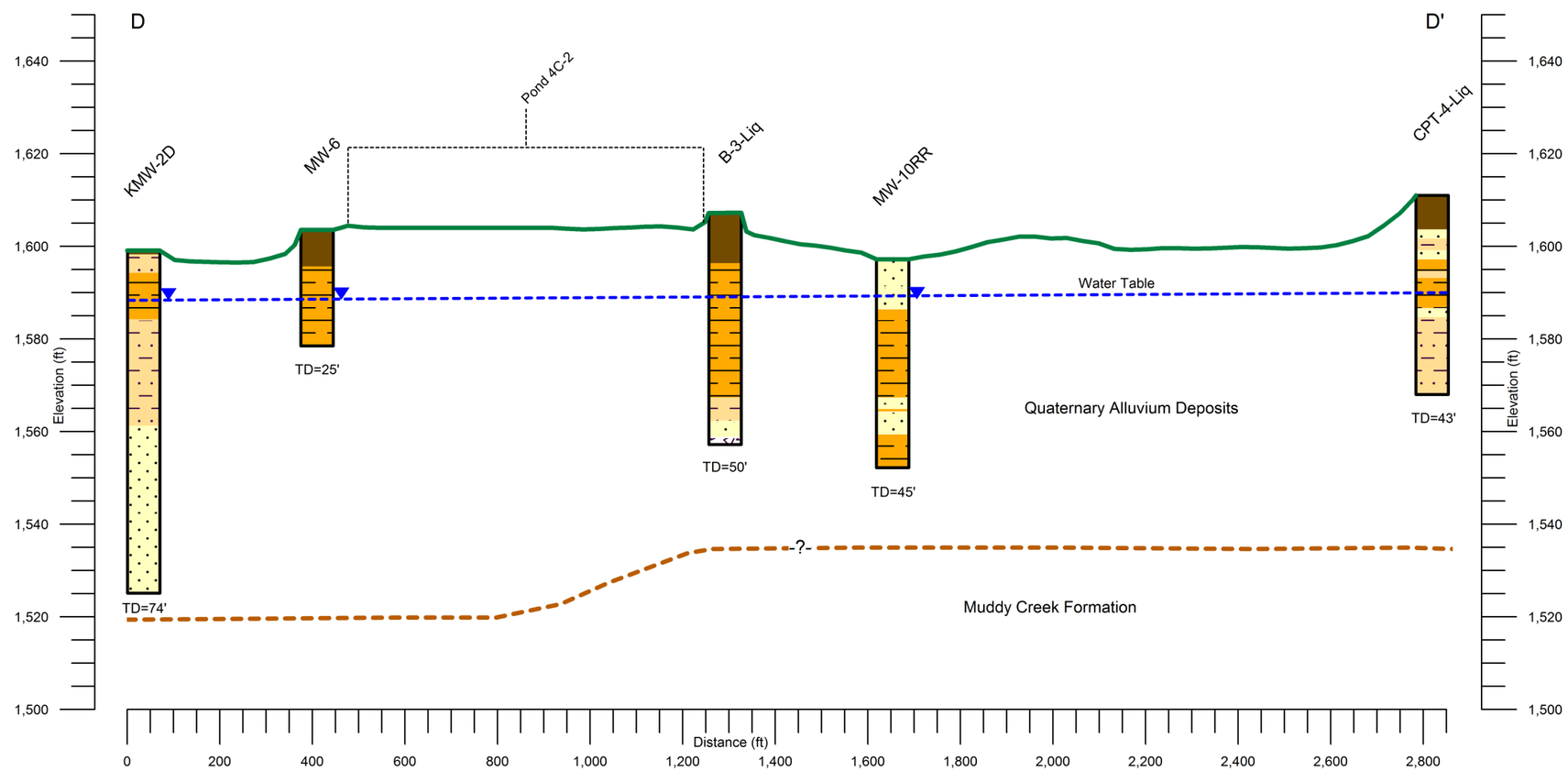
- Fill
- Gravel
- Sand
- Silt
- Clay
- Conglomerate
- Ground Surface
- Estimated Potentiometric Surface
- Estimated Top of Muddy Creek Formation
- Groundwater Elevation (2012 - 3rd Quarter)

NVEnergy

Stanley Consultants

July 2014

CROSS SECTION C'-C''
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 4-9



REV	No.	DATE	DRWN	CHKD	APVD	REVISION DESCRIPTION
1		5/12/14	CC	JO	RLS	Submittal to NDEP
0		9/23/13	CC	JO	RLS	Submittal to NDEP

LEGEND

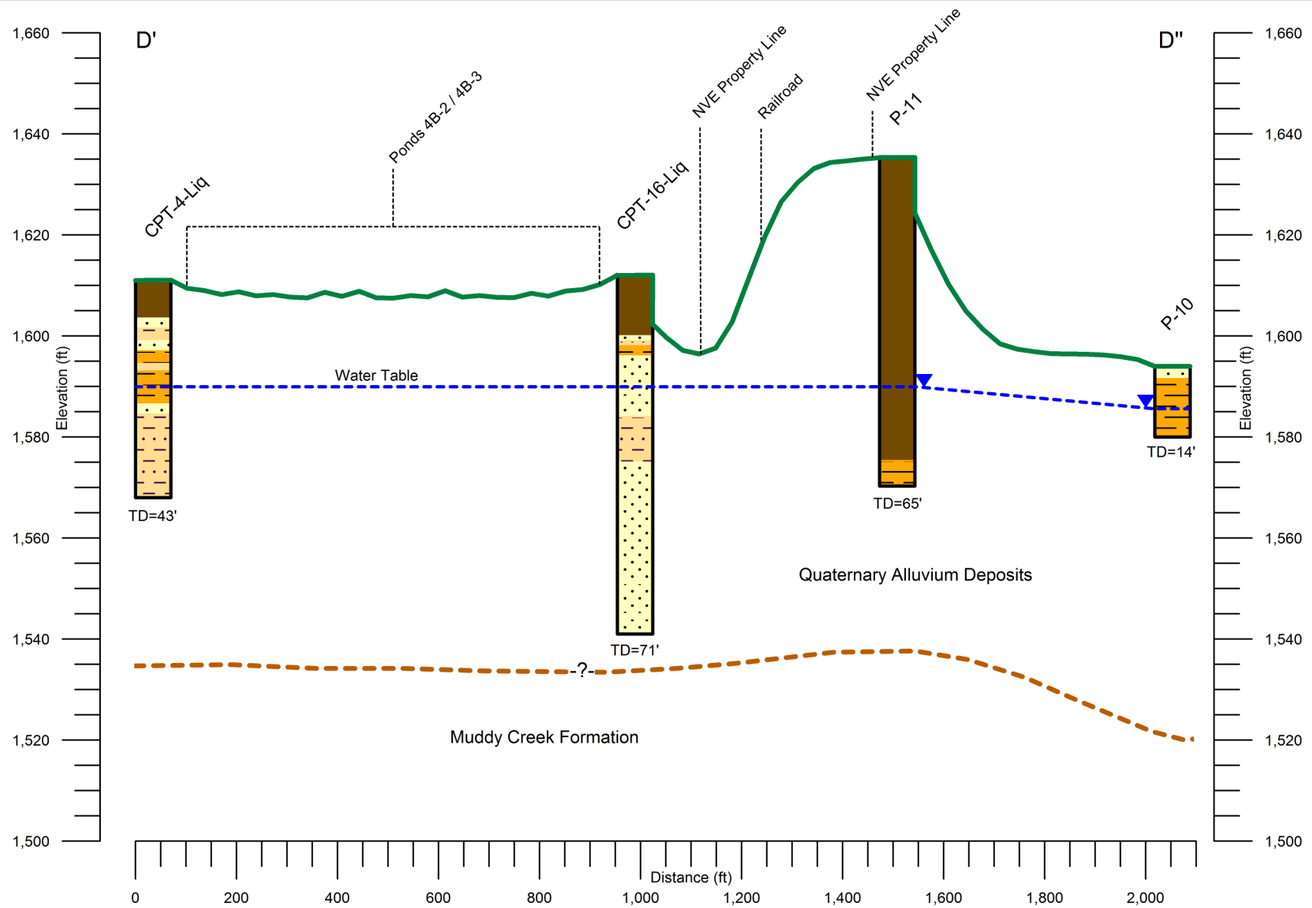
- Fill
- Gravel
- Sand
- Silt
- Clay
- Conglomerate
- Ground Surface
- Estimated Potentiometric Surface
- Estimated Top of Muddy Creek Formation
- Groundwater Elevation (2012 - 3rd Quarter)

NVEnergy

Stanley Consultants

July 2014

CROSS SECTION D-D'
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 4-10



REV	No.	DATE	DRWN	CHKD	APVD	REVISION DESCRIPTION
1		5/12/14	CC	JO	RLS	Submittal to NDEP
0		9/23/13	CC	JO	RLS	Submittal to NDEP

LEGEND

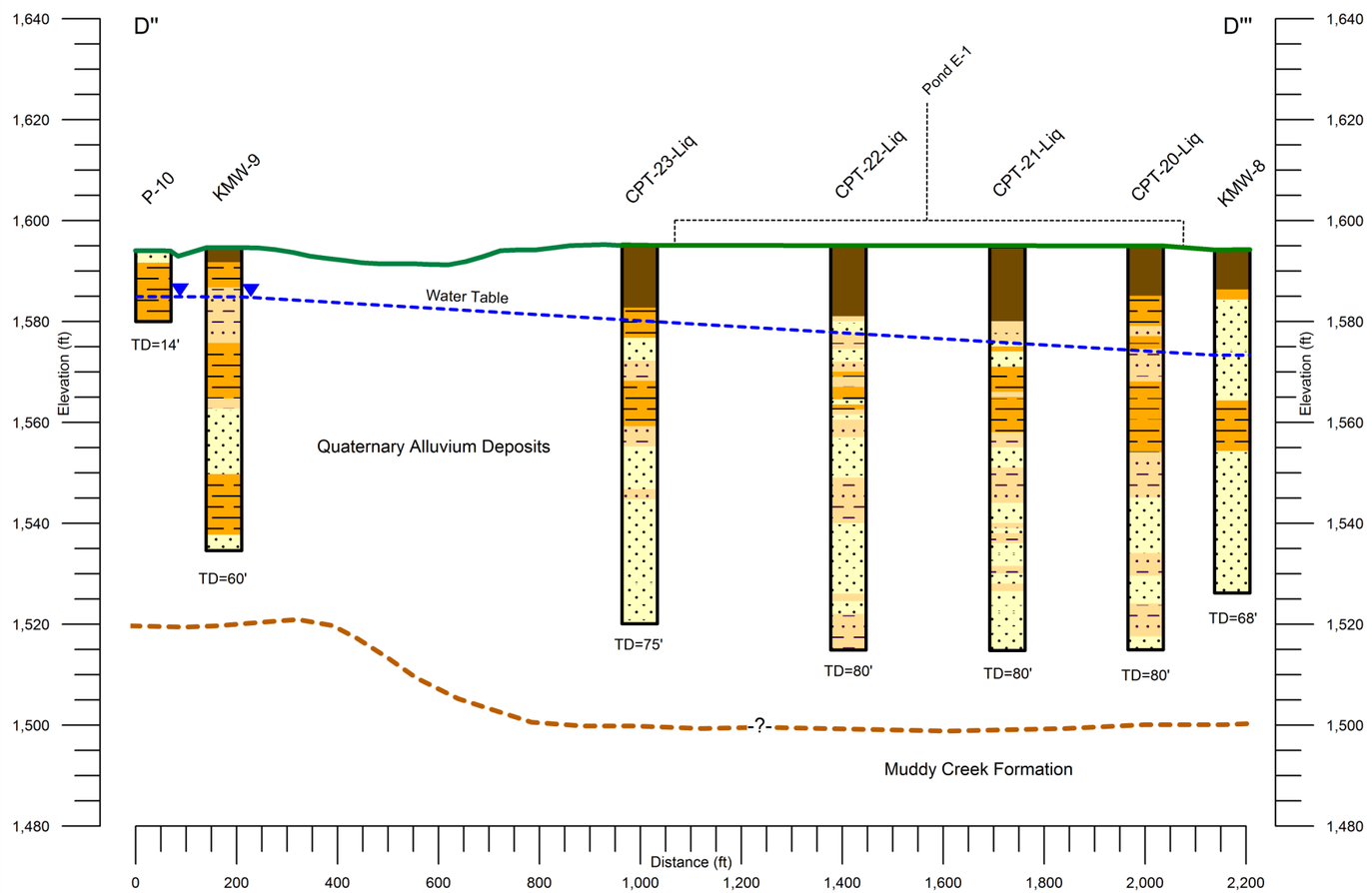
- Fill
- Gravel
- Sand
- Silt
- Clay
- Conglomerate
- Ground Surface
- Estimated Potentiometric Surface
- Estimated Top of Muddy Creek Formation
- Groundwater Elevation (2012 - 3rd Quarter)

NVEnergy

Stanley Consultants

July 2014

CROSS SECTION D'-D"
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 4-11



REV	No.	DATE	DRWN	CHKD	APVD	REVISION DESCRIPTION
1		5/12/14	CC	JO	RLS	Submittal to NDEP
0		9/23/13	CC	JO	RLS	Submittal to NDEP

LEGEND

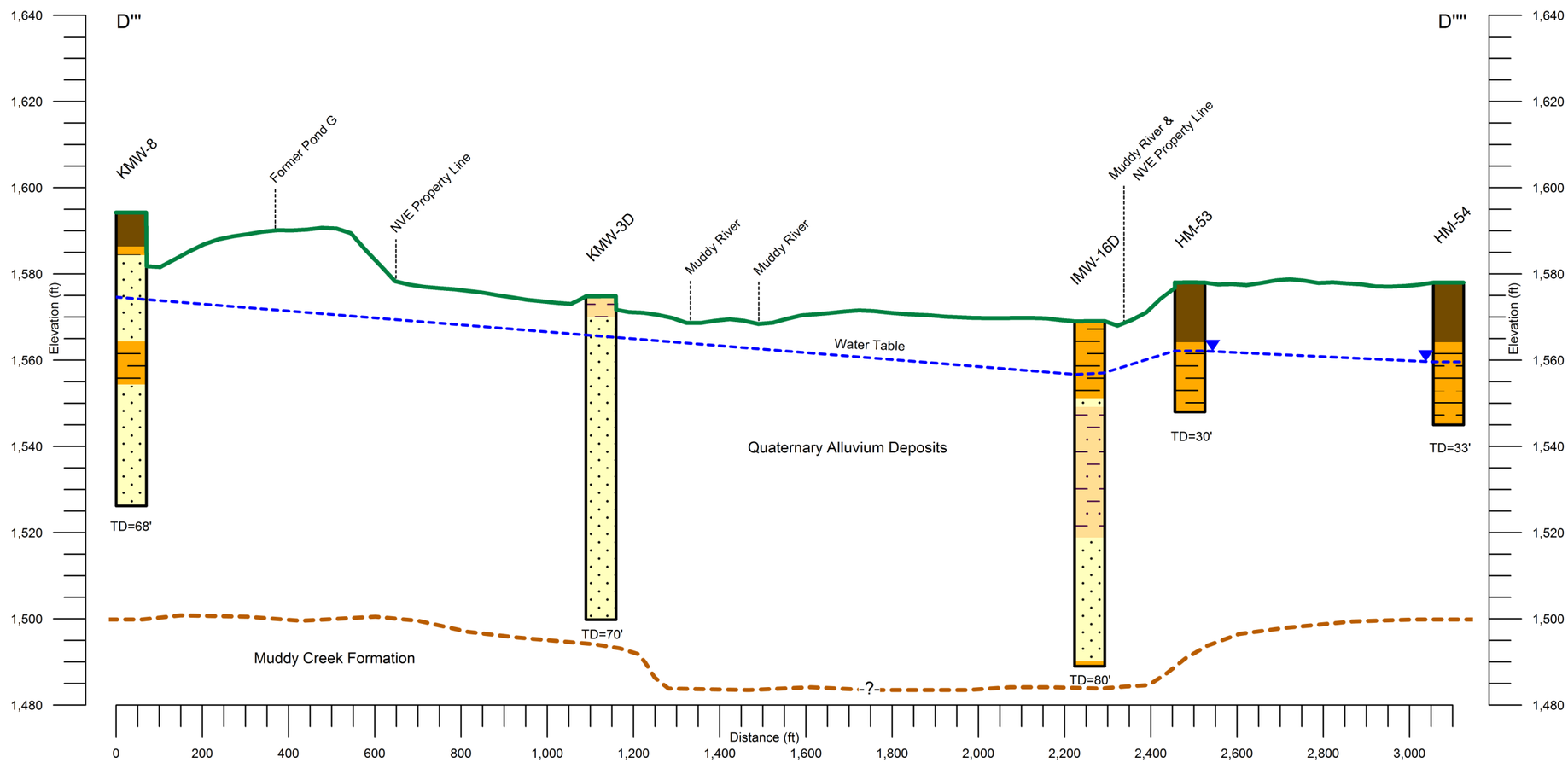
- Fill
- Gravel
- Sand
- Silt
- Clay
- Conglomerate
- Ground Surface
- Estimated Potentiometric Surface
- Estimated Top of Muddy Creek Formation
- Groundwater Elevation (2012 - 3rd Quarter)

NVEnergy

Stanley Consultants

July 2014

CROSS SECTION D"-D'''
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 4-12



REV	No.	DATE	DRWN	CHKD	APVD	REVISION DESCRIPTION
1		5/12/14	CC	JO	RLS	Submittal to NDEP
0		9/23/13	CC	JO	RLS	Submittal to NDEP

LEGEND

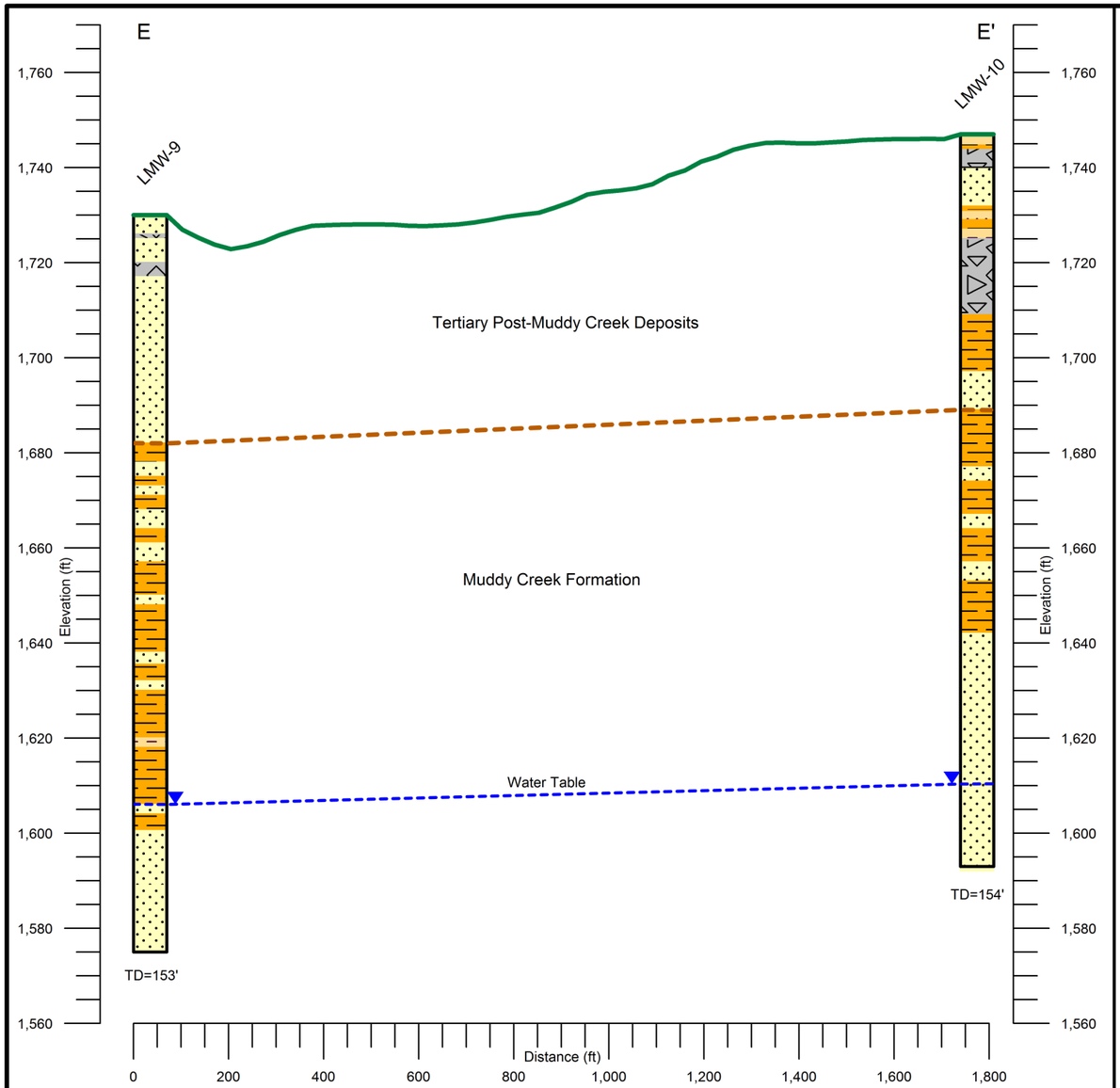
- Fill
- Gravel
- Sand
- Silt
- Clay
- Conglomerate
- Ground Surface
- Estimated Potentiometric Surface
- Estimated Top of Muddy Creek Formation
- Groundwater Elevation (2012 - 3rd Quarter)

NVEnergy

Stanley Consultants

July 2014

CROSS SECTION D'''-D''''
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 4-13



REV	No.	DATE	DRWN	CHKD	APVD	REVISION DESCRIPTION
1		5/12/14	CC	JO	RLS	Submittal to NDEP
0		9/23/13	CC	JO	RLS	Submittal to NDEP

LEGEND

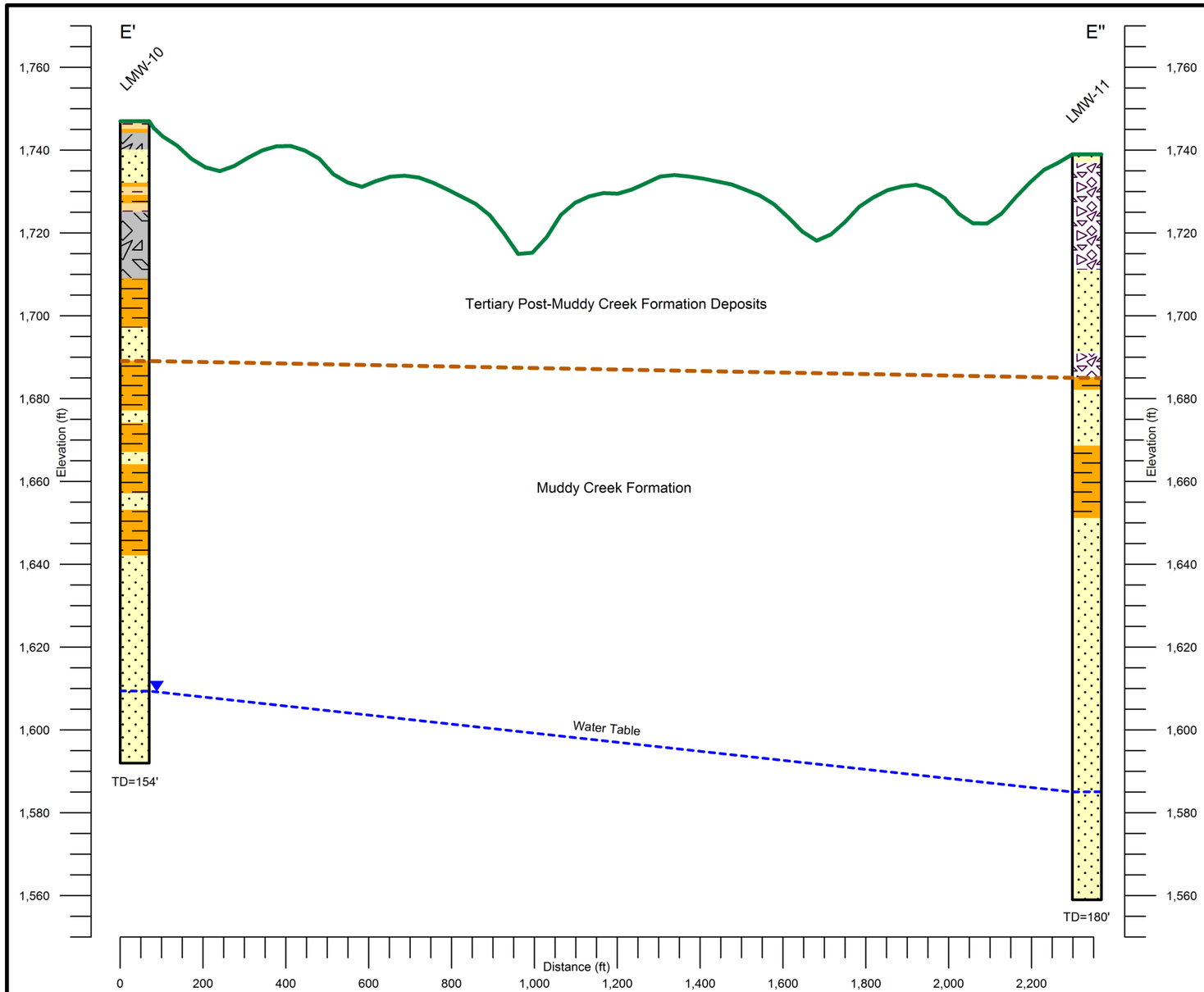
- Fill
- Gravel
- Sand
- Silt
- Clay
- Conglomerate
- Ground Surface
- Estimated Potentiometric Surface
- Estimated Top of Muddy Creek Formation
- Groundwater Elevation (2012 - 3rd Quarter)

NVEnergy

Stanley Consultants

July 2014

CROSS SECTION E-E'
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 4-14



REV	No.	DATE	DRWN	CHKD	APVD	REVISION DESCRIPTION
1		5/12/14	CC	JO	RLS	Submittal to NDEP
0		9/23/13	CC	JO	RLS	Submittal to NDEP

LEGEND

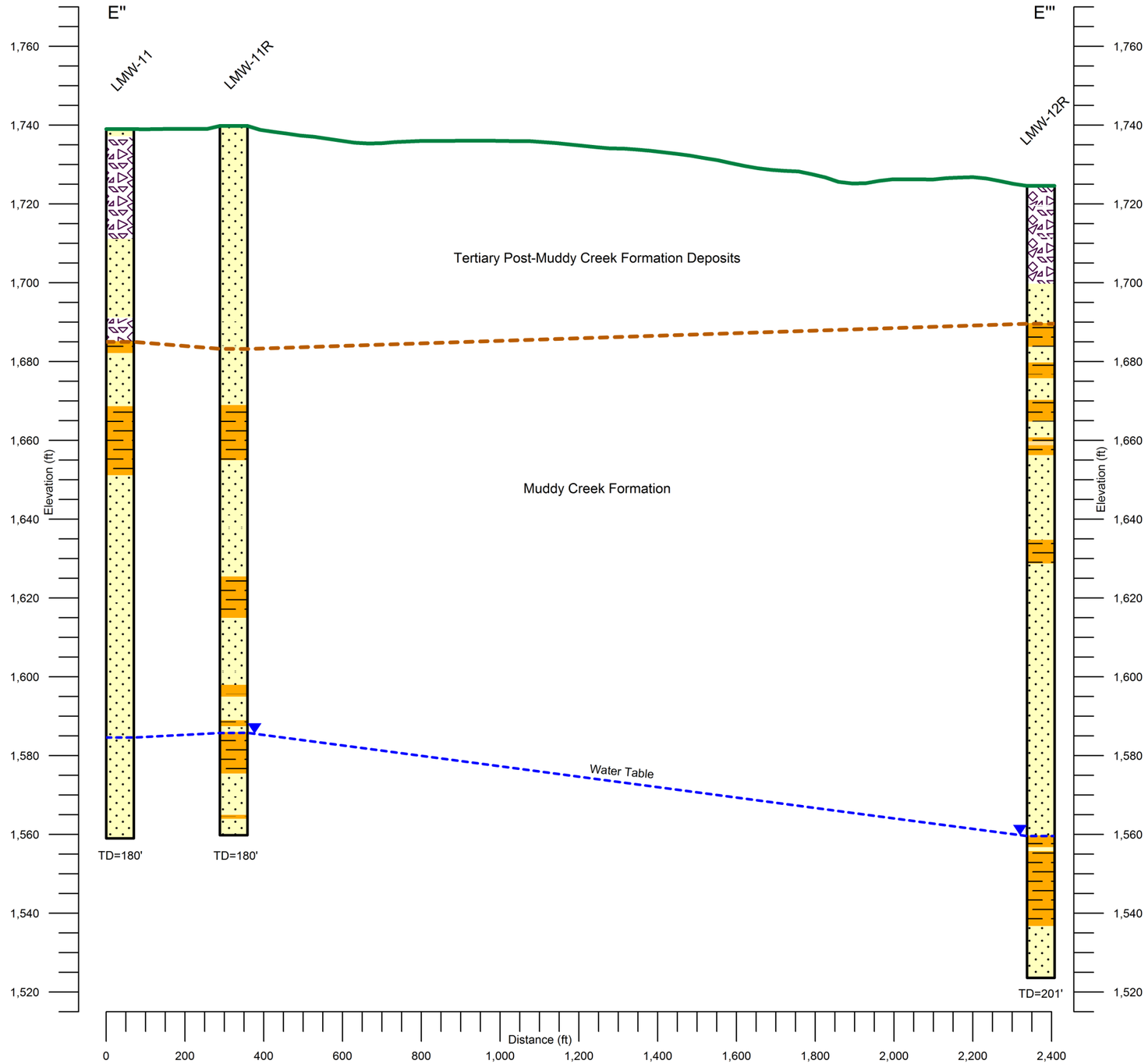
- Fill
- Gravel
- Sand
- Silt
- Clay
- Conglomerate
- Ground Surface
- Estimated Potentiometric Surface
- Estimated Top of Muddy Creek Formation
- Groundwater Elevation (2012 - 3rd Quarter)

NVEnergy

Stanley Consultants

July 2014

CROSS SECTION E'-E"
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 4-15



LEGEND

- Fill
- Gravel
- Sand
- Silt
- Clay
- Conglomerate
- Ground Surface
- Estimated Potentiometric Surface
- Estimated Top of Muddy Creek Formation
- Groundwater Elevation (2012 - 3rd Quarter)

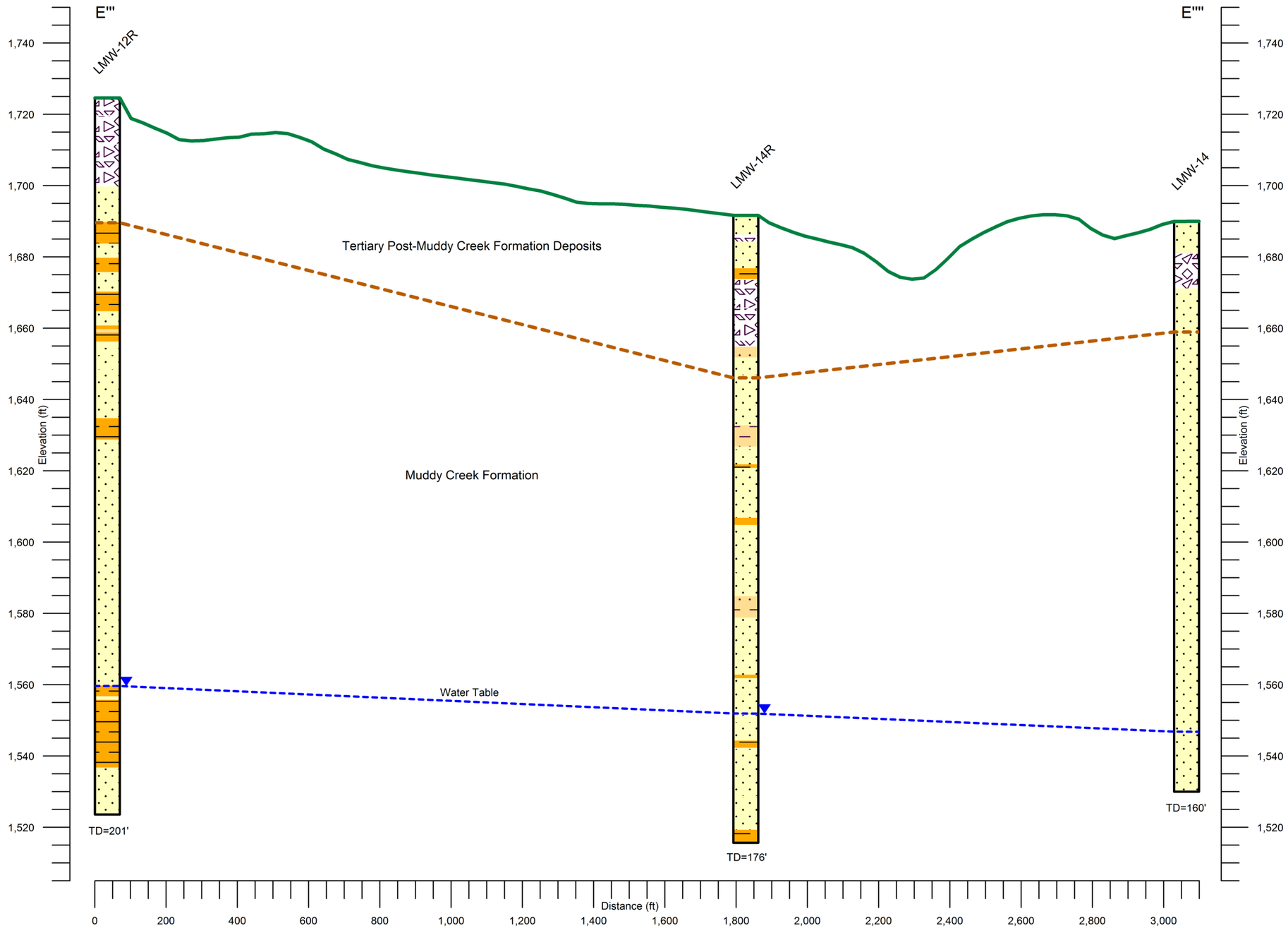
REV	No.	DATE	DRWN	CHKD	APVD	REVISION DESCRIPTION
1		5/12/14	CC	JO	RLS	Submittal to NDEP
0		9/23/13	CC	JO	RLS	Submittal to NDEP

NVEnergy

Stanley Consultants

July 2014

CROSS SECTION E"-E'''
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 4-16



LEGEND

- Fill
- Gravel
- Sand
- Silt
- Clay
- Conglomerate
- Ground Surface
- Estimated Potentiometric Surface
- Estimated Top of Muddy Creek Formation
- Groundwater Elevation (2012 - 3rd Quarter)

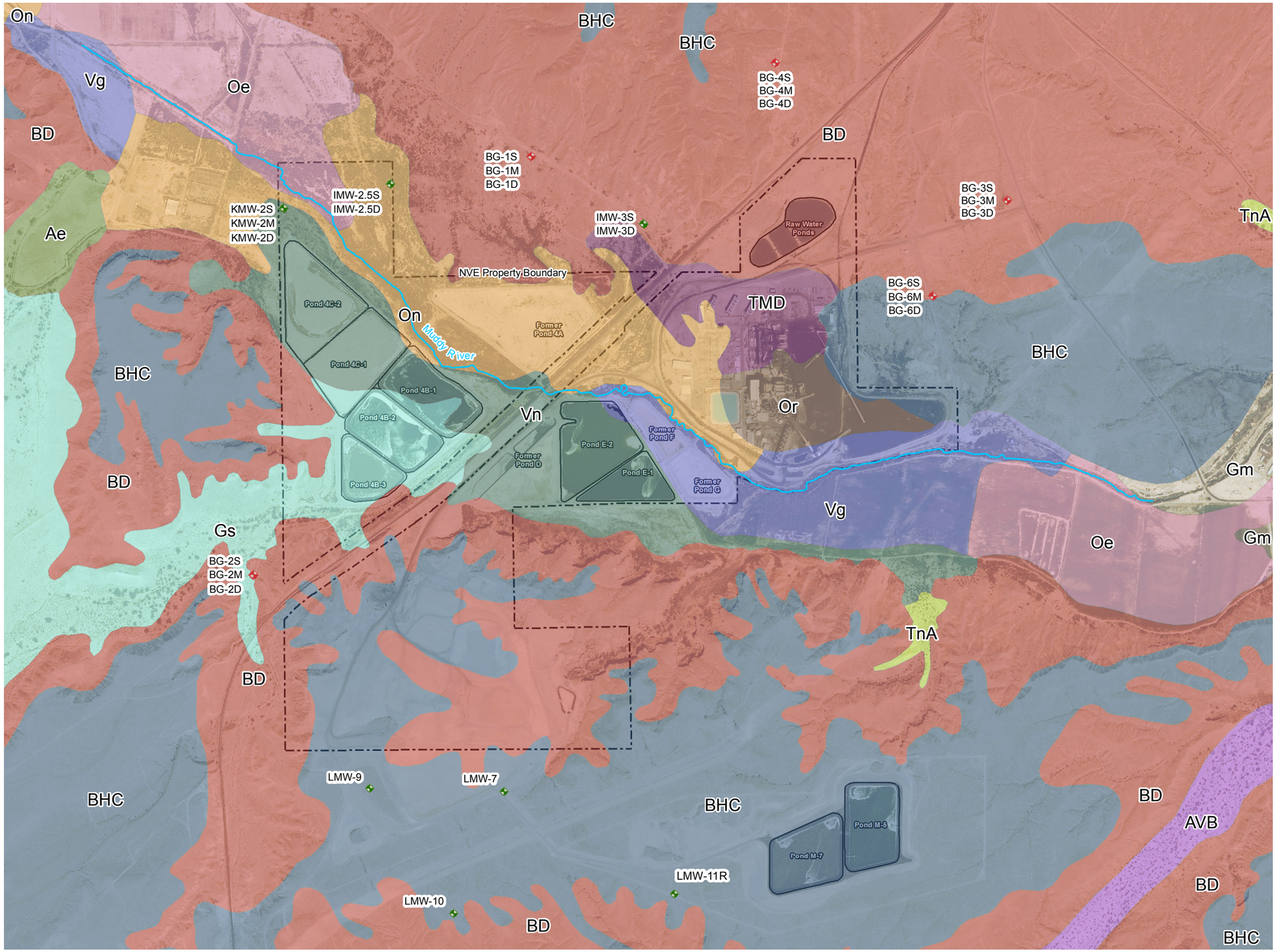
REV	No.	DATE	DRWN	CHKD	APVD	REVISION DESCRIPTION
1		5/12/14	CC	JO	RLS	Submittal to NDEP
0		9/23/13	CC	JO	RLS	Submittal to NDEP

NVEnergy

Stanley Consultants

July 2014

CROSS SECTION E'''-E''''
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 4-17



Legend

Background Sampling Location

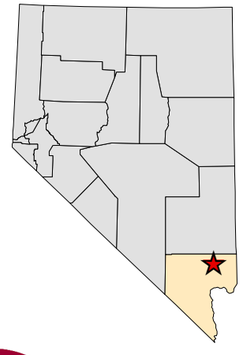
- Groundwater Sampling Location
- Soil and Groundwater Sampling Location
- Property Boundary
- Muddy River
- Pond Outline

Topsoils

- AVB, Arizo gravelly fine sand, 2 to 4 % slopes
- Ae, Anthony fine sandy loam
- BD, Badland
- BHC, Bard gravelly fine sandy loam, 2 to 8% slopes
- Gm, Gila loam, strongly saline
- Gs, Glendale loam, strongly saline
- Oe, Overton silty clay, slightly saline
- On, Overton silty clay, strongly saline
- Or, Overton clay, overwash, saline
- TMD, Tonapah very gravelly sand loam, 4 to 15 % slopes
- TnA, Toquop fine sand, 0 to 2 % slopes
- Vg, Virgin River silty clay
- Vn, Virgin River silty clay, strongly saline

1,200 600 0 1,200 2,400 Feet

Notes:
1. Aerial imagery provided by USDA-FSA Aerial Photography Field Office; published 11/15/2013; photographs taken Spring 2013
2. Topsoils obtained from the USDA



Stanley Consultants INC.

July 2014

REV	No.	REVISION DESCRIPTION	DATE	DRWN	CHKD	APVD
1		Submittal to NDEP	5/12/14	JO/CC	AE	RLS
0		Submittal to NDEP	9/23/13	JO/CC	AE	RLS

0 1 in.
At full size
1 inch = 1,200 feet

NVEnergy

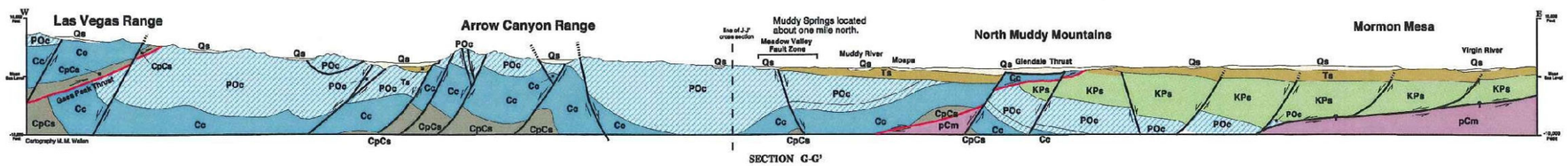
20618.09.22

REV. 1

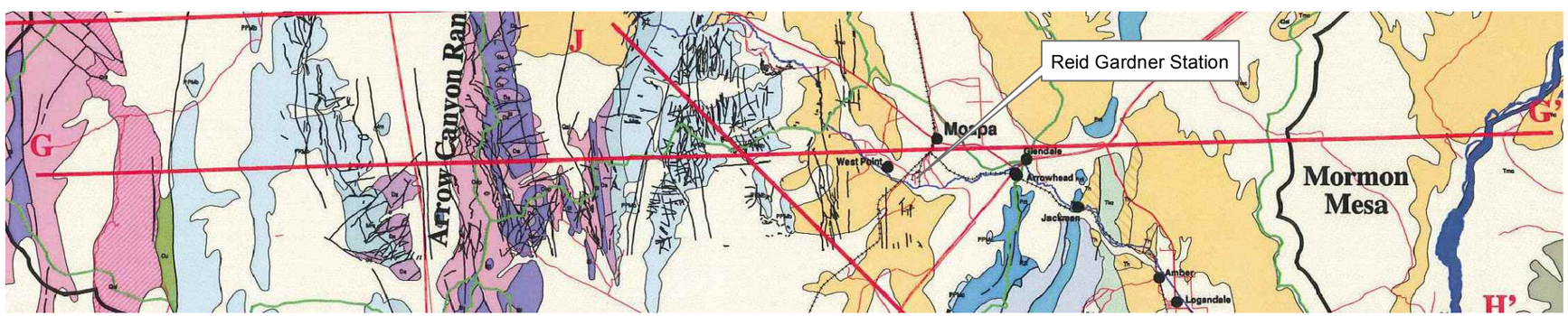
SURFACE SOIL TYPES
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 5

\\lcy1s1\Projects_F\20618_03_NVE_RGS_AOC_Imp\09\Active\14-GIS\GIS\WorkingData\Mxd\Background\debc_report\Fig5_SoilMap.mxd © STANLEY CONSULTANTS

Cross-Section G-G'



Cross-Section Location



Legend

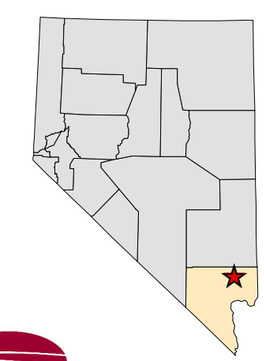
Cross Section Geologic Unit Abbreviations and Defintions

- Qs - Alluvium
- Ts - Muddy Creek Formation
- KPs - Cretaceous through Permian clastic rocks
- POc - Permian through ordovician carbonate rocks
- Cc - Cambrian carbonate rocks
- CpCs - Cambrian and pre-Cambrian siliciclastic rocks
- pCm - pre-Cambrian igneous and metamorphic rocks

Fault and Contact Types

- Normal Fault
- Thrust Fault
- Contact

Notes:
1. Cross-Section Schematic from WATER RESOURCES AND GROUND-WATER MODELING IN THE WHITE RIVER AND MEADOW VALLEY FLOW SYSTEMS: Clark, Lincoln, Nye,and White Pine Counties, Nevada. By Las Vegas Valley Water District, June 2001



Stanley Consultants INC.

July 2014

SCHEMATIC REGIONAL GEOLOGIC CROSS-SECTION
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 6

REV	No.	REVISION DESCRIPTION	DATE	DRWN	CHKD	APVD
1		Submittal to NDEP	5/12/14	JO	AE	RLS
0		Submittal to NDEP	9/23/13	JO	AE	RLS

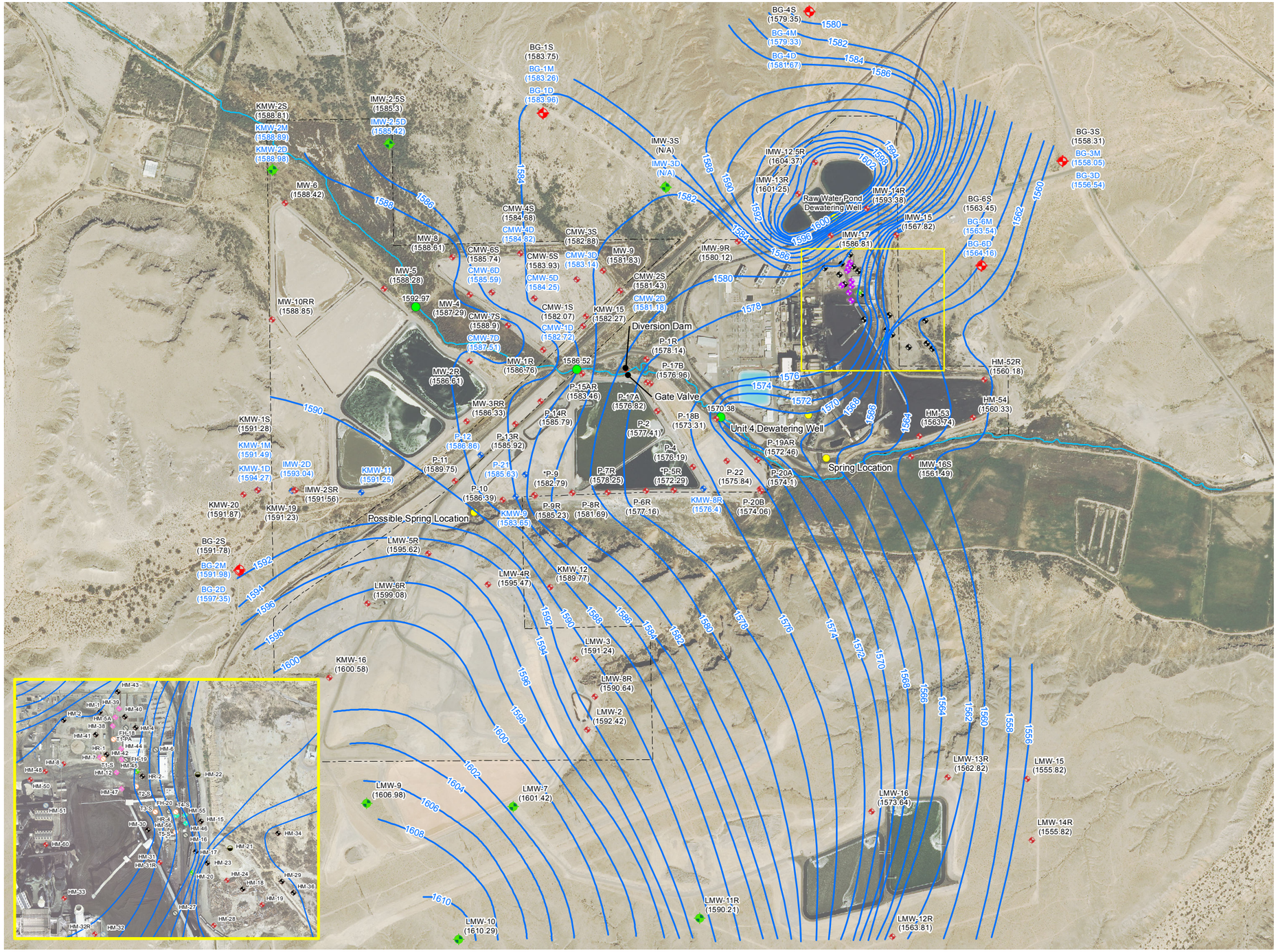
NOT TO SCALE

NVEnergy

20618.09.22

REV. 1

\\lcy-fs1\Projects_F\20618_03_NVE_RGS_AOC_Imp09\Active\14-GIS\GIS\WorkingData\Mxd\Backgroundfieldc_report\Fig6_SchematicCrossSection.mxd © STANLEY CONSULTANTS



Legend

- Property Boundary
- Muddy River

Background Sampling Location

- Groundwater Sampling Location
- Soil and Groundwater Sampling Location

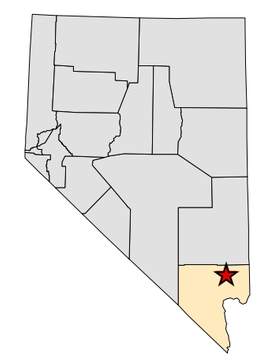
Monitoring Wells

- Deep or Medium
- Shallow
- Passive Recovery
- Vapor Extraction
- Free Product
- Dewatering Locations / Water Sources
- Surface Water Elevation
- Groundwater Elevation Contour (ft)

1,100 550 0 1,100 2,200 Feet

Notes:

1. Main map aerial imagery provided by USDA-FSA Aerial Photography Field Office; published 11/15/2013; photographs taken Spring 2013
2. Inset map aerial imagery provided by USDA-FSA Aerial Photography Field Office; published 2/22/2011; photographs taken late Spring 2010
3. Elevations obtained from NVE 2012-Q3 Groundwater Monitoring Report; only wells gauged that quarter are shown in figure
4. Shallow, medium, and deep well classifications are subject to change
5. Elevations at deep and medium wells are not contoured
6. *P-9, P-5R data not considered for contouring



Stanley Consultants INC.

July 2014

SHALLOW GROUNDWATER ELEVATION CONTOUR MAP
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 7

REV	No.	REVISION DESCRIPTION	DATE	DRWN	CHKD	APVD
1		Submittal to NDEP	5/12/14	CC	JO	RLS
0		Submittal to NDEP	9/23/13	CC	JO	RLS

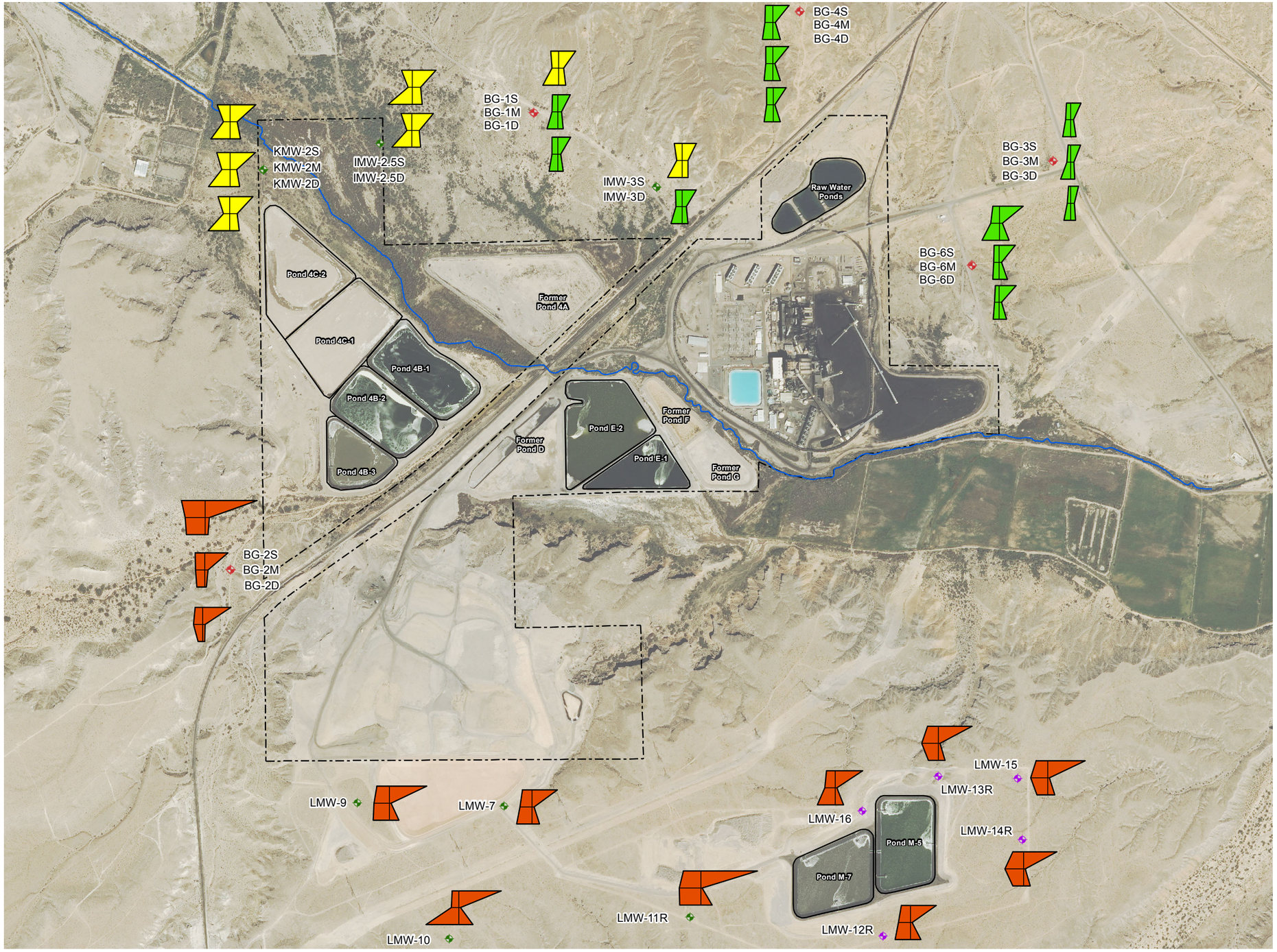
0 1 in.
At full size
1 inch = 1,100 feet

NVEnergy

20618.09.22

REV. 1

\\cy-fs1\Projects_F\20618_03_NVE_RGS_AOC_Imp\09\Active\14-GIS\GIS\WorkingData\mxd\Backgroundfetc. report\Fig7_GWElevation.mxd © STANLEY CONSULTANTS



Legend

Background Sampling Location

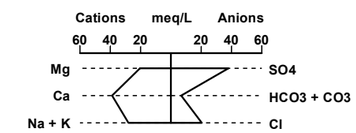
- Groundwater Sampling Location
- Soil and Groundwater Sampling Location
- Mesa Pond Sampling Location

Stiff Diagram Color

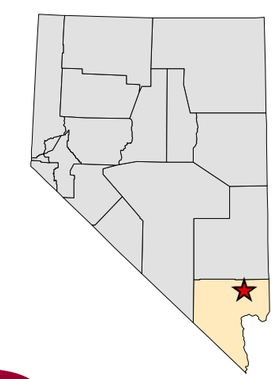
- Alluvial Group
- Muddy Creek - Mesa Group
- Muddy Creek - North Group
- Muddy River
- Pond Outline
- Property Boundary

1,100 550 0 1,100 2,200 Feet

Stiff Diagram Key



Notes:
1. Aerial imagery provided by USDA-FSA Aerial Photography
   Field Office; published 11/15/2013; photographs taken Spring 2013
   Field Office; published 2/22/2011; photographs taken late Spring 2010
2. Well clusters consist of three wells (S,M,D)
3. Data from 2nd Quarter 2012
4. Bicarbonate and carbonate was not analyzed at LMW-12R, LMW-13R, LMW-14R, LMW-15, and LMW-16



Stanley Consultants INC.

July 2014

REV	No.	REVISION DESCRIPTION	DATE	DRWN	CHKD	APVD
1		Submittal to NDEP	5/19/14	CC	JO/AE	RLS
0		Submittal to NDEP	9/23/13	CC	JO/AE	RLS

0 1 in.
At full size
1 inch = 1,100 feet

NVEnergy

20618.09.22

REV. 1

STIFF DIAGRAMS
Background Conditions Report
AOC Implementation
NV Energy
Reid Gardner Station
Moapa, NV
Figure 8

\\lcv-fs1\Projects_F\20618_03_NVE_RGS_AOC_Imp09\Active\14-GIS\GIS\WorkingData\Mxd\Background\ebc_report\Fig8_StiffDiagrams.mxd © STANLEY CONSULTANTS

Appendix B

Photographs

Photo 1: 12/20/11, BG-2, ROW Access marked, cactus and mesquite trees flagged by SWCA Environmental Consultants, facing west.

Photo 2: 12/20/11, BG-2, Access road surveyed and flagged. Eagle Drilling at BG-2D location, facing south.

Photo 3: 12/20/11, Drilling at BG-2D location, facing west.

Photo 4: 12/20/11, Drilling at BG-2D location, facing north.

Photo 5: 12/20/11, Continuous soil cores were collected in plastic liners and placed in wooden boxes for logging the lithology and for long-term storage.

Photo 6: 12/20/11, BG-2D, 0'-10' bgs (bottom box) SP (poorly graded fine-grained sand); 10'-20' bgs (middle box) – SP and SM (silty sand with gravel). BG-2S screen interval 15'-35' bgs.

Photo 7: 12/20/11, BG-2D, 23'-30' bgs - SM (silty sand with gravel) bottom core, and CH (fat clay) top core.

Photo 8: 12/20/11, BG-2D, 23'-30' bgs - SM (silty sand with gravel) and CH (fat clay) interbeds. Top right of photo is base of core at 30' bgs.

Photo 9: 12/20/11, BG-2D, 30'-32' bgs - SM (fine grained silty sand).

Photo 10: 12/20/11, BG-2D, 32'-40'bgs (center box) - CH (greenish gray fat clay) and SM (silty sand) interbeds.

Photo 11: 12/20/11, 2” diameter “California” type split spoon sampler with brass rings utilized for collecting soil samples for geotechnical analysis.

Photo 12: 12/20/11, Geotechnical soil samples sealed, labeled, and stored in metal boxes for delivery to Converse Consultants.

Photo 13: 12/20/11, Soil placed in bags for geotechnical analysis by Converse Consultants.

Photo 14: 12/20/11, BG-2D, 40'-50' bgs – CH (fat clay) and CL (lean clay) interbeds in bottom (40'-43' bgs) and middle (43'-47' bgs) cores; SM (greenish gray silty sand) and CH interbeds in top core (47'-50' bgs). BG-2M screen interval 40'-60' bgs.

Photo 15: 12/20/11, BG-2D, 51.5'-58.5'' – CH (fat clay) with 6 inches of SM (silty sand) at 58' (bottom core right side of photo).

Photo 16: 12/21/11, Drilling at BG-2D, facing west.

Photo 17: 12/21/11, BG-2D 70'-78' bgs, color change from gray to brown at approximately 77' bgs. BG-2D screen interval 78'-93'.

Photo 18: 12/21/11, BG-2D, Approximately 79' bgs – SM (silty sand).

Photo 19: 12/220/11, BG-2D, 80'-82' bgs – SM (silty sand and CH (fat clay).

Photo 20: 12/220/11, BG-2D, approximately 80' bgs – SM (silty sand).

Photo 21: 12/22/11, BG-2D, approximately 81' bgs - CH (fat clay).

Photo 22: 12/22/11, BG-2D, 89' bgs – CH (clay with reddish brown and tan laminations).

Photo 23: 12/23/11, approximately 95' bgs, strongly cemented sandstone clast.

Photo 24: 12/27/11, Augers used for drilling.

Photo 25: 12/27/11, BG-2D Monitoring well installation.

.
Photo 26: 12/28/11, BG-2M, gypsum crystals at approximately 25' bgs.

Photo 27: 12/29/11, Grout truck for monitoring well installation.

Photo 28: 12/30/11, Completed BG-2D, BG-2M, and BG-2S monitoring wells, facing northwest.

Photo 29: 1/3/12, BG-1 drilling location, facing southeast.

Photo 30: 1/3/12, BG-1 drilling location. Mesquite tree flagged, existing trash, facing west.

Photo 31: 1/4/12, BG-1D drilling location, facing south.

Photo 32: 1/4/12, BG-1D 14'-20' bgs-SW (well graded sand with gravel). BG-1S screen interval 18' – 38' bgs.

Photo 33: 1/4/12, BG-1D 20'-25' bgs-GW (well graded gravel) in bottom core and SM (silty sand) with gravel in top core.

Photo 34: 1/4/12, BG-1D 25'-30' bgs-CL (sandy lean clay with gravel), GW-GM (well graded gravel with sand), and SP (poorly graded sand) interbeds.

Photo 35: 1/14/12, BG-1D, approximately 28’ bgs – GW/GM (well graded gravel with sand and silt.

Photo 36: 1/4/12, BG-1D, approximately 30’ bgs – SP (poorly graded sand).

Photo 37: 1/4/12, BG-1M, approximately 30’ bgs – SP (poorly graded sand).

Photo 38: 1/4/12, BG-1D, 40’-46’ bgs – GW (well graded gravel with sand) top core (40’ – 42’) CL (lean clay with gravel) (42’-45’), and SM-CL (silty sand to sandy lean clay) bottom core (45’-46’). Alluvium from 0-42’ bgs, Muddy Creek formation from 42’ bgs to bottom of boring.

Photo 39: 1/5/12, BG-1D, 52'–60' bgs – CL (lean clay with gravel). BG-1M screen interval 52'-67' bgs.

Photo 40: 1/5/12, Drilling at BG-1D, 60'-66' bgs – CL (lean clay) and SM (silty sand) interbeds.

Photo 41: 1/6/12, BG-1D, 82'-87' bgs – CL (lean clay). BG-1D screen interval 85' – 100' bgs.

Photo 42: 1/6/12, BG-1D, approximately 84' bgs – CL (lean clay).

Photo 43: 1/6/12, BG-1D, 87'-90 bgs – CL (lean clay).

Photo 44: 1/9/12, BG-1D, 4" PVC well construction materials.

Photo 45: 1/12/12, BG-1M, Drilling monitoring well BG-1M, loader for soil cuttings, facing northwest.

Photo 46: 1/12/12, BG-1M. Bentonite grout in BG-1M.

Photo 47: 1/13/12, BG-1D, BG-1M, and BG-1S, setting metal protective casings in concrete.

Photo 48: 1/13/12, BG-1D, BG-1M, and BG-1S, completed monitoring wells, facing east.

Photo 49: 1/17/12, BG-4 entrance to ROW road, road surveyed and flagged, facing east.

Photo 50: 1/17/12, BG-4, Dust permit for background monitoring wells, facing northwest from rail line underpass.

Photo 51: 1/17/12, BG-4D, setting up for drilling, cactus and mesquite trees surveyed and flagged, facing south.

Photo 52: 1/17/12, BG-4D, 0-14' bgs – CL (sandy and lean clay) and SP (poorly graded sand) interbeds (bottom box), and SC (clayey sand) top box. Muddy Creek formation from surface to bottom of boring.

Photo 53: 1/18/12, BG-4D, approximately 33' bgs (top box) – SM (silty sand and carbonate); approximately 29' bgs (bottom box) CL (lean clay).

Photo 54: 1/19/12, BG-4D, approximately 69' bgs, CH, fat clay.

Photo 55: 1/19/12, BG-4D, 73'–78' bgs - SP (sand) and CL (lean clay) interbeds. BG-4S screen interval 72' – 97' bgs.

Photo 56: 1/19/12, BG-4D, approximately 75' bgs, CL (lean clay)

Photo 57: 1/19/12, BG-4D, approximately 80' – 82' bgs (top core) – CL (lean clay), and CL/ML (silty clay), groundwater encountered approximately 80'bgs.

Photo 58: 1/19/12, BG-4D, 88'-100'bgs –SP (sand), CH (fat clay), CL/SP/ML (interbeds of sand, silt, and clay), SM (silty sand), and CL-ML (silty clay).

Photo 59: 1/19/12, BG-4D, 88'-92' bgs (bottom box) – SP (sand) bottom core and CH (fat clay) top core; 97'-100' bgs (top box) SM (silty sand) and CL-ML (silty clay).

Photo 60: 1/20/12, BG-4D, 110'-117' bgs – SP (sand) and CL (lean clay) bottom core (113'-114' bgs).

Photo 61: 1/23/12, BG-4D, 117'-122' bgs (top box) - CH (fat clay), ML (sandy silt), CL (lean clay), and SM (silty sand); 122'-127' bgs (bottom box) – CL (lean clay) and SM (silty sand).

Photo 62: 1/23/12, BG-4D, approximately 126' bgs – CL (lean clay) with silt and gypsum

Photo 63: 1/24/12, BG-4D, Drilling location, facing west.

Photo 64: 1/24/12, BG-4D, 155’ – 160’ bgs – SM (silty sand) and CL (lean clay).

Photo 65: 1/25/12, BG-4D, approximately 167' bgs – SM (silty sand).

Photo 66: 1/30/12, BG-4 location, equipment vandalized with graffiti.

Photo 67: 1/31/12, BG-4D, installing 4” PVC monitoring well with centralizers.

Photo 68: 2/1/12, BG-4S, spraying water for dust suppression, facing south.

Photo 69: 2/3/12, BG-4D, BG-4M, and BG-4S completed well locations. SWCA biologist monitoring for tortoise and protected vegetation while moving equipment, facing north.

Photo 70: 2/6/12, BG-6D, Eagle Drilling preparing plastic sleeves for soil core collection, facing north.

Photo 71: 2/6/12, BG-6D 0'–9' bgs – GW (well graded gravel with sand) and SW (well graded sand with gravel).

Photo 72: 2/6/12, BG-6D, approximately 8' bgs – SW (well graded sand with gravel). Alluvium from 0-11' bgs, Muddy Creek formation from 11' bgs to bottom of boring.

Photo 73: 2/7/12, BG-6D, 45’ – 50’ bgs – SM (silty sand) top core and CH (fat clay) bottom core. BG-1S screen interval 47’ -67’ bgs.

Photo 74: 2/7/12, BG-6D, approximately 51’ bgs, CH (fat clay) with 2” sandstone layer.

Photo 75: 2/7/12, BG-6D, approximately 54’ bgs, CL/ML/SM (clay, silt, and sand interbeds).

Photo 76: 2/7/12, BG-6D, approximately 64’ bgs, SM (silty sand).

Photo 77: 2/8/12, BG-6D, 85'– 90' bgs - SM (silty sand) bottom core and CH (fat clay) top core, with sandstone layer between the SM and CH (87' bgs). BG-4M screen interval 84' – 99' bgs.

Photo 78: 2/8/12, BG-6D 90'-95' bgs (center box)-CH (fat clay) and CL/ML/SM (clay, silt, and sand interbeds).

Photo 79: 2/9/12, BG-6D approximately 120' bgs – ML (sandy silt). BG-6D screen interval 115' – 130' bgs.

Photo 80: BG-6D approximately 128' bgs - CL/ML/SM (clay, silt, and sand interbeds). Total depth of boring = 135' bgs.

Photo 81: 2/13/12/12, BG-6D, Eagle Drilling pumping bentonite grout into monitoring well BG-6D, facing east.

Photo 82: 2/14/12, BG-6M, Eagle Drilling installing monitoring well BG-6M, facing east.

Photo 83: 2/15/12, Drilling at BG-6S. Drilling cuttings collected and placed in end loader for disposal in on-site landfill, facing east.

Photo 84: 2/21/12, Completed BG-6D, BG-6M, and BG-6S monitoring wells, facing northwest.

Photo 85: 2/21/12, BG-3D, Set up and begin drilling at BG-3D location, facing north.

Photo 86: 2/21/12, BG-3D, 0'-2' bgs composited soil sample, GW (well graded gravel with sand). Alluvium from 0-11' bgs, Muddy Creek formation from 11' bgs to bottom of boring.

Photo 87: 2/22/12, BG-3D, 60'-62' & 67'-70' bgs - ML (silt with sand and gravel), and SP (poorly graded sand), bottom core; SP (poorly graded sand) and CL (lean clay), top core. BG-3S screen interval 60'-75' bgs.

Photo 88: 2/23/12, BG-3D, bottom core-approximately 103'-105' bgs -SP (poorly graded sand) and SM (silty sand), top core- approximately 106'–107' bgs–CL (lean clay). BG-3M screen interval 95'–110' bgs.

Photo 89: 2/24/12, BG-3D, 133–140’ bgs–SM (silty sand) bottom core, and CL (lean clay), top core. BG-3D screen interval 130’ – 145’ bgs. Total depth of boring = 151’bgs.

Photo 90: 3/5/12, BG-3M, Eagle Drilling spraying water for dust suppression, facing north.

Photo 91: 3/9/12/12, BG-3D, BG-3M, and BG-3S, completed wells. Metal casing and concrete, facing north.

Photo 92: 05/20/11, Post-Muddy Creek Tertiary Deposits, conglomerate on Mesa comprised of cemented sand, silt, gravel and cobbles, facing north.

Photo 93: 2/16/11, Post-Muddy Creek Tertiary Deposits, Conglomerate on Mesa, facing east.

Photo 94: 05/20/11, Post-Muddy Creek Tertiary Deposits above Muddy Creek Formation on the Mesa, facing south from Station haul road.

Photo 95: 3/12/12, Development of monitoring wells BG-1D, BG-1M, and BG-1S, facing east.

Photo 96: 3/12/12, Storage tank for hauling monitoring well development water to ponds for disposal, facing north.

Photo 97: 3/13/12, Grundfos 2.48 horsepower pump utilized for water removal.

Photo 98: 3/13/12, Grundfos 0.939 horsepower pump utilized for water removal.

Photo 99: 4/5/12, Monitoring well development, BG-6 monitoring well location, facing north.

Photo 100: 4/5/12, Imhoff cones used to determine amount of fines in development water and Horiba to determine groundwater parameters, BG-6 monitoring wells location.

Photo 101: 7/30/12, aquifer testing at BG-1S, generator in back of truck to supply power for pump, facing northeast.

Photo 102: 7/30/12, aquifer testing at BG-1S, tripod and winch to raise and lower pump, facing southwest.

Photo 103: 8/1/12, aquifer testing at BG-1M, effluent discharge into water truck.

Photo 104: 8/10/12, aquifer testing at KMW-2D, effluent discharge into water truck, facing north.

Photo 105: 8/7/12, MR-1 muddy river monitoring location, facing northeast.

Photo 106: 8/10/12, Aquifer testing at KMW-2D, collecting groundwater quality parameters with a Horiba U-22 multi-probe water quality monitor.

Appendix C

Field Documentation

Right of Way Survey
Monitoring Well Survey
Soil Boring Log and Monitoring Well Diagrams
Well Development Forms

Table C-1 Background Well Construction ROW Survey Data				
Well Name	**State Plane Northing**	**State Plane Easting**	**Elevation (ft AMSL)**	**Description**
BG-1	26944581.6080	932118.1667	None	NE Corner of BLM ROW @ Ground Surface
BG-1	26944481.6150	932119.3506	1616.3	SE Corner of BLM ROW @ Ground Surface
BG-1	26944480.4311	932019.3576	1609.2	SW Corner of BLM ROW @ Ground Surface
BG-1	26944580.4241	932018.1737	1612.7	NW Corner of BLM ROW @ Ground Surface
BG-2	26939712.5497	928907.3102	1613.3	NE Corner of BLM ROW @ Ground Surface
BG-2	26939615.8685	928881.7615	1624.5	SE Corner of BLM ROW @ Ground Surface
BG-2	26939641.4172	928785.0802	1612.5	SW Corner of BLM ROW @ Ground Surface
BG-2	26939738.0985	928810.6290	1611.5	NW Corner of BLM ROW @ Ground Surface
BG-3	26944031.3817	937571.4170	1620.6	NE Corner of BLM ROW @ Ground Surface
BG-3	26943935.1874	937598.7419	1620.4	SE Corner of BLM ROW @ Ground Surface
BG-3	26943907.8624	937502.5476	1618.2	SW Corner of BLM ROW @ Ground Surface
BG-3	26944004.0568	937475.2227	1617.8	NW Corner of BLM ROW @ Ground Surface
BG-4	26945642.5106	934925.8150	1669.0	NE Corner of BLM ROW @ Ground Surface
BG-4	26945542.5106	934925.8237	1668.7	SE Corner of BLM ROW @ Ground Surface
BG-4	26945542.5019	934825.8237	1657.0	SW Corner of BLM ROW @ Ground Surface
BG-4	26945642.5019	934825.8150	1659.8	NW Corner of BLM ROW @ Ground Surface
BG-6	26942966.2565	936694.1403	1610.1	NE Corner of BLM ROW @ Ground Surface
BG-6	26942870.3119	936722.3294	1611.8	SE Corner of BLM ROW @ Ground Surface
BG-6	26942842.1228	936626.3848	1616.9	SW Corner of BLM ROW @ Ground Surface
BG-6	26942938.0674	936598.1957	1617.2	NW Corner of BLM ROW @ Ground Surface

Table C-2 Background Well Location Survey Data					
Well Name	**State Plane Northing**	**State Plane Easting**	**Elevation (ft AMSL)**	**Stickup Above Ground Surface (ft)**	**Description**
BG-1S	26944523.8976	932043.8834	1613.13	2.74	Top of Well Casing
BG-1S	26944524.3198	932042.7127	1610.39	--	Ground Elevation
BG-1M	26944518.9254	932034.9933	1613.24	3.10	Top of Well Casing
BG-1M	26944518.9344	932036.1313	1610.14	--	Ground Elevation
BG-1D	26944513.7022	932043.1673	1612.95	3.07	Top of Well Casing
BG-1D	26944514.8724	932043.2773	1609.88	--	Ground Elevation
BG-2S	26939689.9940	928836.5721	1617.23	3.50	Top of Well Casing
BG-2S	26939689.9162	928834.4742	1613.73	--	Ground Elevation
BG-2M	26939684.3891	928828.1998	1617.59	3.60	Top of Well Casing
BG-2M	26939686.2563	928828.4291	1613.99	--	Ground Elevation
BG-2D	26939679.5169	928836.8716	1617.65	3.50	Top of Well Casing
BG-2D	26939681.5621	928837.1676	1614.15	--	Ground Elevation
BG-3S	26944006.0762	937534.0105	1623.60	2.53	Top of Well Casing
BG-3S	26944006.0172	937535.9796	1621.07	--	Ground Elevation
BG-3M	26944014.4708	937539.1169	1623.60	2.30	Top of Well Casing
BG-3M	26944015.5391	937540.6020	1621.30	--	Ground Elevation
BG-3D	26944014.3707	937529.0290	1623.91	2.69	Top of Well Casing
BG-3D	26944013.5542	937527.1580	1621.22	--	Ground Elevation
BG-4S	26945592.9758	934861.8333	1662.43	2.49	Top of Well Casing
BG-4S	26945594.5299	934862.4082	1659.94	--	Ground Elevation
BG-4M	26945600.2131	934855.5130	1662.43	2.91	Top of Well Casing
BG-4M	26945601.6454	934856.2002	1659.52	--	Ground Elevation
BG-4D	26945590.5685	934852.3391	1662.52	2.97	Top of Well Casing
BG-4D	26945592.1099	934852.8163	1659.55	--	Ground Elevation
BG-6S	26942902.0220	936680.8360	1618.85	2.58	Top of Well Casing
BG-6S	26942903.7182	936679.7247	1616.27	--	Ground Elevation
BG-6M	26942904.0475	936670.8754	1619.20	2.94	Top of Well Casing
BG-6M	26942905.1755	936670.4678	1616.26	--	Ground Elevation
BG-6D	26942911.1736	936677.5078	1619.37	3.12	Top of Well Casing
BG-6D	26942909.2603	936677.0704	1616.25	--	Ground Elevation

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number: **BG-1S**	Facility Name **NV Energy- Reid Gardner Station**	Facility Street Address **Clark County, NV**	Page **1 of 2**
Boring Location:	Northing: **26944523.8976**	Easting: **932043.8834**	
Boring Depth (ft) X Diameter (in): **43' x 8"**		Drilling Method: **Sonic**	
Certified Well Contractor Name: **Eagle Drilling**		Logged by: **T. Knause**	
Start Date: **1/13/2012**	End Date: **1/13/2012**	Ground Surface Elevation (ASL): **1610.39'**	
Start Time: **08:00**	End Time: **16:00**	Top of Casing Elevation (ASL): **1613.13'**	

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
0	Aboveground steel protector													
1	concrete pad											C	CH	0 - 8 Fat Clay, hard, dry, reddish brown to gray, high plasticity, slow dilatency, cohesive, massive, trace greenish gray gypsum nodules, trace silt laminations
2												0-2'		
3	4" schedule 40 PVC casing													
4														
5														
6	10' concrete surface seal													
7														
8			6.5/8'											
9													ML	8' - 11' Sandy Silt with gravel, very fine grained, dry, loose, tan, trace angular medium limestone, volcanic non-plastic, non-cohesive, massive
10												10' G		
11	bentonite grout													
12													ML	11' - 14' Sandy Silt with Gravel, very fine grained, dry, loose, light tan, carbonate, trace angular coarse limestone, volcanics, and dolomite gravel (<2"), non-plastic, non-cohesive, massive
13														
14			6/6'											
15													SW	14' - 20' Well Graded Sand with Gravel, loose, dry, tan, some very coarse angular limestone, volcanics, and dolomite gravel (<2"), with little cobbles (<5"), massive
16														
17														
18														
19												19' G		
20			6/6'											
21		19 50/5.5'					2.69	111.24	4.97E-02			20'-21'	GW	20' - 22' Well Graded Gravel, very coarse grained (<5"), loose, dry, tan
22	#12 sand filter pack			NP	NV	NP				0.5	8.79	19'-22'	SM	22' - 25' Silty Sand with Gravel, well graded, loose, dry, tan to light gray, some gravel, little cobbles, sub-angular to sub-rounded limestone, dolomite, and volcanics clasts (<5"), massive
23														
24														
25	∇		5/5'											
26	▼ 1/13/2012												CL	25' - 26' Sandy Lean Clay with Gravel, fine grained, few gravel, wet, soft, brown, non-plastic, slow dilatency, non-cohesive, massive
27													GW-GM	26' - 29' Well Graded Gravel with Sand and Silt, fine to very coarse grained, some gravel, little cobbles, very angular to sub-rounded limestone, dolomite, and volcanics, wet, soft, brown, massive, sharp contact
28	15'-0.01" slot PVC screen													
29												29' G	CL	29' - 29.5' Sandy Lean Clay, fine grained, soft, wet, brown, non-plastic, slow dilatency, non-cohesive, massive
30			5/5'										SP	29.5' - 30' Poorly Graded Sand, fine to medium grained, loose, wet, brown, massive

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-1S	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**2 of 2**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
31													GW-GC	30' - 33' Well Graded Gravel with Clay and Sand, very coarse to very fine grained sand, gray to brown, loose to soft, wet, some gravel and trace cobbles, sub-angular to sub-rounded limestone, dolomite, and volcanics, high plasticity and cohesive fines, massive
32	15'-0.01" slot													
33	PVC screen													
34													GC	33' - 34' Clayey Gravel, very coarse to very fine grained, gray, loose to soft, wet, some gravel and trace cobbles, sub-angular to sub-rounded limestone, dolomite, and volcanics, high plasticity and cohesive fines, massive
35														
36													SP	35' - 37' Poorly Graded Sand, fine to medium grained, loose, wet, brown, massive
37	#12 sand filter pack													
38													GW-GC	37' - 39' Well Graded Gravel with Clay and Sand, very coarse to very fine grained sand, gray to brown, loose to soft, wet, some gravel and trace cobbles, sub-angular to sub-rounded limestone, dolomite, and volcanics, high plasticity and cohesive fines, massive
39	5' tailpipe		Flowing											
40			Sands 10/10'										SP	39' - 40' Poorly Graded Sand, fine to medium grained, loose, wet, brown, massive
41												40' G	GW	40' - 42' Well Graded Gravel with Sand, very coarse to fine grained, gray, loose,wet, some sub-angular to sub-rounded limestone, dolomite, and volcanics gravel, massive, sharp contact
42	4" schedule 40 PVC casing							Alluvium						
43	TD=43'			NP	NV	NP		Muddy Creek	0.3	9.04	40'-42' 43' G		CL	42' - 43' Lean Clay, dry, hard, reddish brown, non-plastic, slow dilatency, non-cohesive, massive, trace gypsum nodules
44														**1/12/12 end of day**
45														
46														**Note: Descriptions, laboratory analysis, and blow counts collected from soil boring BG-1D**
47														**Alluvium observed from 0-42'**
48														**Muddy Creek Formation observed from 42'-43'**
49														**Gradational changes between lithologies unless otherwise noted**
50														**Total drilling depth 43' - 1/12/12**
51														
52														
53														
54														
55														
56														
57														
58														
59														
60														
61														
62														
63														
64														
65														

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-1M	NV Energy- Reid Gardner Station	Clark County, NV	1 of 3

Boring Location:	Northing: 26944518.9254	Easting: 932034.9933	
Boring Depth (ft) X Diameter (in): 73' x 8"		Drilling Method: Sonic	
Certified Well Contractor Name: Eagle Drilling		Logged by: T. Knause	
Start Date: 1/10/2012	End Date: 1/12/2012	Ground Surface Elevation (ASL):	1610.14'
Start Time: 08:00	End Time: 14:00	Top of Casing Elevation (ASL):	1613.24'

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
0	Aboveground steel protector													
1	concrete pad											C	CH	0 - 8 Fat Clay, hard, dry, reddish brown to gray, high plasticity, slow dilatency, cohesive, massive, trace greenish gray gypsum nodules, trace silt laminations
2												0-2'		
3	4" schedule 40 PVC casing													
4														
5														
6	10' concrete surface seal													
7														
8			6.5/6'											
9													ML	8' - 11' Sandy Silt with gravel, very fine grained, dry, loose, tan, trace angular medium limestone, volcanic non-plastic, non-cohesive, massive
10												10' G		
11	bentonite grout													
12													ML	11' - 14' Sandy Silt with Gravel, very fine grained, dry, loose, light tan, carbonate, trace angular coarse limestone, volcanics, and dolomite gravel (<2"), non-plastic, non-cohesive, massive
13														
14			6/6'											
15													SW	14' - 20' Well Graded Sand with Gravel, loose, dry, tan, some very coarse angular limestone, volcanics, and dolomite gravel (<2"), with little cobbles (<5"), massive
16														
17														
18														
19												19' G		
20			6/6'											
21		19 50/5.5'					2.69	111.24	4.97E-02			20'-21'	GW	20' - 22' Well Graded Gravel, very coarse grained (<5"), loose, dry, tan
22														
23				NP	NV	NP				0.5	8.79	19'-22'	SM	22' - 25' Silty Sand with Gravel, well graded, loose, dry, tan to light gray, some gravel, little cobbles, sub-angular to sub-rounded limestone, dolomite, and volcanics clasts (<5"), massive
24														
25	▽		5/5'											
26	▼ 1/10/2012												CL	25' - 26' Sandy Lean Clay with Gravel, fine grained, few gravel, wet, soft, brown, non-plastic, slow dilatency, non-cohesive, massive
27													GW-GM	26' - 29' Well Graded Gravel with Sand and Silt, fine to very coarse grained, some gravel, little cobbles, very angular to sub-rounded limestone, dolomite, and volcanics, wet, soft, brown, massive, sharp contact
28													CL	29' - 29.5' Sandy Lean Clay, fine grained, soft, wet, brown, non-plastic, slow dilatency, non-cohesive, massive
29												29' G	SP	29.5' - 30' Poorly Graded Sand, fine to medium grained, loose, wet, brown, massive
30			5/5'											

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

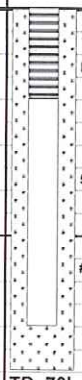
Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-1M	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**2 of 3**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
31													GW-GC	30' - 33' Well Graded Gravel with Clay and Sand, very coarse to very fine grained sand, gray to brown, loose to soft, wet, some gravel and trace cobbles, sub-angular to sub-rounded limestone, dolomite, and volcanics, high plasticity and cohesive fines, massive
32														
33	4" schedule 40 PVC casing													
34													GC	33' - 34' Clayey Gravel, very coarse to very fine grained, gray, loose to soft, wet, some gravel and trace cobbles, sub-angular to sub-rounded limestone, dolomite, and volcanics, high plasticity and cohesive fines, massive
35														
36													SP	35' - 37' Poorly Graded Sand, fine to medium grained, loose, wet, brown, massive
37														
38													GW-GC	37' - 39' Well Graded Gravel with Clay and Sand, very coarse to very fine grained sand, gray to brown, loose to soft, wet, some gravel and trace cobbles, sub-angular to sub-rounded limestone, dolomite, and volcanics, high plasticity and cohesive fines, massive
39			Flowing Sands										SP	39' - 40' Poorly Graded Sand, fine to medium grained, loose, wet, brown, massive
40			10/10'									40' G		
41	bentonite grout												GW	40' - 42' Well Graded Gravel with Sand, very coarse to fine grained, gray, loose,wet, some sub-angular to sub-rounded limestone, dolomite, and volcanics gravel, massive, sharp contact
42								Alluvium						
43				NP	NV	NP		Muddy Creek		0.3	9.04	40'-42' 43' G	CL	42' - 45' Lean Clay, dry, hard, reddish brown, non-plastic, slow dilatency, non-cohesive, massive, trace gypsum nodules
44														
45														
46		15 36 50/4"	6/6"									46' G	SM-CL	45' - 48' Silty Sand to Sandy Lean Clay, dry to moist, loose to hard, reddish brown, non-plastic, slow dilatency, non-cohesive, massive
47							17.45	114.06	2.08E-07			46'-47		
48														
49				13	26	13				0.9	8.39	45'-48'	CL-CH	48' - 50' Lean to Fat Clay with Gravel, gradational, dry, hard, reddish brown, non- plastic to medium plasticity, slow dilatency, non-cohesive to cohesive, interbedded, trace coarse angular limestone and dolomite gravel (1"-2")
50			4/4'											
51													CL	50' - 60' Lean Clay with Gravel, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, trace coarse angular limestone and dolomite gravel (1"-2"), interbedded with Silty Sand, very fine grained, loose, wet
52														
53														
54														
55														
56												55' G		
57	#12 sand filter pack													
58														
59														
60			10/10'											
61			Flowing Sands										SM	60' - 62' Silty Sand, very fine grained, loose, wet, reddish brown, massive (logged from cleanout material)
62			0/2'	18	34	16				2.4	8.35	62' -65'	CL	62' - 63.5' Lean Clay with Sand, very fine grained, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, trace grayish green gypsum lenses, massive
63	15'-0.01" slot PVC screen													
64		21 28 50/5"					28.95	97.52	4.40E-05			63'-64	SM	63.5' - 64' Silty Sand, very fine grained, loose, wet, reddish brown, bedded
65													CL	64' - 66' Lean Clay with Sand, very fine grained, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, massive

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-1M	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**3 of 3**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
66	 15'-0.01" slot PVC screen												CL	66' - 70' Lean Clay with Sand, very fine grained, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, trace grayish tan silt laminations, massive
67														**1/10/12 end of day**
68														
69	5' tailpipe													
70			8/8'											
71	#12 sand filter pack												CL	70' - 73.5' Lean Clay, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, trace gray gypsum laminations, massive
72														**1/11/12 end of day**
73														**Note: Descriptions, laboratory analysis, and blow counts collected from soil boring BG-1D.**
74	**TD=73'**													**Alluvium observed from 0-42'** **Muddy Creek Formation observed from 42'-73'**
75														**Gradational changes between lithologies unless otherwise noted** **Total drilling depth 73' - 1/12/12**
76														
77														
78														
79														
80														
81														
82														
83														
84														
85														
86														
87														
88														
89														
90														
91														
92														
93														
94														
95														
96														
97														
98														
99														
100														

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number: **BG-1D**	Facility Name **NV Energy- Reid Gardner Station**	Facility Street Address **Clark County, NV**	Page **1 of 4**
Boring Location:	Northing: **26944513.7022**	Easting: **932043.1673**	
Boring Depth (ft) X Diameter (in): **105' x 8"**		Drilling Method: **Sonic**	
Certified Well Contractor Nam **Eagle Drilling**		Logged by: **T. Knause**	
Start Date: **1/4/2012**	End Date: **1/9/2012**	Ground Surface Elevation (ASL): **1609.88'**	
Start Time: **09:00**	End Time: **14:00**	Top of Casing Elevation (ASL): **1612.95'**	

Soil Boring/Well Construction: Aboveground steel protector; concrete pad; 4" schedule 40 PVC casing; 10' concrete surface seal; bentonite grout

Depth (ft bgs)	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
0–5											0-2' C	CH	0 - 8 Fat Clay, hard, dry, reddish brown to gray, high plasticity, slow dilatency, cohesive, massive, trace greenish gray gypsum nodules, trace silt laminations
8		6.5/5'											
9–10											10' G	ML	8' - 11' Sandy Silt with gravel, very fine grained, dry, loose, tan, trace angular medium limestone, volcanic non-plastic, non-cohesive, massive
14		6/6'											
14–15												SW	14' - 20' Well Graded Sand with Gravel, loose, dry, tan, some very coarse angular limestone, volcanics, and dolomite gravel (<2"), with little cobbles (<5"), massive
19											19' G		
20		6/6'											
21	19 / 50/5.5'					2.69	111.24	4.97E-02			20'-21'	GW	20' - 22' Well Graded Gravel, very coarse grained (<5"), loose, dry, tan
23			NP	NV	NP				0.5	8.79	19'-22'	SM	22' - 25' Silty Sand with Gravel, well graded, loose, dry, tan to light gray, some gravel, little cobbles, sub-angular to sub-rounded limestone, dolomite, and volcanics clasts (<5"), massive
25		5/5'											
26												CL	25' - 26' Sandy Lean Clay with Gravel, fine grained, few gravel, wet, soft, brown, non-plastic, slow dilatency, non-cohesive, massive
27–28												GW-GM	26' - 29' Well Graded Gravel with Sand and Silt, fine to very coarse grained, some gravel, little cobbles, very angular to sub-rounded limestone, dolomite, and volcanics, wet, soft, brown, massive, sharp contact
29											29' G	CL	29' - 29.5' Sandy Lean Clay, fine grained, soft, wet, brown, non-plastic, slow dilatency, non-cohesive, massive
30		5/5'										SP	29.5' - 30' Poorly Graded Sand, fine to medium grained, loose, wet, brown, massive

▼ 1/10/2012

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-1D	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**2 of 4**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
31													GW-GC	30' - 33' Well Graded Gravel with Clay and Sand, very coarse to very fine grained sand, gray to brown, loose to soft, wet, some gravel and trace cobbles, sub-angular to sub-rounded limestone, dolomite, and volcanics, high plasticity and cohesive fines, massive
32	4" schedule 40 PVC casing													
33														
34													GC	33' - 34' Clayey Gravel, very coarse to very fine grained, gray, loose to soft, wet, some gravel and trace cobbles, sub-angular to sub-rounded limestone, dolomite, and volcanics, high plasticity and cohesive fines, massive
35														
36													SP	35' - 37' Poorly Graded Sand, fine to medium grained, loose, wet, brown, massive
37														
38													GW-GC	37' - 39' Well Graded Gravel with Clay and Sand, very coarse to very fine grained sand, gray to brown, loose to soft, wet, some gravel and trace cobbles, sub-angular to sub-rounded limestone, dolomite, and volcanics, high plasticity and cohesive fines, massive
39			Flowing Sands										SP	39' - 40' Poorly Graded Sand, fine to medium grained, loose, wet, brown, massive
40			10/10'											
41	bentonite grout											40' G	GW	40' - 42' Well Graded Gravel with Sand, very coarse to fine grained, gray, loose,wet, some sub-angular to sub-rounded limestone, dolomite, and volcanics gravel, massive, sharp contact
42								Alluvium						
43				NP	NV	NP		Muddy Creek		0.3	9.04	40'-42' 43' G	CL	42' - 45' Lean Clay, dry, hard, reddish brown, non-plastic, slow dilatency, non-cohesive, massive, trace gypsum nodules
44														
45													SM-CL	45' - 48' Silty Sand to Sandy Lean Clay, dry to moist, loose to hard, reddish brown, non-plastic, slow dilatency, non-cohesive, massive
46		15 36 50/4"	6/6'				17.45	114.06	2.08E-07			45' G 45'-47'		**1/4/12 end of day**
47														
48														
49				13	26	13				0.9	8.39	45'-48'	CL-CH	48' - 50' Lean to Fat Clay with Gravel, gradational, dry, hard, reddish brown, non- plastic to medium plasticity, slow dilatency, non-cohesive to cohesive, interbedded, trace coarse angular limestone and dolomite gravel (1"-2")
50			4/4'											
51													CL	50' - 60' Lean Clay with Gravel, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, trace coarse angular limestone and dolomite gravel (1"-2"), interbedded with Silty Sand, very fine grained, loose, wet
52														
53														
54														
55														
56												55' G		
57														
58														
59														
60			10/10'											
61			Flowing Sands										SM	60' - 62' Silty Sand, very fine grained, loose, wet, reddish brown, massive (logged from cleanout material)
62			0/2'	18	34	16				2.4	8.35	62'-65'	CL	62' - 63.5' Lean Clay with Sand, very fine grained, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, trace grayish green gypsum lenses, massive
63														
64		21 28 50/5"					28.95	97.52	4.40E-05			63'-64'	SM	63.5' - 64' Silty Sand, very fine grained, loose, wet, reddish brown, bedded
65													CL	64' - 66' Lean Clay with Sand, very fine grained, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, massive

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-1D	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**3 of 4**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
66														
67													CL	66' - 70' Lean Clay with Sand, very fine grained, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, trace grayish tan silt laminations, massive
68														
69	4" schedule 40 PVC casing													
70			8/8'											
71													CL	70' - 73.5' Lean Clay, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, trace gray gypsum laminations, massive
72	bentonite grout													
73														
74													SM	73.5' - 74' Silty Sand, very fine grained, loose, wet, reddish brown, bedded
75			4/5'										CL	74' - 80' Lean Clay, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, massive
76														
77														
78														
79												78' G		@78' - Gypsum, loose, dry, gray, thinly bedded
80			5/5'											**1/5/12 end of day**
81													CL	80' - 88' Lean Clay, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, few tan silt laminations, massive
82	#12 sand filter pack													
83														
84														
85			5/5'											
86														
87	15'-0.01" slot PVC screen													
88														
89													SM	88' - 90' Silty Sand, very fine grained, loose, wet, reddish brown, partially cemented with carbonate
90			5/5'											
91													SM	90' - 95' Silty Sand, very fine grained, loose, wet, reddish brown, massive
92														
93												92' G		
94														
95														
96													CL	95' - 97' Lean Clay, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, massive
97														
98													SM	97' - 99' Silty Sand, very fine grained, loose, wet, reddish brown, massive
99													CL	99' - 100' Lean Clay, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, massive
100			10/10'											**1/6/12 end of day**

Stanley Consultants INC

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-1D	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**4 of 4**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
101	#12 sand												SM	100' - 105' Silty Sand, very fine grained, loose, wet, reddish brown, massive
102	filter pack		1.5/1.5'				17.85	113.39	2.08E-03			100.5'-101.5		
103	5' tailpipe			15	20	5				0.7	8.37	99'-102'		**Note: Alluvium observed from 0-42'**
104														**Muddy Creek Formation observed from 42'-105'**
105	**TD=105'**		3.5/3.5'											**Gradational changes between lithologies unless otherwise noted**
106														**Total drilling depth 105' - 1/9/12**
107														
108														
109														
110														
111														
112														
113														
114														
115														
116														
117														
118														
119														
120														
121														
122														
123														
124														
125														
126														
127														
128														
129														
130														
131														
132														
133														
134														
135														

Soil Boring Log and Monitoring Well Diagram

Stanley Consultants INC.

Boring/Well Number: **BG-2S**	Facility Name **NV Energy- Reid Gardner Station**	Facility Street Address **Clark County, NV**	Page **1 of 2**
Boring Location:	Northing: **26939689.9940**	Easting: **928836.5721**	
Boring Depth (ft) X Diameter (in): **40' x 8"**		Drilling Method **Sonic**	
Certified Well Contractor Name: **Eagle Drilling**		Logged by: **J. Oriano/ T. Knause**	
Start Date: **12/29/2011**	End Date: **12/30/2011**	Ground Surface Elevation (ASL): **1613.73'**	
Start Time: **14:00**	End Time: **12:00**	Top of Casing Elevation (ASL): **1617.23'**	

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
0	Aboveground steel protector													
1	concrete pad											C	SP	0'-18' Poorly Graded Sand, tan, fine grained, loose, dry, non-plastic, non-cohesive, massive
2												0-2'		
3	4" schedule 40 PVC casing													
4														
5														
6	10' concrete surface seal													
7														
8														
9														
10			4.5/10'									10' G		
11	bentonite grout													
12														
13														
14														
15														
16														
17														
18													SM	18'-20.5' Silty Sand with Gravel, weak to moderately carbonate cemented sand and gravel, light gray with white to brown thin beds, stiff, dry, non-plastic, non-cohesive, with few round to angular tan to dark gray limestone gravel and volcanic gravel (<2") and trace fine to coarse grained sand
19												19' G		
20			5/10'											
21	1/3/12	17 15 15					6.42	123.35	9.19E-04			21' G 20.5'-21.5'	SM	20.5'-24.5' Silty Sand with Gravel, fine to medium grained, well graded, dark brown to dark reddish brown, loose, moist to wet at 24', non-plastic, cohesive, massive, oxidized, with little gravel and cobbles (<4"), angular to rounded, limestone, dolomite, and volcanics, plastic fines, trace gypsum crystals
22				NP	NV	NP					7.81	19'-21'		
23	#12 sand filter pack													
24														
25									Alluvium Muddy Creek				CH	24.5'-28' Fat Clay, olive brown, very stiff, dry, high plasticity, cohesive, generally massive with trace gypsum crystals throughout, gypsum crystals concentrated along fractures, trace fine grained sand lenses, sand ranges from orange to tan, black mottles, trace limestone gravel
26														
27														
28	15'-0.01" slot PVC screen												SM	28'-29', Silty Sand, fine grained, dark yellowish brown, medium dense, poorly graded, moist, non-plastic, non-cohesive, massive, trace gray clay nodules (<1")
29													CH	29'-30' Fat Clay, dark gray, hard, dry, high plasticity, cohesive, massive, trace black mottles, massive, uniform color
30			10/10'									30' G	SM	30'-32', Silty Sand, fine grained, grayish brown, medium dense, poorly

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-2S	NV Energy- Reid Gardner Station	Clark County, NV	2 of 2

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
31														graded, moist, non-plastic, non-cohesive, massive, minor dark reddish staining
32												32' G	CH	@ 32' - color change, light gray (~0.5") and orange red (~2") 32'-33.5' Fat Clay, dark greenish gray, hard, dry, high plasticity, cohesive, massive, trace rounded flat gypsum nodules (<0.5")
33	15'-0.01" slot PVC screen													
34	#12 sand filter pack												SM	33.5'-34.5' Silty Sand, fine grained, dark greenish gray, medium dense, poorly graded, moist, non-plastic, non-cohesive, massive
35													CH	34.5'-38' Fat Clay, dark greenish gray, hard, dry, high plasticity, cohesive, massive, trace angular limestone gravel (<0.5" to 3")
36														
37														
38	5' tailpipe													
39													SM	38'-41' Silty Sand, fine grained, dark greenish gray, medium dense, poorly graded, moist, non-plastic, non-cohesive, massive
40	TD=40'		10/10'											
41														**Note: Descriptions, laboratory analysis, and blow counts collected from soil boring BG-2D.**
42														**Note: Alluvium observed from 0'-24.5'; Muddy Creek Formation observed from 24.5'- 40'**
43														**Muddy Creek Green Member 24.5'-40'**
44														**Gradational changes between lithologies unless otherwise noted**
45														
46														
47														
48														
49														
50														
51														
52														
53														
54														
55														
56														
57														
58														
59														
60														
61														
62														
63														
64														
65														

Soil Boring Log and Monitoring Well Diagram

Stanley Consultants INC.

Boring/Well Number: **BG-2M**	Facility Name **NV Energy- Reid Gardner Station**	Facility Street Address **Clark County, NV**	Page **1 of 2**
Boring Location:	Northing: **26939684.3891**	Easting: **928828.1998**	
Boring Depth (ft) X Diameter (in): **65' x 8"**		Drilling Method **Sonic**	
Certified Well Contractor Name: **Eagle Drilling**		Logged by: **J. Oriano/ T. Knause**	
Start Date: **12/28/2011**	End Date: **12/29/2011**	Ground Surface Elevation (ASL): **1613.99'**	
Start Time: **8:30**	End Time: **13:00**	Top of Casing Elevation (ASL): **1617.59'**	

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
0	Aboveground steel protector													
1	concrete pad											C	SP	0'-18' Poorly Graded Sand, tan, fine grained, loose, dry, non-plastic, non-cohesive, massive
2												0-2'		
3	4" schedule 40 PVC casing													
4														
5														
6	10' concrete surface seal													
7														
8														
9														
10			4.5/10									10' G		
11	bentonite grout													
12														
13														
14														
15														
16														
17														
18													SM	18'-20.5' Silty Sand with Gravel, weak to moderately carbonate cemented sand and gravel, light gray with white to brown thin beds, stiff, dry, non-plastic, non-cohesive, with few round to angular tan to dark gray limestone gravel and volcanic gravel (<2") and trace fine to coarse grained sand
19												19' G		
20			5/10'											
21		17											SM	20.5'-24.5' Silty Sand with Gravel, fine to medium grained, well graded, dark brown to dark reddish brown, loose, moist to wet at 24', non-plastic, cohesive, massive, oxidized, with little gravel and cobbles (<4"), angular to rounded, limestone, dolomite, and volcanics, plastic fines, trace gypsum crystals
		15										21' G		
	1/3/12	15					6.42	123.35	9.19E-04			20.5'-21.5'		
22				NP	NV	NP					7.81	19'-21'		
23														
24														
25									Alluvium / Muddy Creek				CH	24.5'-28' Fat Clay, olive brown, very stiff, dry, high plasticity, cohesive, generally massive with trace gypsum crystals throughout, gypsum crystals concentrated along fractures, trace fine grained sand lenses, sand ranges from orange to tan, black mottles, trace limestone gravel
26														
27													SM	28'-29', Silty Sand, fine grained, dark yellowish brown, medium dense, poorly graded, moist, non-plastic, non-cohesive, massive, trace gray clay nodules (<1")
28														
29													CH	29'-30' Fat Clay, dark gray, hard, dry, high plasticity, cohesive, massive, trace black mottles, massive, uniform color
30			10/10'									30' G	SM	30'-32', Silty Sand, fine grained, grayish brown, medium dense, poorly

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-2M	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**2 of 2**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
31														graded, moist, non-plastic, non-cohesive, massive, minor dark reddish staining
														@ 32' - color change, light gray (~0.5") and orange red (~2")
32												32' G	CH	32'-33.5' Fat Clay, dark greenish gray, hard, dry, high plasticity,
33	4" schedule 40 PVC casing													cohesive, massive, trace rounded flat gypsum nodules (<0.5")
34													SM	33.5'-34.5' Silty Sand, fine grained, dark greenish gray, medium dense, poorly graded, moist, non-plastic, non-cohesive, massive
35													CH	34.5'-38' Fat Clay, dark greenish gray, hard, dry, high plasticity, cohesive, massive, trace angular limestone gravel (<0.5" to 3")
36														
37														
38														
39													SM	38'-41' Silty Sand, fine grained, dark greenish gray, medium dense, poorly graded, moist, non-plastic, non-cohesive, massive
40			10/10'											
41	#12 sand filter pack													
42													CH	41'-42' Fat Clay, dark greenish gray, hard, dry, high plasticity, cohesive, massive
43		9											CL	42'-43' Lean Clay with Sand, fine grained, dark greenish gray, medium dense, poorly graded, moist, non-plastic, non-cohesive, massive
44		17 50-6"					23.81	98.5	5.3E-08			43'-44'	CH	43'-47' Fat Clay, dark greenish gray, hard, dry, high plasticity, cohesive, massive
45				20	33	13					8.48	42'-44'		
46														
47														
48													SM	47'-48' Silty Sand, fine grained, dark greenish gray, medium dense, poorly graded, moist, non-plastic, non-cohesive, massive, plastic fines
49	15'-0.01" slot PVC screen												CH	48'-58' Fat Clay, dark greenish gray, hard, dry, high plasticity cohesive, massive
50			10/10'											
51														
52														
53														
54														
55														
56														
57														
58			8/8'	NP	NV							58' G		
59													SM	58'-58.5' Silty Sand, fine grained, dark greenish gray, medium dense, poorly graded, moist, non-plastic, non-cohesive, massive, plastic fines
60			2/2'									59'-62'	CH	58.5'-74' Fat Clay, dark greenish gray, hard, dry, high plasticity, cohesive, massive
61		15 22												**12/28/11 end of day**
62	5' tailpipe	30 50/5"					34.03	85.01	7.25E-09			61'-62'		**Note: Descriptions, laboratory analysis, and blow counts collected from soil boring BG-2D.**
63				29	100	71					8.63	59'-62'		**Note: Alluvium observed from 0'-24.5'; Muddy Creek Formation observed from 24.5'- 65'**
64														**Muddy Creek Green Member 24.5'-65'**
														Gradational changes between lithologies unless otherwise noted
65	**TD=65'**													**Total drilling depth 65' - 12/29/11**

Soil Boring Log and Monitoring Well Diagram

Stanley Consultants INC.

Boring/Well Number: **BG-2D**	Facility Name **NV Energy- Reid Gardner Station**	Facility Street Address **Clark County, NV**	Page **1 of 3**
Boring Location:	Northing: **26939679.5169**	Easting: **928836.8716**	
Boring Depth (ft) X Diameter (in): **100' x 8"**		Drilling Method: **Sonic**	
Certified Well Contractor Name: **Eagle Drilling**		Logged by: **J. Oriano/ T. Knause**	
Start Date: **12/20/2011**	End Date: **12/27/2011**	Ground Surface Elevation (ASL): **1614.15'**	
Start Time: **09:30**	End Time: **14:00**	Top of Casing Elevation (ASL): **1617.65'**	

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
0	Aboveground steel protector													
1	concrete pad											C	SP	0'-18' Poorly Graded Sand, tan, fine grained, loose, dry, non-plastic, non-cohesive, massive
2												0-2'		
3	4" schedule 40 PVC casing													
4														
5														
6	10' concrete surface seal													
7														
8														
9														
10			4.5/10									10' G		
11	bentonite grout													
12														
13														
14														
15														
16														
17														
18													SM	18'-20.5' Silty Sand with Gravel, weak to moderately carbonate cemented sand and gravel, light gray with white to brown thin beds, stiff, dry, non-plastic, non-cohesive, with few round to angular tan to dark gray limestone gravel and volcanic gravel (<2") and trace fine to coarse grained sand
19												19' G		
20			5/10'											
21		17											SM	20.5'-24.5' Silty Sand with Gravel, fine to medium grained, well graded, dark brown to dark reddish brown, loose, moist to wet at 24', non-plastic, cohesive, massive, oxidized, with little gravel and cobbles (<4"), angular to rounded, limestone, dolomite, and volcanics, plastic fines, trace gypsum crystals
		15										21' G		
22		15					6.42	123.35	9.19E-04			20.5'-21.5'		
23	1/3/12			NP	NV	NP					7.81	19'-21'		
24														
25									Alluvium					
								Muddy Creek					CH	24.5'-28' Fat Clay, olive brown, very stiff, dry, high plasticity, cohesive, generally massive with trace gypsum crystals throughout, gypsum crystals concentrated along fractures, trace fine grained sand lenses, sand ranges from orange to tan, black mottles, trace limestone gravel
26														
27														
28													SM	28'-29', Silty Sand, fine grained, dark yellowish brown, medium dense, poorly graded, moist, non-plastic, non-cohesive, massive, trace gray clay nodules (<1")
29													CH	29'-30' Fat Clay, dark gray, hard, dry, high plasticity, cohesive, massive, trace black mottles, massive, uniform color
30			10/10'									30' G	SM	30'-32', Silty Sand, fine grained, grayish brown, medium dense, poorly

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-2D	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**2 of 3**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
31														graded, moist, non-plastic, non-cohesive, massive, minor dark reddish staining
														@ 32' - color change, light gray (~0.5") and orange red (~2")
32												32' G	CH	32'-33.5' Fat Clay, dark greenish gray, hard, dry, high plasticity,
	4" schedule													cohesive, massive, trace rounded flat gypsum nodules (<0.5")
33	40 PVC casing													
													SM	33.5'-34.5' Silty Sand, fine grained, dark greenish gray, medium dense,
34														poorly graded, moist, non-plastic, non-cohesive, massive
													CH	34.5'-38' Fat Clay, dark greenish gray, hard, dry, high plasticity,
35														cohesive, massive, trace angular limestone gravel (<0.5" to 3")
36														
37														
38														
													SM	38'-41' Silty Sand, fine grained, dark greenish gray, medium dense,
39														poorly graded, moist, non-plastic, non-cohesive, massive
40			10/10'											
41	bentonite													
	grout												CH	41'-42' Fat Clay, dark greenish gray, hard, dry, high plasticity, cohesive,
42														massive
													CL	42'-43' Lean Clay with Sand, fine grained, dark greenish gray, medium
43		9												dense, poorly graded, moist, non-plastic, non-cohesive, massive
		17										43'-	CH	43'-47' Fat Clay, dark greenish gray, hard, dry, high plasticity, cohesive,
44		50-6"					23.61	93.5	5.3E-08			44		massive
45				20	33	13					8.48	42'-44'		
46														
47														
													SM	47'-48' Silty Sand, fine grained, dark greenish gray, medium dense,
48														poorly graded, moist, non-plastic, non-cohesive, massive
													CH	48'-58' Fat Clay, dark greenish gray, hard, dry, high plasticity, cohesive,
49														massive
50			10/10'											
51														
52														
53														
54														
55														
56														
57														
58			8/8'	NP	NV							58' G		**12/20/11 end of day**
													SM	58'-58.5' Silty Sand, fine grained, dark greenish gray, medium dense,
59														poorly graded, moist, non-plastic, non-cohesive, massive
												59'-	CH	58.5'-74' Fat Clay, dark greenish gray, hard, dry, high plasticity,
60			2/2'									62		cohesive, massive
		15												
61		22												
		30										61'-		
62		50/5"					34.03	85.01	7.25E-09			62		
63				29	100	71					8.63	59'-62'		
64														
65														

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-2D	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**3 of 3**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
66														
67														
68														
69	4" schedule 40 PVC casing													
70			10/10'											
71														
72	bentonite grout													
73														
74														
75			5/5'	NV	NP	NP					8.08	75' G	SM	74'-77' Silty Sand, fine grained, dark greenish gray, medium dense, poorly graded, wet, non-plastic, non-cohesive, massive
76	#12 sand filter pack	10 18 36					18.58	111.35	5.94E-03					
77		50-3"										76'-77	CH	77'-77.5' Sandy Fat Clay, dark gray, grayish brown, and dark brown interbeds, hard, dry, high plasticity, cohesive
78			3/3'										SM	77.5'-80.5' Silty Sand, fine grained, brown, medium dense, poorly graded, wet, non-plastic, non-cohesive, massive
79														
80			2/2'											**12/21/11 end of day**
81												81' G	CH	80.5'-82' Fat Clay, dark yellowish brown, laminated beds with gray, dark brown, light gray, hard, dry, high plasticity, cohesive, massive
82			2/2'											
83		14 24		NV	NP	NV					8.32	82.5'-83.5	SM	82'-100' Silty Sand, fine grained, reddish brown, medium dense, poorly graded, wet, non-plastic, non-cohesive, massive, with 1" to 2" clay lenses and little sandstone clasts
84	15'-0.01" slot PVC screen	50-5"	2/2'											
85							21.22	108.84	8.46E-02			82'-84'		
86			2/2'											
87														
88														
89														@89' -6" clay, reddish brown with tan and brown laminations, hard, dry, with trace tan sandstone clasts
90			4/4'											
91														
92														
93														
94			flowing sand											@94' - 4" clay, reddish brown with tan and brown laminations, hard, dry
95			5/5'											**12/22/11 end of day**
96														@95' - strongly cemented sandstone clasts (2"-4"), light reddish brown
97	5' tailpipe													**Note: Alluvium observed from 0'-24.5';**
98														**Muddy Creek Formation observed from 24.5'-100'** **Muddy Creek Green Member 24.5'-80.5', Red Member 80.5'-100'**
99			flowing sand											**Gradational changes between lithologies unless otherwise noted** **Flowing sand cave in to 98'**
100	**TD=100'**		5/5'											**Total drilling depth 100' - 12/27/11**

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-3S	NV Energy- Reid Gardner Station	Clark County, NV	1 of 3

Boring Location:	Northing: 26944006.0762	Easting: 937534.0105	
Boring Depth (ft) X Diameter (in):	80' X 8"	Drilling Method:	Sonic
Certified Well Contractor Name:	Eagle Drilling	Logged by:	T. Knause / J. Oriano
Start Date: 3/5/2012	End Date: 3/7/2012	Ground Surface Elevation (ASL):	1621.07'
Start Time: 08:00	End Time: 15:30	Top of Casing Elevation (ASL):	1623.60'

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
0	Aboveground steel protector													
1	concrete pad											0-2' C	SP-SM	0' - 2' Sand with Silt and Gravel, very fine grained, reddish brown, few angular sandstone clast (<1"), loose, dry, massive.
2														
3	4" schedule 40 PVC casing												SP-SM	2' - 5' Sand with Silt and Gravel, very fine grained, tan, little angular sandstone clast (<2"), loose, dry, massive, thinly bedded, powdery carbonate
4														
5			5/5'											
6	10' concrete surface seal												SP-SM	5' - 7' Sand with Silt and Gravel, poorly graded, very fine grained, tan, little angular sandstone clast (<1"), loose, dry, massive
7														
8													CL	7' - 10' Lean Clay with Sand, very fine grained, grayish tan, weakly cemented to loose sand, dry, non-plastic, slow dilatency, non-cohesive, massive
9														
10			5/5'									10' G		
11									Alluvium				SM	10' - 11' Silty Sand, very fine grained, tan, poorly graded, loose, dry
12	bentonite grout								Muddy Creek				CL	11' - 16' Lean Clay, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, beds (2"-3") of carbonate, white, hard, dry
13														
14														
15														
16			6/6'											
17												17' G	CL	16' - 20' Lean Clay, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, interbedded with tan silt and reddish brown sand, very finegrained, loose, dry, little gypsum lenses or laminations
18														
19														
20			4/4'											
21		50/2"	NC										CL	20' - 27' Lean Clay, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, interbedded with white carbonate, hard, dry
22												22' G		
23														
24														
25														
26														
27			7/7'											
28													CL	27' - 28' Lean Clay, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, massive
29												29' G	SP	28' - 30' Poorly Graded Sand, very fine grained, brown, loose, dry, massive
30			3/3'											

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-3S	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**2 of 3**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
31													SP	30' - 31' Poorly Graded Sand, fine grained, brown, loose, dry, massive 31' - 32' Caliche, white, hard, dry, massive
32													CL	32'-35' Lean Clay, hard, dry, reddish brown, low to medium plasticity, slow dilatency, cohesive, massive
33	4" schedule 40 PVC casing													
34														
35														
36			6/6'										ML	35'-36' Silt, reddish brown, dry, loose, non-plastic, rapid dilatency, non-cohesive, massive
37													CL	36'-37' Lean Clay, hard, dry, reddish brown, low to medium plasticity, slow dilatency, cohesive, massive
38													SP	37'-38' Poorly Graded Sand, very fine grained, brown, loose, dry, massive
39													CL	38'-39' Lean Clay, hard, dry, reddish brown, low to medium plasticity, slow dilatency, cohesive, massive
40		14	4/4' 1.4/1.4										ML	39'-40' Silt, reddish brown, dry, loose, non-plastic, rapid dilatency, very angular sandstone clast (<1"), loose, dry, massive
41	bentonite grout	25 50/5"					21.58	103.25	2.41E-09			40.5-41.5	CL	40'-41' Lean Clay, hard, dry, reddish brown, low to medium plasticity, slow dilatency, cohesive, massive
42													SP	41' - 43' Poorly Graded Sand, very fine grained, brown, loose, dry, massive
43				17	41	24				0.4	8.31	40'-42'		
44													CL	43' - 44' Lean Clay, hard, dry, reddish brown, low to medium plasticity, slow dilatency, cohesive, massive
45			5/5'										ML	44' - 46' Silt, tan, dry, loose, non-plastic, rapid dilatency, non-cohesive, interbedded with white carbonate, hard, dry
46														
47													SM	46' - 50' Silty Sand, very fine grained, poorly graded, brown to tan, loose, dry
48														
49														
50			5/5'											**3/5/12 end of day**
51													ML	50'-51' Silt, tan, loose, dry, non-plastic, rapid dilatency, non-cohesive, massive
52													SP	51' - 54' Silty Sand, very fine grained, poorly graded, brown to tan, loose, dry
53														
54			4/4'											
55													SP	54' - 55' Poorly Graded Sand, very fine grained, brown, loose, moist, massive
56													ML	55' - 56' Silt, tan, loose, dry, non-plastic, rapid dilatency, non-cohesive,
57													SP	56' - 59' Silty Sand, very fine grained, poorly graded, brown to tan, loose, dry
58				NP	NV	NP				0.3	8.95	58'-60'		
59	#12 sand filter pack												CH	59' 60' Fat Clay, hard, moist, reddish brown, high plasticity, slow dilatency, cohesive, massive
60			6/6'											
61		50/5"					3.53	101.78	2.27E-03			60'-60.5	ML	60' - 61' Silt with Sand and Gravel, angular sandstone clasts, grayish brown, loose, moist, non-plastic, rapid dilatency, non-cohesive, massive
62	3/7/2012												SP	61' - 64' Poorly Graded Sand, very fine grained, reddish brown, loose, moist, massive
63	15'-0.01" slot PVC screen											63' G		
64													CH	64' - 65' Fat Clay, medium stiff, moist, reddish brown, high plasticity, slow dilatency, cohesive, massive
65												65' G	SP	65' - 68' Poorly Graded Sand, very fine grained, reddish brown, loose,

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-3S	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**3 of 3**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
66														wet, massive
67	#12 sand filter pack		6/6'											
68														
69												69' G	CL	68' - 70' Lean Clay, stiff, moist, reddish brown, low plasticity, slow dilatency, cohesive, massive
70			3/3'											
71													CL/CH	70'-71' Lean to Fat Clay, gradational, hard, moist, reddish brown, low to high plasticity, cohesive, tan silt laminations
72	15'-0.01" slot PVC screen												ML	very angular sandstone clast (<2"), loose, dry, massive, thinly bedded 71' - 73.5' Sandy Silt, medium stiff, brown to tan, wet, non-plastic, rapid dilatency, non-cohesive, massive
73			3/3'											
74													CH/CL	73.5' - 77' Fat to Lean Clay, gradational, hard, moist, reddish brown, angular sandstone clast (<1"), loose, dry, massive
75														cohesive, tan silt laminations, gypsum lenses and nodules
76														
77	5' tailpipe													
78			5/5'										ML	77' - 79' Sandy Silt, medium stiff, brown to tan, wet, non-plastic, rapid dilatency, non-cohesive, massive
79														
80		4	0.5/2'										SM	79' - 80' Silty Sand, fine grained, poorly graded, reddish brown, medium dense, wet, non-cohesive, massive
81	TD=80'													**3/6/12 end of day** **Total Drilling Depth 80' - 3/7/12**
82														**Note: Descriptions, laboratory analysis, and blow counts collected from soil boring BG-3D.**
83														**Alluvium observed from 0-11'** **Muddy Creek Formation observed from 11'-80'**
84														**Gradational changes between lithologies unless otherwise noted**
85														
86														
87														
88														
89														
90														
91														
92														
93														
94														
95														
96														
97														
98														
99														
100														

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number: **BG-3M**	Facility Name **NV Energy- Reid Gardner Station**	Facility Street Address **Clark County, NV**	Page **1 of 4**
Boring Location:	Northing: **26944014.4708**	Easting: **937539.1169**	
Boring Depth (ft) X Diameter (in): **117' X 8"**		Drilling Method: **Sonic**	
Certified Well Contractor Name: **Eagle Drilling**		Logged by: **T. Knause / J. Oriano**	
Start Date: **2/29/2012**	End Date: **3/5/2012**	Ground Surface Elevation (ASL): **1621.30'**	
Start Time: **11:30**	End Time: **09:30**	Top of Casing Elevation (ASL): **1623.60'**	

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
0	Aboveground steel protector													
1	concrete pad											0-2' C	SP-SM	0' - 2' Sand with Silt and Gravel, very fine grained, reddish brown, few angular sandstone clast (<1"), loose, dry, massive.
2														
3	4" schedule 40 PVC casing												SP-SM	2' - 5' Sand with Silt and Gravel, very fine grained, tan, little angular sandstone clast (<2"), loose, dry, massive, thinly bedded, powdery carbonate
4														
5			5/5'											
6	10' concrete surface seal												SP-SM	5' - 7' Sand with Silt and Gravel, poorly graded, very fine grained, tan, little angular sandstone clast (<1"), loose, dry, massive
7														
8													CL	7' - 10' Lean Clay with Sand, very fine grained, grayish tan, weakly cemented to loose sand, dry, non-plastic, slow dilatency, non-cohesive, massive
9														
10			5/5'									10' G		
11									Alluvium				SM	10' - 11' Silty Sand, very fine grained, tan, poorly graded, loose, dry
12	bentonite grout								Muddy Creek				CL	11' - 16' Lean Clay, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, beds (2"-3") of carbonate, white, hard, dry
13														
14														
15														
16			6/6'											
17												17' G	CL	16' - 20' Lean Clay, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, interbedded with tan silt and reddish brown sand, very finegrained, loose, dry, little gypsum lenses or laminations
18														
19														
20			4/4'											
21		50/2"	NC										CL	20' - 27' Lean Clay, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, interbedded with white carbonate, hard, dry
22												22' G		
23														
24														
25														
26														
27			7/7'											
28													CL	27' - 28' Lean Clay, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, massive
29												29' G	SP	28' - 30' Poorly Graded Sand, very fine grained, brown, loose, dry, massive
30			3/3'											

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-3M	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**2 of 4**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
31													SP	30' - 31' Poorly Graded Sand, fine grained, brown, loose, dry, massive 31' - 32' Caliche, white, hard, dry, massive
32													CL	32'-35' Lean Clay, hard, dry, reddish brown, low to medium plasticity, slow dilatency, cohesive, massive
33	4" schedule 40 PVC casing													
34														
35														
36			6/6'										ML	35'-36' Silt, reddish brown, dry, loose, non-plastic, rapid dilatency, non-cohesive, massive
37													CL	36'-37' Lean Clay, hard, dry, reddish brown, low to medium plasticity, slow dilatency, cohesive, massive
38													SP	37'-38' Poorly Graded Sand, very fine grained, brown, loose, dry, massive
39													CL	38'-39' Lean Clay, hard, dry, reddish brown, low to medium plasticity, slow dilatency, cohesive, massive
40		14	4/4' 1.4'/1.4										ML	39'-40' Silt, reddish brown, dry, loose, non-plastic, rapid dilatency, very angular sandstone clast (<1"), loose, dry, massive
41	bentonite grout	25 50/5"					21.58	103.25	2.41E-09			40.5-41.5'	CL	40'-41' Lean Clay, hard, dry, reddish brown, low to medium plasticity, slow dilatency, cohesive, massive
42													SP	41' - 43' Poorly Graded Sand, very fine grained, brown, loose, dry, massive
43				17	41	24				0.4	8.31	40'-42'		
44													CL	43' - 44' Lean Clay, hard, dry, reddish brown, low to medium plasticity, slow dilatency, cohesive, massive
45			5/5'										ML	44' - 46' Silt, tan, dry, loose, non-plastic, rapid dilatency, non-cohesive, interbedded with white carbonate, hard, dry
46														
47													SM	46' - 50' Silty Sand, very fine grained, poorly graded, brown to tan, loose, dry
48														
49														
50			5/5'											
51													ML	50'-51' Silt, tan, loose, dry, non-plastic, rapid dilatency, non-cohesive, massive
52													SP	51' - 54' Silty Sand, very fine grained, poorly graded, brown to tan, loose, dry
53														
54			4/4'											
55													SP	54' - 55' Poorly Graded Sand, very fine grained, brown, loose, moist, massive
56													ML	55' - 56' Silt, tan, loose, dry, non-plastic, rapid dilatency, non-cohesive,
57													SP	56' - 59' Silty Sand, very fine grained, poorly graded, brown to tan, loose, dry
58				NP	NV	NP				0.3	8.95	58'-60'		
59													CH	59' 60' Fat Clay, hard, moist, reddish brown, high plasticity, slow dilatency, cohesive, massive
60			6/6'											**2/29/12 end of day**
61	3/6/2012	50/5"					3.53	101.78	2.27E-03			60'-60.5'	ML	60' - 61' Silt with Sand and Gravel, angular sandstone clasts, grayish brown, loose, moist, non-plastic, rapid dilatency, non-cohesive, massive
62													SP	61' - 64' Poorly Graded Sand, very fine grained, reddish brown, loose, moist, massive
63												63' G		
64													CH	64' - 65' Fat Clay, medium stiff, moist, reddish brown, high plasticity, slow dilatency, cohesive, massive
65												65' G	SP	65' - 68' Poorly Graded Sand, very fine grained, reddish brown, loose,

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-3M	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**3 of 4**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
66														wet, massive
67	4" schedule 40 PVC casing		6/8'											
68														
69												69' G	CL	68' - 70' Lean Clay, stiff, moist, reddish brown, low plasticity, slow dilatency, cohesive, massive
70			3/3'											
71													CL/CH	70'-71' Lean to Fat Clay, gradational, hard, moist, reddish brown, low to high plasticity, cohesive, tan silt laminations
72	Bentonite												ML	very angular sandstone clast (<2"), loose, dry, massive, thinly bedded 71' - 73.5' Sandy Silt, medium stiff, brown to tan, wet, non-plastic, rapid dilatency, non-cohesive, massive
73			3/3'											
74													CH/CL	73.5' - 77' Fat to Lean Clay, gradational, hard, moist, reddish brown, angular sandstone clast (<1"), loose, dry, massive
75														cohesive, tan silt laminations, gypsum lenses and nodules
76														
77														
78			5/5'										ML	77' - 79' Sandy Silt, medium stiff, brown to tan, wet, non-plastic, rapid dilatency, non-cohesive, massive
79														
80		4	0.5/2'										SM	79' - 81' Silty Sand, fine grained, poorly graded, reddish brown, medium dense, wet, non-cohesive, massive
81		12 27					24.29	104.74	1.21E-04			80'-81'	CL	81'-82.5' Lean Clay, stiff, reddish brown with brown and tan laminations, medium plasticity, moist
82														
83				NP	NV	NP				0.3	8.46	80'-82	CL/ML/SM	82.5'-87.5' Clay, Silt, and Sand Gradational Interbeds, (<1' each), reddish brown
84														
85														
86														
87														
88													SP-SM	87.5'-90' Poorly Graded Sand with Silt, fine grained, reddish brown, medium dense, wet, non-cohesive
89														@87.5 -sandstone clast, 2" - 4" wide, subangular, @87.5'-88' silt and clay lenses, reddish brown to brown,
90			10/10'											
91													CL	90'-91' Lean clay, reddish brown with brown and tan silt laminations, very stiff, medium plasticity, dry
92													SP	91'-100' Poorly Graded Sand, fine to medium grained, reddish brown to brown, loose, moist, massive
93			3/3'											
94														@93' - 4" sandstone layer and sandstone clasts, well cemented sandstone, < 1" to core diameter width, 1/2" thick, subangular
95												69' G		@94' - 4" fat clay, dark reddish brown with tan laminations, very stiff, dry, trace gray oval gypsum nodules (<0.5")
96														
97														@96' -2" lean clay, carbonate layer on top of clay with sandstone clast (<2", subangular)
98														@97.5' - 1" fat clay, reddish brown with red, tan, and brown
99														@98' - 2" sandstone layer, strongly cemented sandstone, 2" thick @99.5' - 1" lean clay, reddish brown with red, tan, and brown
100			7/7'											@100' - 6" fat clay, dark reddish brown very stiff, dry, few gray

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-3M	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**4 of 4**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
101							17.76	109.35	6.13E-05			100.5'-101.5		oval gypsum nodules (< 0.5")
102	#12 sand filter pack			NP	NV	NP				0.5	8.68	100'-102'		
103														
104													SM	104'-105' Silty Sand, very fine grained, poorly graded, reddish brown, medium dense, wet, non-cohesive, massive
105												105' G	ML	105'-106' Sandy Silt, medium stiff, reddish brown, wet, non-plastic, cohesive, non-plastic, massive
106													CL	106'-107' Lean Clay, hard, reddish brown with brown and tan laminations, medium plasticity, moist, trace gray oval gypsum nodules (<1/2")
107	15'-0.01" slot PVC screen		7/7'										SP-SM	107'-108.5' Poorly Graded Sand with Silt, fine grained, reddish brown, medium dense, wet, non-cohesive, trace dark gray mottles
108													SM	@107' - sandstone clasts, <1", subangular, well cemented 108.5-110' Silty Sand, very fine grained, poorly graded, reddish brown, medium dense, wet, non-cohesive, massive, trace black mottles
109														@109' - sandstone clasts, <2" wide, subangular, strongly cemented, 1" clay layer underlying sandstone, reddish brown
110			3/3'											@109.5' -2" sandstone layer, well cemented sandstone, carbonate
111	5' tailpipe												ML	110'-110.5' Sandy Silt, medium stiff, reddish brown, wet, non-plastic, cohesive
112													CL	110.5-111' Lean Clay, very stiff, reddish brown with brown silt laminations, medium plasticity, dry
113													ML	111'-113' Sandy Silt, medium stiff, reddish brown, wet, non-cohesive, very fine grained sand
114													SM	113'-117' Silty Sand, fine grained, poorly graded, reddish brown, medium dense, wet, non-cohesive
115														@115' - sandstone clast, 1" - 2", semirounded, well cemented
116														
117			7/7'											**Total Drilling Depth 117' - 3/1/12**
118	**TD=117'**													**Note: Descriptions, laboratory analysis, and blow counts collected from soil boring BG-3D.**
119														**Alluvium observed from 0-11'** **Muddy Creek Formation observed from 11'-117'**
120														**Gradational changes between lithologies unless otherwise noted**
121														
122														
123														
124														
125														
126														
127														
128														
129														
130														
131														
132														
133														
134														
135														

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-3D	NV Energy- Reid Gardner Station	Clark County, NV	1 of 5

Boring Location:	Northing: 26944014.3707	Easting: 937529.0290	
Boring Depth (ft) X Diameter (in):	135' X 8"	Drilling Method:	Sonic
Certified Well Contractor Name:	Eagle Drilling	Logged by:	T. Knause / J. Oriano
Start Date: 2/21/2012	End Date: 2/29/2012	Ground Surface Elevation (ASL):	1621.22'
Start Time: 09:00	End Time: 09:30	Top of Casing Elevation (ASL):	1623.91'

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
0	Aboveground steel protector													
1	concrete pad											0-2' C	SP-SM	0' - 2' Sand with Silt and Gravel, very fine grained, reddish brown, few angular sandstone clast (<1"), loose, dry, massive.
2														
3	4" schedule 40 PVC casing												SP-SM	2' - 5' Sand with Silt and Gravel, very fine grained, tan, little angular sandstone clast (<2"), loose, dry, massive, thinly bedded, powdery carbonate
4														
5			5/5'											
6	10' concrete surface seal												SP-SM	5' - 7' Sand with Silt and Gravel, poorly graded, very fine grained, tan, little angular sandstone clast (<1"), loose, dry, massive
7														
8													CL	7' - 10' Lean Clay with Sand, very fine grained, grayish tan, weakly cemented to loose sand, dry, non-plastic, slow dilatency, non-cohesive, massive
9														
10			5/5'									10' G		
11									Alluvium				SM	10' - 11' Silty Sand, very fine grained, tan, poorly graded, loose, dry
12	bentonite grout								Muddy Creek				CL	11' - 16' Lean Clay, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, beds (2"-3") of carbonate, white, hard, dry
13														
14														
15														
16			6/6'											
17												17' G	CL	16' - 20' Lean Clay, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, interbedded with tan silt and reddish brown sand, very finegrained, loose, dry, little gypsum lenses or laminations
18														
19														
20			4/4'											
21		50/2"	NC										CL	20' - 27' Lean Clay, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, interbedded with white carbonate, hard, dry
22												22' G		
23														
24														
25														
26														
27			7/7'											
28													CL	27' - 28' Lean Clay, hard, dry, reddish brown, non-plastic, slow dilatency, non-cohesive, massive
29												29' G	SP	28' - 30' Poorly Graded Sand, very fine grained, brown, loose, dry, massive
30			3/3'											

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-3D	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**2 of 5**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
31													SP	30' - 31' Poorly Graded Sand, fine grained, brown, loose, dry, massive 31' - 32' Caliche, white, hard, dry, massive
32													CL	32'-35' Lean Clay, hard, dry, reddish brown, low to medium plasticity, slow dilatency, cohesive, massive
33	4" schedule 40 PVC casing													
34														
35														
36			6/6"										ML	35'-36' Silt, reddish brown, dry, loose, non-plastic, rapid dilatency, non-cohesive, massive
37													CL	36'-37' Lean Clay, hard, dry, reddish brown, low to medium plasticity, slow dilatency, cohesive, massive
38													SP	37'-38' Poorly Graded Sand, very fine grained, brown, loose, dry, massive
39													CL	38'-39' Lean Clay, hard, dry, reddish brown, low to medium plasticity, slow dilatency, cohesive, massive
40		14	4/4' 1.4/1.4										ML	39'-40' Silt, reddish brown, dry, loose, non-plastic, rapid dilatency, very angular sandstone clast (<1"), loose, dry, massive
41	bentonite grout	25 50/5"					21.58	103.25	2.41E-09			40.5-41.5	CL	**2/21/2012 end of day** 40'-41' Lean Clay, hard, dry, reddish brown, low to medium plasticity, slow dilatency, cohesive, massive
42													SP	41' - 43' Poorly Graded Sand, very fine grained, brown, loose, dry, massive
43				17	41	24				0.4	8.31	40'-42'		
44													CL	43' - 44' Lean Clay, hard, dry, reddish brown, low to medium plasticity, slow dilatency, cohesive, massive
45			5/5'										ML	44' - 46' Silt, tan, dry, loose, non-plastic, rapid dilatency, non-cohesive, interbedded with white carbonate, hard, dry
46														
47													SM	46' - 50' Silty Sand, very fine grained, poorly graded, brown to tan, loose, dry
48														
49														
50			5/5'											
51													ML	50'-51' Silt, tan, loose, dry, non-plastic, rapid dilatency, non-cohesive, massive
52													SP	51' - 54' Silty Sand, very fine grained, poorly graded, brown to tan, loose, dry
53														
54			4/4'											
55													SP	54' - 55' Poorly Graded Sand, very fine grained, brown, loose, moist, massive
56													ML	55' - 56' Silt, tan, loose, dry, non-plastic, rapid dilatency, non-cohesive,
57													SP	56' - 59' Silty Sand, very fine grained, poorly graded, brown to tan, loose, dry
58				NP	NV	NP				0.3	8.95	58'-60'		
59														
60			6/6"										CH	59' 60' Fat Clay, hard, moist, reddish brown, high plasticity, slow dilatency, cohesive, massive
61		50/5"					3.53	101.78	2.27E-03			60'-60.5	ML	60' - 61' Silt with Sand and Gravel, angular sandstone clasts, grayish brown, loose, moist, non-plastic, rapid dilatency, non-cohesive, massive
62	3/6/2012												SP	61' - 64' Poorly Graded Sand, very fine grained, reddish brown, loose, moist, massive
63												63' G		
64													CH	64' - 65' Fat Clay, medium stiff, moist, reddish brown, high plasticity, slow dilatency, cohesive, massive
65												65' G	SP	65' - 68' Poorly Graded Sand, very fine grained, reddish brown, loose,

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-3D	NV Energy- Reid Gardner Station	Clark County, NV	3 of 5

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
66														wet, massive
67	4" schedule 40 PVC casing		8/8'											
68														
69												69' G	CL	68' - 70' Lean Clay, stiff, moist, reddish brown, low plasticity, slow dilatency, cohesive, massive
70			3/3'											
71													CL/CH	70'-71' Lean to Fat Clay, gradational, hard, moist, reddish brown, low to high plasticity, cohesive, tan silt laminations
72	Bentonite												ML	very angular sandstone clast (<2"), loose, dry, massive, thinly bedded 71' - 73.5' Sandy Silt, medium stiff, brown to tan, wet, non-plastic, rapid dilatency, non-cohesive, massive
73			3/3'											
74													CH/CL	73.5' - 77' Fat to Lean Clay, gradational, hard, moist, reddish brown, angular sandstone clast (<1"), loose, dry, massive
75														cohesive, tan silt laminations, gypsum lenses and nodules
76														
77														
78			5/5'										ML	77' - 79' Sandy Silt, medium stiff, brown to tan, wet, non-plastic, rapid dilatency, non-cohesive, massive
79														
80		4	0.5/2'										SM	79' - 81' Silty Sand, fine grained, poorly graded, reddish brown, medium dense, wet, non-cohesive, massive
81		12 27					24.29	104.74	1.21E-04			80'-81'	CL	**2/22/2012 end of day** 81'-82.5' Lean Clay, stiff, reddish brown with brown and tan laminations, medium plasticity, moist
82														
83				NP	NV	NP				0.3	8.45	80'-82'	CL/ML/SM	82.5'-87.5' Clay, Silt, and Sand Gradational Interbeds, (<1' each), reddish brown
84														
85														
86														
87														
88													SP-SM	87.5'-90' Poorly Graded Sand with Silt, fine grained, reddish brown, medium dense, wet, non-cohesive
89														@87.5 -sandstone clast, 2" - 4" wide, subangular, @87.5'-88' silt and clay lenses, reddish brown to brown,
90			10/10'											
91													CL	90'-91' Lean clay, reddish brown with brown and tan silt laminations, very stiff, medium plasticity, dry
92													SP	91'-100' Poorly Graded Sand, fine to medium grained, reddish brown to brown, loose, moist, massive
93			3/3'											
94														@93' - 4" sandstone layer and sandstone clasts, well cemented sandstone, < 1" to core diameter width, 1/2" thick, subangular
95												69' G		@94' - 4" fat clay, dark reddish brown with tan laminations, very stiff, dry, trace gray oval gypsum nodules (<0.5")
96														
97														@96' -2" lean clay, carbonate layer on top of clay with sandstone clast (<2", subangular)
98														@97.5' - 1" fat clay, reddish brown with red, tan, and brown
99														@98' - 2" sandstone layer, strongly cemented sandstone, 2" thick @99.5' - 1" lean clay, reddish brown with red, tan, and brown
100			7/7'											@100' - 6" fat clay, dark reddish brown very stiff, dry, few gray

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-3D	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**4 of 5**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
														oval gypsum nodules (< 0.5")
101							17.76	109.35	6.13E-05			100.5'-101.5		
102														
				NP	NV	NP				0.5	8.68	100'-102		
103														
													SM	104'-105' Silty Sand, very fine grained, poorly graded, reddish brown,
104														medium dense, wet, non-cohesive, massive
													ML	105'-106' Sandy Silt, medium stiff, reddish brown, wet, non-plastic,
105												105' G		cohesive, non-plastic, massive
													CL	106'-107' Lean Clay, hard, reddish brown with brown and tan laminations,
106														medium plasticity, moist, trace gray oval gypsum nodules (<1/2")
													SP-SM	107'-108.5' Poorly Graded Sand with Silt, fine grained, reddish brown,
107	4" schedule		7/7'											medium dense, wet, non-cohesive, trace dark gray mottles
	40 PVC casing													@107' - sandstone clasts, <1", subangular, well cemented
108													SM	108.5-110' Silty Sand, very fine grained, poorly graded, reddish brown,
109														medium dense, wet, non-cohesive, massive, trace black mottles
														@109' - sandstone clasts, <2" wide, subangular, strongly
														cemented, 1" clay layer underlying sandstone, reddish brown
110			3/3'											@109.5' -2" sandstone layer, well cemented sandstone,
														carbonate
111													ML	110'-110.5' Sandy Silt, medium stiff, reddish brown, wet, non-plastic,
														cohesive
112													CL	110.5-111' Lean Clay, very stiff, reddish brown with brown silt
														laminations, medium plasticity, dry
113													ML	111'-113' Sandy Silt, medium stiff, reddish brown, wet,
														non-cohesive, very fine grained sand
114													SM	113'-119' Silty Sand, fine grained, poorly graded, reddish brown,
115														medium dense, wet, non-cohesive
														@115' - sandstone clast, 1" - 2", semirounded,
116														well cemented
117			7/7'											
118														
119														@118' - 1" sandstone layer, reddish brown, well cemented
														sandstone, clay mottles (< 1" - < 2")
														119'-120' - Sandstone, Sand, and Carbonate, 1" thick sandstone layers
120			3/3'											
		5												**2/23/12 end of day**
121		11										120.5'-121.5	SM	120'-124' Silty sand, fine to medium grained, poorly graded, reddish
		37					20.10	110.85	5.83E-06					brown, medium dense, wet, non-cohesive, trace clay and sandstone
122														@121' - 4" clay and silt interbeds
				NP	NV	NP				8.68	0.9	102'-122'		@122' - sandstone clast, <2", poorly to strongly cemented
123														@123.5' - 6" sandstone interbeds, 2" thick layers, reddish
124														brown, strongly cemented sandstone
													ML	124'-128" Sandy Silt, medium stiff, reddish brown, wet,
125														non-cohesive, very fine grained sand
126	bentonite													@124.5' -2" clay beds, reddish brown, stiff
	grout													@126' -2" clay beds, reddish brown, stiff
127														
128			8/8'											
													SM	128'-131' Silty Sand and Carbonate, fine grained, poorly graded, tan,
129	#12 sand													dense, moist, non-cohesive
	filter pack													
130			2/2'											
131	15'-0.01" slot											131' G	SM	131'-135.5' Silty Sand, very fine grained, poorly graded, reddish brown,
	PVC screen													medium dense, wet, non-cohesive to cohesive, non-plastic, trace
132														sandstone clasts and medium grained sand laminations
133														
134														@135' - sandstone clast, < 2" - < 3", strongly cemented,
135														subangular

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-3D	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**5 of 5**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
													CL	135.5-136.5' Lean clay, hard, reddish brown, blocky, with gravel layers
136												136' G	SM	136.5'-141' Silty Sand, fine to medium grained, poorly graded, reddish brown, medium dense, wet, non-cohesive, no gravel
137	#12 sand filter pack													
138														
139														
140			10/10'											@140' - trace gray sand nodules
														@141'- 3" sandstone clasts, < 3", strongly cemented
141													CL	141'-142' Lean Clay, reddish brown, stiff, moist, silt lenses and gray mottles, medium plasticity
142	15'-0.01" slot PVC screen												ML	142'-143.5' Sandy Silt, medium stiff, reddish brown, wet, non-cohesive, very fine grained sand, massive
143			3/3'									142.5'- 143.5	CL	143.5' - 146' Lean Clay with Sand, stiff, dry, reddish brown, non-cohesive, with very fine grained sand
144							19.51	106.32	8.46E-07					
145				NP	NV	NP				0.1	8.85	42.5'-144'		
146													SM	146'-147' Silty Sand, fine grained, poorly graded, reddish brown, medium dense, moist, non-cohesive
147	5' tailpipe													147'-151' Sandstone and Carbonate
148														@147-148.5 - tan to grey sandstone clasts and carbonate @148.5-2" thick layer of sandstone, reddish brown
149			6/6'											**2/27/12 end of day**
150														@150'- difficult drilling, strongly cemented sandstone and caliche
151			2/2'											**2/28/12 end of day**
152	TD=151'													
153														**Note: Alluvium observed from 0-11'** **Muddy Creek Formation observed from 11'-151'**
154														**Gradational changes between lithologies unless otherwise noted**
155														**Total Drilling Depth 151' - 2/28/12**
156														
157														
158														
159														
160														
161														
162														
163														
164														
165														
166														
167														
168														
169														
170														

Soil Boring Log and Monitoring Well Diagram

Stanley Consultants INC.

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-4S	NV Energy- Reid Gardner Station	Clark County, NV	1 of 4

Boring Location:	Northing: 26945592.9758	Easting: 934861.8333	
Boring Depth (ft) X Diameter (in):	105' x 8"	Drilling Method:	Sonic
Certified Well Contractor Name:	Eagle Drilling	Logged by:	J. Oriano/T. Knause
Start Date: 2/1/2012	End Date: 2/2/2012	Ground Surface Elevation (ASL):	1659.94'
Start Time: 11:00	End Time: 16:00	Top of Casing Elevation (ASL):	1662.43'

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
0	Aboveground steel protector													
1									Muddy Creek			C	CL	0-2' Sandy Clay, soft, reddish brown, dry, low plasticity, massive, some very fine grained sand, reddish brown.
2												0-2'	CL	2'-5' Lean Clay, reddish brown, stiff, dry, medium plasticity, blocky, reddish brown, brown, and tan silt laminations
3	4" schedule 40 PVC casing													
4														
5			5/5'										SP	5'-7.5' Sand, poorly graded, loose, reddish brown, fine grained, dry, non-cohesive, massive, little clay nodules
6	10' concrete surface seal													@6' - 6" sandstone layer, 2" thick beds, trace powdery carbonate
7														
8													CL	7.5'-9' Lean Clay, reddish brown, stiff, dry, medium plasticity, blocky, reddish brown, brown, and tan silt laminations
9			4/4'											@9' -3" Sandstone clasts, light reddish brown, subangular, <2", powdery carbonate
10												10' G	SC	9'-19' Clayey Sand, poorly graded, loose, reddish brown, fine grained, dry, non-cohesive, massive, little clay nodules
11	bentonite grout													
12														
13														
14														
15			6/6'											
16														
17														
18														@18' - 6" powdery carbonate, white, loose, dry, non-cohesive
19												19' G	CL	19'-28' Lean Clay, reddish brown, stiff, dry, medium plasticity, blocky, reddish brown, brown, and tan silt laminations
20			6/6'											
21		50 / 50					3.21	103.56	1.62E-04			20.5'-21.5'		
22		50/5"	2/2'	18	47	29				1.0	8.10	20'-22'		
23														
24														
25														
26			4/4'											
27														
28													SC	28'-32.5' Clayey Sand, poorly graded, loose, reddish brown, fine grained, dry, non-cohesive, little reddish brown clay laminated beds
29														
30			4/4'											

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-4S	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**2 of 4**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
31														
32													SM	32.5'-33.5' Silty Sand and Carbonate, white, loose, dry, non-cohesive, reddish brown, fine grained sand
33	4" schedule 40 PVC casing													
34													CL	33.5'-40' Lean Clay, reddish brown with tan and brown laminations, dry, stiff, medium plasticity, cohesive, with occasional 1" beds of carbonate
35			5/5'											
36														
37														
38														
39														@38' 8" sandy, reddish brown fine grained sand
40			5/5'									40' G		@39' - 4" carbonate, white, sandy
41	bentonite grout	16 37 50/4"					16.11	115.16	1.70E-09			40.5'-41.5	CL	40'-47' Lean to Fat Clay, dark reddish brown, stiff, dry, uniform color, trace gray gypsum clasts, cohesive, medium to high plasticity
42														@42' - 6" sandstone clasts and carbonate, subangular, <2.5", dry
43				16	39	23				2.4	8.24	40'-42'		
44														
45														
46			6/6'											
47														
48													SP	47'-50' Sand, reddish brown, fine grained, dry, loose, non-cohesive, with little subangular sandstone gravel, subangular, 1-6 cm
49														
50			4/4'										CH	50'-54' Fat Clay, dark reddish brown, stiff, dry, uniform color, trace gray gypsum nodules, (<1"), cohesive, high plasticity
51														
52														
53														
54														
55													SC	54'-57' Clayey Sand, poorly graded, loose, reddish brown, fine grained, dry, non-cohesive, with trace 0.5" - 4" clay nodules and sandstone clasts
56														
57			7/7'										CH	57'-60' Fat Clay, dark reddish brown, stiff, dry, uniform color, trace gray gypsum nodules, (<1"), cohesive, high plasticity
58														
59														
60			3/3'										ML	60'-64' Silt with Sand, soft, light reddish brown, dry, low plasticity, with some very fine grained sand
61		24 50/2"					NA	NA	NA			60'-60.5		
62														
63				NP	NV	NP				1.1	8.66	60'-62'		
64														
65												65' G	SC	64'-67' Clayey Sand, poorly graded, loose, reddish brown, fine grained, dry, non-cohesive, with trace 0.5" - 1.5" clay nodules

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-4S	NV Energy- Reid Gardner Station	Clark County, NV	3 of 4

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
66														
67			7/7'										CH	67'-72' Fat Clay, dark reddish brown, stiff, dry, uniform color trace gray gypsum nodules, (<1"), cohesive, high plasticity
68	4" schedule 40 PVC casing													
69	bentonite grout													
70			3/3'											
71	#12 sand filter pack													
72													SP	72'-74' Sand, poorly graded, reddish brown, very fine grained, dry, loose, non-cohesive, with little reddish brown clay nodules (<5"),
73														
74														
75													CL	74'-76' Lean Clay, reddish brown with tan and brown laminations, dry, very stiff, medium plasticity, cohesive
76			6/6'										SP	76'-77' Sand, poorly graded, reddish brown, fine grained, dry, loose, non-cohesive, with <1.5" sandstone subangular gravel
77														
78													CL	77'-80' Lean Clay with Sand, stiff, reddish brown with tan laminations and brown mottles, cohesive, medium plasticity, blocky, with some very fine grained sand
79												79' G		
80	▽ ▼ 2/3/12		4/4'										CL	@80' soft, moist 80'-81' Lean Clay, very stiff, reddish brown with tan, gray, and red laminations, massive and tight, dry
81		18 41					18.8	108.11	7.65E-07			80.5'-	CL-ML	81'-83' Silty Clay, medium soft, reddish brown, moist, cohesive, low plasticity massive
82		50/5"										81.5 82 G		
83				21	28	7				1.6	8.37	80'-82'	CL/SP	83'-86' Clay and Sand Interbeds, grades over 16" from very fine to fine/medium grained sand, moist
84														
85														
86													CH	86'-87' Fat Clay, dark reddish brown, very stiff, dry, uniform color high plasticity
87													SP	87'-90' Sand, reddish brown, poorly graded, non-cohesive, massive, moist to wet, with trace sandstone clasts, 0-2"
88			8/8'											
89														
90													CH	90'-92' Fat Clay, reddish brown, very stiff, dry, uniform color, cohesive, high plasticity, trace gray gyspum nodules, < 1"
91	15'-0.01" slot PVC screen													
92			4/4'										CL/SP/ML	92'-97' Interbeds of Sand, Silt, and Clay, (<6"), gradational changes, Sandy at 92-93', 93.5'-95', 95.5-96.5' Silty at 95'-95.5'
93														
94														
95												95' G		
96														
97													SM	97'-99' Silty Sand, poorly graded, medium dense, reddish brown, fine grained, wet, non-cohesive
98	5' tailpipe													
99													CL-ML	99'-100' Silty Clay, medium soft, reddish brown, moist, cohesive, low plasticity, massive
100			8/8'											

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-4S	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**4 of 4**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
101	5' tailpipe	50.5/5"											ML	100'-101' Sandy Silt, soft, reddish brown, wet, non cohesive, with some large sandstone clasts, subangular, 0-4" at bottom of bed
		93		17	34	17					8.22	101'-		
102		39					16.83	109.93	5.46E-09			102	CL	101'-104' Sandy lean clay, medium dense, reddish brown, wet, medium plasticity, with sandy laminations, very fine grained
103	#12 sand filter pack											100'-102'		
104													SM	104'-105' Silty sand, poorly graded, medium dense, reddish brown, fine grained, non-cohesive, grades to sandy silt, wet, massive
105														**Total drilling depth 105' - 2/2/12 End of Day**
	TD=105'													**Note: Descriptions, laboratory analysis, and blow counts collected from soil boring BG-4D.**
106														**Muddy Creek Formation observed from 0 - 105'**
107														**Gradational changes between lithologies unless otherwise noted**
108														
109														
110														
111														
112														
113														
114														
115														
116														
117														
118														
119														
120														
121														
122														
123														
124														
125														
126														
127														
128														
129														
130														
131														
132														
133														
134														
135														

Soil Boring Log and Monitoring Well Diagram

Stanley Consultants INC.

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-4M	NV Energy- Reid Gardner Station	Clark County, NV	1 of 4

Boring Location:	Northing: 26945600.2131	Easting: 934855.5130	
Boring Depth (ft) X Diameter (in):	135' x 8"	Drilling Method:	Sonic
Certified Well Contractor Name:	Eagle Drilling	Logged by:	J. Oriano/T. Knause
Start Date: 1/27/2012	End Date: 1/31/2012	Ground Surface Elevation (ASL):	1659.52'
Start Time: 08:00	End Time: 16:00	Top of Casing Elevation (ASL):	1662.43'

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
0	Aboveground steel protector													
								Muddy Creek					CL	0-2' Sandy Clay, soft, reddish brown, dry, low plasticity, massive,
1												C		some very fine grained sand, reddish brown.
2												0-2'	CL	2'-5' Lean Clay, reddish brown, stiff, dry, medium plasticity, blocky,
	4" schedule													reddish brown, brown, and tan silt laminations
3	40 PVC casing													
4														
5			5/5'										SP	5'-7.5' Sand, poorly graded, loose, reddish brown, fine grained, dry,
														non-cohesive, massive, little clay nodules
6	10' concrete													@6' - 6" sandstone layer, 2" thick beds, trace powdery
	surface seal													carbonate
7														
8													CL	7.5'-9' Lean Clay, reddish brown, stiff, dry, medium plasticity, blocky, reddish brown, brown, and tan silt laminations
9			4/4'											@9' -3" Sandstone clasts, light reddish brown, subangular, <2", powdery carbonate
10												10' G	SC	9'-19' Clayey Sand, poorly graded, loose, reddish brown, fine grained,
														dry, non-cohesive, massive, little clay nodules
11	bentonite													
	grout													
12														
13														
14														
15			6/6'											
16														
17														
18														@18' - 6" powdery carbonate, white, loose, dry, non-cohesive
19												19' G	CL	19'-28' Lean Clay, reddish brown, stiff, dry, medium plasticity, blocky,
														reddish brown, brown, and tan silt laminations
20			6/6'											
		50												
21		50					3.21	103.56	1.62E-04			20.5'-		
		50/5"										21.5		
22			2/2'											
				18	47	29				1.0	8.10	20'-22'		
23														
24														
25														
26			4/4'											
27														
28													SC	28'-32.5' Clayey Sand, poorly graded, loose, reddish brown, fine grained,
														dry, non-cohesive, little reddish brown clay laminated beds
29														
30			4/4'											

Stanley Consultants INC

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-4M	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**2 of 4**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
31														
32													SM	32.5'-33.5' Silty Sand and Carbonate, white, loose, dry, non-cohesive, reddish brown, fine grained sand
33	4" schedule 40 PVC casing													
34													CL	33.5'-40' Lean Clay, reddish brown with tan and brown laminations, dry, stiff, medium plasticity, cohesive, with occasional 1" beds of carbonate
35			5/5'											
36														
37														
38														
39														@38' 8" sandy, reddish brown fine grained sand
40			5/5'									40' G		@39' - 4" carbonate, white, sandy
41	bentonite	16 37					16.11	115.16	1.70E-09				CL-CH	40'-47' Lean to Fat Clay, dark reddish brown, stiff, dry, uniform color, trace gray gypsum clasts, cohesive, medium to high plasticity
42	grout	50/4"										40.5'-41.5		@42' - 6" sandstone clasts and carbonate, subangular, <2.5", dry
43				16	39	23				2.4	8.24	40'-42'		
44														
45														
46			6/6'											
47														
48													SP	47'-50' Sand, reddish brown, fine grained, dry, loose, non-cohesive, with little subangular sandstone gravel, subangular, 1-6 cm
49														
50			4/4'										CH	50'-54' Fat Clay, dark reddish brown, stiff, dry, uniform color, trace gray gypsum nodules, (<1"), cohesive, high plasticity
51														
52														
53														
54													SC	54'-57' Clayey Sand, poorly graded, loose, reddish brown, fine grained, dry, non-cohesive, with trace 0.5" - 4" clay nodules and sandstone clasts
55														
56														
57			7/7'										CH	57'-60' Fat Clay, dark reddish brown, stiff, dry, uniform color, trace gray gypsum nodules, (<1"), cohesive, high plasticity
58														
59														
60			3/3'										ML	60'-64' Silt with Sand, soft, light reddish brown, dry, low plasticity, with some very fine grained sand
61		24 50/2"					NA	NA	NA			60'-60.5		
62				NP	NV	NP				1.1	8.66	60'-62'		
63														
64													SC	64'-67' Clayey Sand, poorly graded, loose, reddish brown, fine grained, dry, non-cohesive, with trace 0.5" - 1.5" clay nodules
65												65' G		

Soil Boring Log and Monitoring Well Diagram

Stanley Consultants INC.

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-4M	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**3 of 4**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
66														
67			7/7'										CH	67'-72' Fat Clay, dark reddish brown, stiff, dry, uniform color trace gray gypsum nodules, (<1"), cohesive, high plasticity
68	4" schedule 40 PVC casing													
69														
70			3/3'											
71														
72													SP	72'-74' Sand, poorly graded, reddish brown, very fine grained, dry, loose, non-cohesive, with little reddish brown clay nodules (<5"),
73														
74														
75													CL	74'-76' Lean Clay, reddish brown with tan and brown laminations, dry, very stiff, medium plasticity, cohesive
76	bentonite grout		6/6'											76'-77' Sand, poorly graded, reddish brown, fine grained, dry, loose, non-cohesive, with <1.5" sandstone subangular gravel
77														
78													CL	77'-80' Lean Clay with Sand, stiff, reddish brown with tan laminations and brown mottles, cohesive, medium plasticity, blocky, with some very fine grained sand
79												79' G		@80' soft, moist
80	▽ ▼ 2/3/12		4/4'											**2/27/12 end of day**
81		18 / 41 / 50/5"					18.8	108.11	7.65E-07			80.5'-81.5	CL	80'-81' Lean Clay, very stiff, reddish brown with tan, gray, and red laminations, massive and tight, dry
82												82 G	ML	81'-83' Silty Clay, medium soft, reddish brown, moist, cohesive, low plasticity massive
				21	28	7				1.6	8.37	80'-82'		
83													CL/SP	83'-86' Clay and Sand Interbeds, grades over 16" from very fine to fine/medium grained sand, moist
84														
85														
86													CH	86'-87' Fat Clay, dark reddish brown, very stiff, dry, uniform color high plasticity
87													SP	87'-90' Sand, reddish brown, poorly graded, non-cohesive, massive, moist to wet, with trace sandstone clasts, 0-2"
88			6/8'											
89														
90													CH	90'-92' Fat Clay, reddish brown, very stiff, dry, uniform color, cohesive, high plasticity, trace gray gyspum nodules, < 1"
91														
92			4/4'										CL/SP/ML	92'-97' Interbeds of Sand, Silt, and Clay, (<6"), gradational changes, Sandy at 92-93', 93.5'-95', 95.5-96.5'
93														Silty at 95'-95.5'
94														
95												95' G		
96														
97													SM	97'-99' Silty Sand, poorly graded, medium dense, reddish brown, fine grained, wet, non-cohesive
98														
99													CL-ML	99'-100' Silty Clay, medium soft, reddish brown, moist, cohesive, low plasticity, massive
100			8/8'											

Soil Boring Log and Monitoring Well Diagram

Stanley Consultants INC.

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-4M	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**4 of 4**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
101		50.5/5"											ML	100'-101' Sandy Silt, soft, reddish brown, wet, non cohesive, with some large sandstone clasts, subangular, 0-4" at bottom of bed
102		98 39		17	34	17	16.83	109.93	5.46E-09		8.22	101'-102' 100'-102'	CL	101'-104' Sandy lean clay, medium dense, reddish brown, wet, medium plasticity, with sandy laminations, very fine grained
103	4" schedule 40 PVC casing													
104													SM	104'-105.5' Silty sand, poorly graded, medium dense, reddish brown, fine grained, non-cohesive, grades to sandy silt, wet, massive
105														
106													CL	105.5'-106.5' Lean Clay, reddish brown with light brown laminations, dry, stiff, medium plasticity
107													SM	106.5'-107.5' Silty Sand, poorly graded, medium dense, reddish brown, fine grained, non-cohesive, few sandstone clasts, 2", subangular
108													CL	107.5'-110' Lean Clay, reddish brown with light brown silt lenses, moist, stiff, medium plasticity
109														
110			10/10'										SP	110'-113' Sand, poorly graded, medium dense, reddish brown, fine to medium grained, non-cohesive, uniform, wet, massive
111	bentonite grout													
112														
113													CL	113'-114' Lean Clay, reddish brown with light brown mottles, silt lenses dry, stiff, medium plasticity
114	#12 sand filter pack												SC	114'-117.5' Sand, poorly graded, medium dense, reddish brown fine grained, wet
115														
116														
117	15'-0.01" slot PVC screen											117' G	CH	117.5'-118.5' Fat Clay, very stiff, reddish brown with tan, gray, and red laminations, massive and tight, dry
118														
119													ML	118.5-119.5' Sandy Silt, medium soft, reddish brown, wet, non cohesive
120			10/10'									120' G	CL	119.5'-120' Lean Clay, reddish brown with tan silt laminations, dry, very stiff, medium plasticity, cohesive
121							15.24	106.45	3.75E-08			120.5'-121.5	SM	120'-121' Silty Sand, very fine grained, brown, medium dense, poorly graded, wet, non-plastic, slow dilatency, non-cohesive, massive
122				19	41	22				0.9	8.34	120'-122'	CL	121'-125' Lean Clay, reddish brown, hard, dry, low-plasticity, slow dilatency, non-cohesive, massive **1/30/12 end of day**
123														
124														
125													SM	125'-126' Silty Sand, very fine grained, brown, medium dense, poorly graded, moist, non-plastic, slow dilatency, non-cohesive, massive
126													CL	126'-127' Lean Clay, reddish brown, hard, dry, laminated with tan silt and gray gypsum, low-plasticity, slow dilatency, non-cohesive, massive
127			7/7'										CL	127-128' Sandy Lean Clay, reddish brown, hard, dry, laminated, tan silt and sand, very fine grained, low-plasticity, slow dilatency, non-cohesive, massive
128														
129													SM	128'-130' Silty Sand, very fine grained, brown, interbeds of lean clay, loose to hard, moist to dry, poorly graded, non-plastic, slow dilatency, non-cohesive, massive
130													CL	130'-134.5' Lean Clay, reddish brown, hard, dry, laminated with tan silt and gypsum, very fine grained, low-plasticity, slow dilatency, non-cohesive, massive
131	5' tailpipe													
132													SM	134.5'-13' Silty Sand, very fine grained, brown, loose to medium dense, poorly graded, moist to wet, non-plastic, slow dilatency, non-cohesive, massive
133														**Note: Descriptions, laboratory analysis, and blow counts collected from soil boring BG-4D.**
134														**Muddy Creek Formation observed from 0 - 135'**
135	TD=135'													**Gradational changes between lithologies unless otherwise noted Total drilling depth 135' - 1/31/12 End of Day**

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number: **BG-4D**	Facility Name **NV Energy- Reid Gardner Station**	Facility Street Address **Clark County, NV**	Page **1 of 6**
Boring Location:	Northing: **26945590.5685**	Easting: **934852.3391**	
Boring Depth (ft) X Diameter (in): **174' x 8"**		Drilling Method: **Sonic**	
Certified Well Contractor Name: **Eagle Drilling**		Logged by: **J. Oriano/T. Knause**	
Start Date: **1/17/2012**	End Date: **1/26/2012**	Ground Surface Elevation (ASL): **1659.55'**	
Start Time: **08:00**	End Time: **16:00**	Top of Casing Elevation (ASL): **1662.52'**	

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
0	Aboveground steel protector													
1									Muddy Creek			C	CL	0-2' Sandy Clay, soft, reddish brown, dry, low plasticity, massive, some very fine grained sand, reddish brown.
2												0-2'	CL	2'-5' Lean Clay, reddish brown, stiff, dry, medium plasticity, blocky, reddish brown, brown, and tan silt laminations
3	4" schedule 40 PVC casing													
4														
5			5/5'										SP	5'-7.5' Sand, poorly graded, loose, reddish brown, fine grained, dry, non-cohesive, massive, little clay nodules
6	10' concrete surface seal													@6' - 6" sandstone layer, 2" thick beds, trace powdery carbonate
7														
8													CL	7.5'-9' Lean Clay, reddish brown, stiff, dry, medium plasticity, blocky, reddish brown, brown, and tan silt laminations
9			4/4'											@9' -3" Sandstone clasts, light reddish brown, subangular, <2", powdery carbonate
10												10' G	SC	9'-19' Clayey Sand, poorly graded, loose, reddish brown, fine grained, dry, non-cohesive, massive, little clay nodules
11	bentonite grout													
12														
13														
14														
15			6/6'											
16														
17														
18														@18' - 6" powdery carbonate, white, loose, dry, non-cohesive
19												19' G	CL	19'-28' Lean Clay, reddish brown, stiff, dry, medium plasticity, blocky, reddish brown, brown, and tan silt laminations
20			6/6'											
21		50												
		50					3.21	103.56	1.62E-04			20.5'-21.5		1/17/12 end of day
22		50/5"	2/2'											
23				18	47	29				1.0	8.10	20'-22'		
24														
25														
26			4/4'											
27														
28													SC	28'-32.5' Clayey Sand, poorly graded, loose, reddish brown, fine grained, dry, non-cohesive, little reddish brown clay laminated beds
29														
30			4/4'											

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-4D	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**2 of 6**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
31														
32													SM	32.5'-33.5' Silty Sand and Carbonate, white, loose, dry, non-cohesive, reddish brown, fine grained sand
33	4" schedule 40 PVC casing													
34													CL	33.5'-40' Lean Clay, reddish brown with tan and brown laminations, dry, stiff, medium plasticity, cohesive, with occasional 1" beds of carbonate
35			5/5'											
36														
37														
38														
39														@38' 8" sandy, reddish brown fine grained sand
40			5/5'									40' G		@39' - 4" carbonate, white, sandy
41	bentonite grout	16 37 50/4"					16.11	115.16	1.70E-09			40.5'-41.5	CL-CH	40'-47' Lean to Fat Clay, dark reddish brown, stiff, dry, uniform color, trace gray gypsum clasts, cohesive, medium to high plasticity
42														@42' - 6" sandstone clasts and carbonate, subangular, <2.5", dry
43				16	39	23				2.4	8.24	40'-42'		
44														
45														
46			6/6'											
47														
48													SP	47'-50' Sand, reddish brown, fine grained, dry, loose, non-cohesive, with little subangular sandstone gravel, subangular, 1-6 cm
49														
50			4/4'										CH	50'-54' Fat Clay, dark reddish brown, stiff, dry, uniform color, trace gray gypsum nodules, (<1"), cohesive, high plasticity
51														
52														
53														
54														
55													SC	54'-57' Clayey Sand, poorly graded, loose, reddish brown, fine grained, dry, non-cohesive, with trace 0.5" - 4" clay nodules and sandstone clasts
56														
57			7/7'										CH	57'-60' Fat Clay, dark reddish brown, stiff, dry, uniform color, trace gray gypsum nodules, (<1"), cohesive, high plasticity
58														
59														
60			3/3'										ML	60'-64' Silt with Sand, soft, light reddish brown, dry, low plasticity, with some very fine grained sand
61		24 50/2"					NA	NA	NA			60'-60.5		
62														
63				NP	NV	NP				1.1	8.66	60'-62'		
64														
65												65' G	SC	64'-67' Clayey Sand, poorly graded, loose, reddish brown, fine grained, dry, non-cohesive, with trace 0.5" - 1.5" clay nodules

Soil Boring Log and Monitoring Well Diagram

Stanley Consultants INC.

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-4D	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**3 of 6**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
66														
67			7/7'										CH	67'-72' Fat Clay, dark reddish brown, stiff, dry, uniform color trace gray gypsum nodules, (<1"), cohesive, high plasticity
68	4" schedule 40 PVC casing													
69														
70			3/3'											**1/18/12 end of day**
71														
72													SP	72'-74' Sand, poorly graded, reddish brown, very fine grained, dry, loose, non-cohesive, with little reddish brown clay nodules (<5"),
73														
74														
75													CL	74'-76' Lean Clay, reddish brown with tan and brown laminations, dry, very stiff, medium plasticity, cohesive
76	bentonite grout		6/6'										SP	76'-77' Sand, poorly graded, reddish brown, fine grained, dry, loose, non-cohesive, with <1.5" sandstone subangular gravel
77	▼ 2/3/12													
78	5												CL	77'-80' Lean Clay with Sand, stiff, reddish brown with tan laminations and brown mottles, cohesive, medium plasticity, blocky, with some very fine grained sand
79												79' G		
80	▽		4/4'										CL	@80' soft, moist 80'-81' Lean Clay, very stiff, reddish brown with tan, gray, and red laminations, massive and tight, dry
81		18 41 50/5"					18.8	108.11	7.65E-07			80.5'-81.5	CL-ML	81'-83' Silty Clay, medium soft, reddish brown, moist, cohesive, low plasticity massive
82												82 G		
				21	28	7				1.6	8.37	80'-82'		
83													CL/SP	83'-86' Clay and Sand Interbeds, grades over 16" from very fine to fine/medium grained sand, moist
84														
85														
86													CH	86'-87' Fat Clay, dark reddish brown, very stiff, dry, uniform color high plasticity
87													SP	87'-90' Sand, reddish brown, poorly graded, non-cohesive, massive, moist to wet, with trace sandstone clasts, 0-2"
88			8/8'											
89														
90													CH	90'-92' Fat Clay, reddish brown, very stiff, dry, uniform color, cohesive, high plasticity, trace gray gyspum nodules, < 1"
91														
92			4/4'										CL/SP/ML	92'-97' Interbeds of Sand, Silt, and Clay, (<6"), gradational changes, Sandy at 92-93', 93.5'-95', 95.5-96.5' Silty at 95'-95.5'
93														
94														
95												95' G		
96														
97													SM	97'-99' Silty Sand, poorly graded, medium dense, reddish brown, fine grained, wet, non-cohesive
98														
99													CL-ML	99'-100' Silty Clay, medium soft, reddish brown, moist, cohesive, low plasticity, massive
100			8/8'											**1/19/12 end of day**

Soil Boring Log and Monitoring Well Diagram

Stanley Consultants INC.

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-4D	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**4 of 6**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
101		50.5/5"											ML	100'-101' Sandy Silt, soft, reddish brown, wet, non cohesive, with some large sandstone clasts, subangular, 0-4" at bottom of bed
		93		17	34	17					8.22	101'-		
102		39					16.83	109.93	5.46E-09			102	CL	101'-104' Sandy lean clay, medium dense, reddish brown, wet, medium plasticity, with sandy laminations, very fine grained
103	4" schedule 40 PVC casing											100'-102'		
104													SM	104'-105.5' Silty sand, poorly graded, medium dense, reddish brown, fine grained, non-cohesive, grades to sandy silt, wet, massive
105														
106													CL	105.5'-106.5' Lean Clay, reddish brown with light brown laminations, dry, stiff, medium plasticity
107													SM	106.5'-107.5' Silty Sand, poorly graded, medium dense, reddish brown, fine grained, non-cohesive, few sandstone clasts, 2", subangular
108													CL	107.5'-110' Lean Clay, reddish brown with light brown silt lenses, moist, stiff, medium plasticity
109														
110			10/10"										SP	110'-113' Sand, poorly graded, medium dense, reddish brown, fine to medium grained, non-cohesive, uniform, wet, massive
111	bentonite grout													
112														
113													CL	113'-114' Lean Clay, reddish brown with light brown mottles, silt lenses dry, stiff, medium plasticity
114													SP	114'-117.5' Sand, poorly graded, medium dense, reddish brown fine grained, wet
115														
116														
117												117' G	CH	117.5'-118.5' Fat Clay, very stiff, reddish brown with tan, gray, and red laminations, massive and tight, dry
118														
119													ML	118.5-119.5' Sandy Silt, medium soft, reddish brown, wet, non cohesive
120			10/10"									120' G	CL	119.5'-120' Lean Clay, reddish brown with tan silt laminations, dry, very stiff, medium plasticity, cohesive
121							15.24	106.45	3.75E-08			120.5'- 121.5	SM	120'-121' Silty Sand, very fine grained, brown, medium dense, poorly graded, wet, non-plastic, slow dilatency, non-cohesive, massive
122				19	41	22				0.9	8.34	120'-122'	CL	121'-125' Lean Clay, reddish brown, hard, dry, low-plasticity, slow dilatency, non-cohesive, massive
123														**1/20/12 end of day**
124														
125													SM	125'-126' Silty Sand, very fine grained, brown, medium dense, poorly graded, moist, non-plastic, slow dilatency, non-cohesive, massive
126													CL	126'-127' Lean Clay, reddish brown, hard, dry, laminated with tan silt and gray gypsum, low-plasticity, slow dilatency, non-cohesive, massive
127			7/7"										CL	127-128' Sandy Lean Clay, reddish brown, hard, dry, laminated, tan silt and sand, very fine grained, low-plasticity, slow dilatency, non-cohesive, massive
128													SM	128'-130' Silty Sand, very fine grained, brown, interbeds of lean clay, loose to hard, moist to dry, poorly graded, non-plastic, slow dilatency, non-cohesive, massive
129														
130													CL	130'-134.5' Lean Clay, reddish brown, hard, dry, laminated with tan silt and gypsum, very fine grained, low-plasticity, slow dilatency, non-cohesive, massive
131														
132														
133														
134													SM	134.5'-135.5' Silty Sand, very fine grained, brown, loose to medium dense, poorly graded, moist to wet, non-plastic, slow dilatency, non-cohesive, massive
135														

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-4D	NV Energy- Reid Gardner Station	Clark County, NV	5 of 6

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
136			8.5/8.5										CL	135.5'-138' Lean Clay, reddish brown, hard, dry, low-plasticity, slow dilatency, non-cohesive, massive
137														
138													SM	138'- 140' Silty Sand, very fine grained, brown, loose to medium dense, poorly graded, wet, non-plastic, slow dilatency, non-cohesive, massive, uniform color
139	4" schedule 40 PVC casing													
140														
141			4.5/4.5 1/1'	17	35	18					8.44		SM	141' - 142' Silty Sand, very fine grained, reddish brown, loose to medium dense, poorly graded, moist, non-plastic, slow dilatency, non-cohesive, massive, uniform color
142		50/5" 20/2"					19.69	111.58	3.70E-09			141'-142 140'-142'	CL	142' - 146' Lean Clay, reddish brown, hard, dry, laminated with tan silt, very fine grained, low-plasticity, slow dilatency, non-cohesive, massive
143														
144														
145														
146			5/5'										CL	146' - 149.5' Lean Clay, reddish brown, hard, dry, laminated with tan silt, very fine grained, low-plasticity, slow dilatency, non-cohesive, massive **1/23/12 end of day**
147														
148														
149	bentonite grout												SM	149.5'-150' Silty Sand, very fine grained, reddish brown, loose, wet
150													CL	150'-152' Lean Clay, reddish brown, hard, dry, laminated with tan silt, very fine grained, low-plasticity, slow dilatency, non-cohesive, massive
151														
152													SM CL	152'-152.5' Silty Sand, very fine grained, reddish brown, loose, wet 152.5'-155' Lean Clay, reddish brown, hard, dry, laminated with tan silt, very fine grained, low-plasticity, slow dilatency, non-cohesive, massive
153														
154	#12 sand filter pack													
155			9/9'										CL	155'-155.5' Lean Clay, reddish brown, hard, dry, laminated with tan silt, very fine grained, low-plasticity, slow dilatency, non-cohesive, massive
156													SM CL	155.5'-156' Silty Sand, very fine grained, reddish brown, loose, wet 156'-157.5' Lean Clay, reddish brown, hard, dry, laminated with tan silt, very fine grained, low-plasticity, slow dilatency, non-cohesive, massive
157													SM	157.5'-158.5' Silty Sand, very fine grained, reddish brown, loose, wet
158													CL	158.5'-160' Lean Clay, reddish brown, hard, dry, laminated with tan silt, very fine grained, low-plasticity, slow dilatency, non-cohesive, massive
159														
160			5/5'											**1/24/12 end of day**
161		30	1.5/1.5									161' G	CL	160'-164.5' Lean Clay, reddish brown, hard, dry, laminated with tan silt, very fine grained, low-plasticity, slow dilatency, non-cohesive, massive
162		47 32					15.15	114.08	4.06E-09			161'-162		
163	15'-0.01" slot PVC screen			16	25	9				1.3	8.71	160'-162' 163' G		
164														
165			5/5'										SM CL	164.5'-165' Silty Sand, very fine grained, reddish brown, loose, wet 165'-166' Lean Clay, reddish brown, hard, dry, laminated with tan silt, very fine grained, low-plasticity, slow dilatency, non-cohesive, massive
166													SM	166'-169' Silty Sand, very fine grained, reddish brown, loose, wet
167														
168	5' tailpipe													
169													CL	169'-171.5' Lean Clay, reddish brown, hard, dry, laminated with tan silt, very fine grained, low-plasticity, slow dilatency, non-cohesive, massive
170			5/5'											**1/25/12 end of day**

Stanley Consultants INC.

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-4D	NV Energy- Reid Gardner Station	Clark County, NV	6 of 6

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
171	5' tailpipe												SM	171.5'-173' Silty Sand, very fine grained, reddish brown, loose, wet
172														
173	#12 sand filter pack												CL	173'-174' Lean Clay, reddish brown, hard, dry, laminated with tan silt, very fine grained, low-plasticity, slow dilatency, non-cohesive, massive
174			4/4'											
	TD=174'													**Total drilling depth 174' - 1/26/12 End of Day**
175														
176														**Note: Muddy Creek Formation observed from 0 - 174'**
177														**Gradational changes between lithologies unless otherwise noted**
178														
179														
180														
181														
182														
183														
184														
185														
186														
187														
188														
189														
190														
191														
192														
193														
194														
195														
196														
197														
198														
199														
200														
201														
202														
203														
204														
205														

Soil Boring Log and Monitoring Well Diagram

Stanley Consultants INC.

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-6S	NV Energy- Reid Gardner Station	Clark County, NV	1 of 3

Boring Location:	Northing: 26942902.0220	Easting: 936680.8360	
Boring Depth (ft) X Diameter (in): 72' X 8"		Drilling Method: Sonic	
Certified Well Contractor Name: Eagle Drilling		Logged by: J. Oriano	
Start Date: 2/15/2012	End Date: 2/16/2012	Ground Surface Elevation (ASL): 1616.27'	
Start Time: 15:30	End Time: 15:00	Top of Casing Elevation (ASL): 1618.85'	

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
0	Aboveground steel protector													
1	concrete pad											C	GW	0-7' - Well Graded Gravel with Sand, reddish brown top 1' grades to tan and light gray, loose, dry, non-cohesive, non-plastic, massive, gravel varies in size, shape and color; abundant dark gray angular to subrounded volcanic gravel (<2") , limestone, dolomite, volcanics, and weak to strongly cemented sandstone; powdery carbonate and carbonate coating on gravel
2												0-2'		
3	4" schedule 40 PVC casing													
4														
5														
6	10' concrete surface seal													
7														
8													SW	7'-11' Well Graded Sand with Gravel, very fine grained sand, tan to light reddish brown, dry, loose, non-plastic, non-cohesive gravel varies in size, shape and color; light to dark gray angular to subrounded gravel (<2.5"), dolomite and volcanics, weakly to strongly cemented sandstone gravel, and coarse sand
9			9/9'									9' G		
10														
11									Alluvium					
12	bentonite grout								Muddy Creek				SP	11'-28' Sand, reddish brown, poorly graded, fine grained, dry, non-cohesive, non-plastic, trace moderately cemented sandstone clasts @11' - 4" clay, reddish brown, dry, hard
13			4/4'											
14														
15														
16														
17			4/4'											@16.5' - 2" thick strongly cemented sandstone layer light reddish brown
18														
19														
20			3/3'											@ 19' - 4" moderately cemented sandstone clasts, <1.5", subangular
21		30 50/5.5"										20'-21'		@20' - 2" clay, reddish brown, dry, stiff, crumbly
22							3.51	109.38	7.21E-05					
23				NP	NV	NP				0.2	8.33	19'-22'		
24														@23' - 4" strongly cemented sandstone clasts, <2", subangular
25			5/5'											
26														@25' - 2" clay, dark reddish brown, hard, dry, with silt and fine sand laminations
27														
28												28' G	CH	28' - 30' Fat Clay, dark reddish brown, hard, blocky, massive, dry, few gray oval gypsum nodules (<0.5")
29														
30			5/5'										SM	30'-36' Silty Sand, very fine grained, poorly graded, reddish brown, loose, dry, non-cohesive, non-plastic

Stanley Consultants INC

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-6S	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**2 of 3**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
31														
32														@ 31.5' - 4" sandstone and carbonate, light gray powdery carbonate; strongly cemented sandstone clasts (<3")
	4" schedule													
33	40 PVC casing													
34			4/4'											
35														
36														36' - 37.5' - Sandstone and Carbonate, tan, strongly cemented sandstone layer and 1 " clasts, powdery carbonate
37													CH	37.5' - 38.5' - Fat Clay, reddish brown, hard, dry, high plasticity, cohesive, uniform color, some sandy red and brown mottles
38													ML	38.5' - 39' - Sandy Silt, soft, light reddish brown, very fine grained sand, dry, loose, with powdery carbonate
39														@39' - 2" sandstone layer, core diameter, light reddish brown
40			6/6'										CH	39'-40.5' - Fat Clay, reddish brown, hard, dry, high plasticity, cohesive, uniform color
		29												**2/15/12 end of day**
41	bentonite	50					2.99	101.19	1.47E-02			40.5'-	SM	40.5'- 44'- Silty Sand, fine grained, reddish brown, poorly graded, loose,
	grout	50/3.5'										41.5'		dry, non-plastic, non-cohesive, some clay nodules (<1.5")
42														@42' - grades lighter reddish brown with powdery carbonate
43				NP	NV	NP				0.2	8.62	40'-42'		
44														44'-45' - Sandstone and Carbonate, tan, strongly cemented subangular sandstone clasts (<2 '), with powdery carbonate
45			5/5'										SM	45'-48'- Silty Sand, fine grained, loose, reddish brown, poorly graded, dry, non-plastic, non-cohesive, trace moderately cemented sandstone
46														
47														
48														
49	#12 sand filter pack												CH	48' - 53.5' - Fat Clay, reddish brown, hard, dry, cohesive, high plasticity, massive, uniform color
50			5/5'											
51														
52	3/15/12													@51 - 2" sandstone layer, strongly cemented, reddish brown, with powdery carbonate
														@53' 4" - silty sand, reddish brown, moist, blocky, uniform color
53												53' G	CL/ML/SM	53.5' - 55' - Clay, Silt and Sand, gradational interbeds, reddish brown and light brown laminations, moist
54														@54' - red laminations, black mottles
														@55'-3" sandstone layer, strongly cemented
55			5/5'										CL	55' - 57.5' - Lean Clay, reddish brown, soft to stiff, moist, cohesive, medium plasticity, with sand and silt interbeds
56														
57													SM	57.5' - 67' - Silty Sand, fine grained, reddish brown, poorly graded, wet, medium dense, uniform color, with little strongly cemented sandstone clasts <2.5", subangular
	15'-0.01" slot													
58	PVC screen											58' G		
59														
60			5/5'											
		27												
61		50/4"												
62														@ 61' - 2" silty clay, reddish brown No sample in modified california, sandstone plugged
63														
64			4/4'											
65														

Stanley Consultants INC

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-6S	NV Energy- Reid Gardner Station	Clark County, NV	3 of 3

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
66	15'-0.01" slot PVC screen													
67			3/3'										CL/ML/SM	67'-68.5' Clay, Silt, and Sand, gradational interbeds, <6" each, reddish brown, wet, with little subangular sandstone clasts (<1.5")
68	#12 sand filter pack													
69													CH	68.5'-74' - Fat Clay, stiff to hard, reddish brown, dry, cohesive, medium to high plasticity, tan and brown thin laminations, sandstone layers
70														
71	5' tailpipe													
72														@72' very stiff, trace red mottles and gray oval gypsum nodules (<0.5")
73	TD=72'													**2/16/12 end of day**
74														**Note: Descriptions, laboratory analysis, and blow counts collected from soil boring BG-6D**
75														**Alluvium observed from 0-11'** **Muddy Creek Formation observed from 11'-72'**
76														**Gradational changes between lithologies unless otherwise noted**
77														
78														
79														
80														
81														
82														
83														
84														
85														
86														
87														
88														
89														
90														
91														
92														
93														
94														
95														
96														
97														
98														
99														
100														

Soil Boring Log and Monitoring Well Diagram

Stanley Consultants INC.

Boring/Well Number: **BG-6M**	Facility Name **NV Energy- Reid Gardner Station**	Facility Street Address **Clark County, NV**	Page **1 of 4**
Boring Location:	Northing: **26942904.0475**	Easting: **936670.8754**	
Boring Depth (ft) X Diameter (in): **105' X 8"**		Drilling Method: **Sonic**	
Certified Well Contractor Name: **Eagle Drilling**		Logged by: **J. Oriano**	
Start Date: **2/13/2012**	End Date: **2/15/2012**	Ground Surface Elevation (ASL): **1616.26'**	
Start Time: **10:00**	End Time: **15:00**	Top of Casing Elevation (ASL): **1619.20'**	

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
0	Aboveground steel protector													
1	concrete pad											C	GW	0-7' - Well Graded Gravel with Sand, reddish brown top 1' grades to tan and light gray, loose, dry, non-cohesive, non-plastic, massive, gravel varies in size, shape and color; abundant dark gray angular to subrounded volcanic gravel (<2") , limestone, dolomite, volcanics, and weak to strongly cemented sandstone; powdery carbonate and carbonate coating on gravel
2												0-2'		
3	4" schedule 40 PVC casing													
4														
5														
6	10' concrete surface seal													
7														
8													SW	7'-11' Well Graded Sand with Gravel, very fine grained sand, tan to light reddish brown, dry, loose, non-plastic, non-cohesive gravel varies in size, shape and color; light to dark gray angular to subrounded gravel (<2.5"), dolomite and volcanics, weakly to strongly cemented sandstone gravel, and coarse sand
9			9/9'									9' G		
10														
11									Alluvium					
12	bentonite grout								Muddy Creek				SP	11'-28' Sand, reddish brown, poorly graded, fine grained, dry, non-cohesive, non-plastic, trace moderately cemented sandstone clasts @11' - 4" clay, reddish brown, dry, hard
13			4/4'											
14														
15														
16														
17			4/4'											@16.5' - 2" thick strongly cemented sandstone layer light reddish brown
18														
19														
20			3/3'											@ 19' - 4" moderately cemented sandstone clasts, <1.5", subangular
21		30 50/5.5"										20'-21'		@20' - 2" clay, reddish brown, dry, stiff, crumbly
22							3.51	109.36	7.21E-05					
23				NP	NV	NP				0.2	8.33	19'-22'		
24														@23' - 4" strongly cemented sandstone clasts, <2", subangular
25			5/5'											
26														@25' - 2" clay, dark reddish brown, hard, dry, with silt and fine sand laminations
27														
28												28' G	CH	28' - 30' Fat Clay, dark reddish brown, hard, blocky, massive, dry, few gray oval gypsum nodules (<0.5")
29														
30			5/5'										SM	30'-36' Silty Sand, very fine grained, poorly graded, reddish brown, loose, dry, non-cohesive, non-plastic

Stanley Consultants INC

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-6M	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**2 of 4**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
31														
32														@ 31.5' - 4" sandstone and carbonate, light gray powdery carbonate; strongly cemented sandstone clasts (<3")
33	4" schedule 40 PVC casing													
34			4/4'											
35														
36														36' - 37.5' - Sandstone and Carbonate, tan, strongly cemented sandstone layer and 1 " clasts, powdery carbonate
37													CH	37.5' - 38.5' - Fat Clay, reddish brown, hard, dry, high plasticity, cohesive, uniform color, some sandy red and brown mottles
38													ML	38.5' - 39' - Sandy Silt, soft, light reddish brown, very fine grained sand, dry, loose, with powdery carbonate
39														@39' - 2" sandstone layer, core diameter, light reddish brown
40			6/6'										CH	39'-40.5' - Fat Clay, reddish brown, hard, dry, high plasticity, cohesive, uniform color
41	bentonite grout	29 50 50/3.5"					2.99	101.19	1.47E-02			40.5'-41.5'	SM	40.5'- 44'- Silty Sand, fine grained, reddish brown, poorly graded, loose, dry, non-plastic, non-cohesive, some clay nodules (<1.5")
42														@42' - grades lighter reddish brown with powdery carbonate
43				NP	NV	NP				0.2	8.62	40'-42'		
44														44'-45' - Sandstone and Carbonate, tan, strongly cemented subangular sandstone clasts (<2 '), with powdery carbonate
45			5/5'										SM	45'-48'- Silty Sand, fine grained, loose, reddish brown, poorly graded, dry, non-plastic, non-cohesive, trace moderately cemented sandstone
46														
47														
48														
49													CH	48' - 53.5' - Fat Clay, reddish brown, hard, dry, cohesive, high plasticity, massive, uniform color
50			5/5'											
51														
52	▼ 3/15/12													@51 - 2" sandstone layer, strongly cemented, reddish brown, with powdery carbonate
53	▽											53' G	CL/ML/SM	@53' - 4" silty sand, reddish brown, moist, blocky, uniform color 53.5' - 55' - Clay, Silt and Sand, gradational interbeds, reddish brown and light brown laminations, moist
54														@54' - red laminations, black mottles
55			5/5'										CL	@55'-3" sandstone layer, strongly cemented 55' - 57.5' - Lean Clay, reddish brown, soft to stiff, moist, cohesive, medium plasticity, with sand and silt interbeds
56														
57													SM	57.5' - 67' - Silty Sand, fine grained, reddish brown, poorly graded, wet, medium dense, uniform color, with little strongly cemented sandstone clasts <2.5", subangular
58												58' G		
59														
60			5/5'											**2/13/12 end of day**
61		27 50/4"												
62														@ 61' - 2" silty clay, reddish brown No sample in modified california, sandstone plugged
63														
64			4/4'											
65														

Soil Boring Log and Monitoring Well Diagram

Stanley Consultants INC

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-6M	**NV Energy- Reid Gardner Station**	**Clark County, NV**	**3 of 4**

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
66														
67			3/3'										CL/ML/SM	67'-68.5' Clay, Silt, and Sand, gradational interbeds, <6" each, reddish brown, wet, with little subangular sandstone clasts (<1.5")
68	4" schedule 40 PVC casing													
69													CH	68.5'-74' - Fat Clay, stiff to hard, reddish brown, dry, cohesive, medium to high plasticity, tan and brown thin laminations, sandstone layers
70														
71														
72														@72' very stiff, trace red mottles and gray oval gypsum nodules (<0.5")
73			6/6'											
74		50/4" 44					19.2	108.50	1.29E-08			73'-74'		
75				23	63	40				0.5	8.37	72'-74' 75' G	CL/ML/SM	74'-82' Clay, Silt, and Sand, gradational interbeds, 5" to 10" each, reddish brown, with trace subangular sandstone clasts (<1.5")
76	bentonite grout													
77														
78														
79														
80			7/7'											
81		14 32/5"					21.77	107.18	6.19E-03			80'-81'		
82														
83				16	33	17				0.2	8.41	79'-82'	SM	82' - 87' Silty Sand, fine grained, poorly graded, reddish brown, medium dense, non-plastic, non-cohesive, wet, massive with little silt and clay mottles, (< 1.5")
84														
85			4/5'											
86														
87												87' G	CH	@87'-3" sandstone layer, strongly cemented, underlain by clay 87'-89.5' - Fat Clay, hard, reddish brown, dry, cohesive, high plasticity, brown and reddish brown laminations
88														
89	#12 sand filter pack												SM	89.5'-90.5' Silty Sand, fine grained, poorly graded, reddish brown, medium dense, non-plastic, non-cohesive, wet, massive
90			5/5'										CH	90.5'-91.5' - Fat Clay, very stiff, dark reddish brown, dry, cohesive, high plasticity, massive, trace gray oval gypsum nodules (<0.5")
91														
92													CL/ML/SM	91.5'-95' Clay, Silt, and Sand, gradational interbeds, 2" to 6" each, reddish brown, with trace subangular sandstone clasts (<1.5")
93	15'-0.01" slot PVC screen													
94														
95			5/5'											@94' - 94.5' - sand silty with sandstone clasts (0-4")
96													SM	95' - 103' - Silty Sand, fine grained, poorly graded, reddish brown, medium dense, non-plastic, non-cohesive, wet, massive, with trace subangular sandstone clasts (<1.5")
97														
98												98' G		
99														
100	5' tailpipe		3/5'											@100' - 3" sandstone layer, strongly cemented, reddish brown

Stanley Consultants INC

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-6M	NV Energy- Reid Gardner Station	Clark County, NV	4 of 4

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
101		13 50/3"					18.92	103.39	1.15E-03			100'-101		@100'-103' saturated flowing sand
102				NP	NV	NP				0.1	8.64	99'-102'		
103													CL/ML/SM	103'-106' Sandy Silt, with gradational interbeds of sand and lean clay, 2" to 6" each, reddish brown, medium stiff, wet, non-plastic to medium plasticity, non-cohesive to cohesive
104	5' tailpipe													
105														2/14/12 end of day
106	TD=105'													Note: Descriptions, laboratory analysis, and blow counts collected from soil boring BG-6D.
107														Alluvium observed from 0-11'
108														Muddy Creek Formation observed from 11'-105'
109														Gradational changes between lithologies unless otherwise noted
110														
111														
112														
113														
114														
115														
116														
117														
118														
119														
120														
121														
122														
123														
124														
125														
126														
127														
128														
129														
130														
131														
132														
133														
134														
135														

Soil Boring Log and Monitoring Well Diagram

Stanley Consultants INC.

Boring/Well Number: **BG-6D**	Facility Name **NV Energy- Reid Gardner Station**	Facility Street Address **Clark County, NV**	Page **1 of 4**
Boring Location:	Northing: **26942911.1736**	Easting: **936677.5078**	
Boring Depth (ft) X Diameter (in): **135' X 8"**		Drilling Method: **Sonic**	
Certified Well Contractor Name: **Eagle Drilling**		Logged by: **J. Oriano**	
Start Date: **2/6/2012**	End Date: **2/13/2012**	Ground Surface Elevation (ASL): **1616.25'**	
Start Time: **11:45**	End Time: **9:30**	Top of Casing Elevation (ASL): **1619.37'**	

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
0	Aboveground steel protector													
1	concrete pad											C	GW	0-7' - Well Graded Gravel with Sand, reddish brown top 1' grades to tan and light gray, loose, dry, non-cohesive, non-plastic, massive, gravel varies in size, shape and color; abundant dark gray angular to subrounded volcanic gravel (<2") , limestone, dolomite, volcanics, and weak to strongly cemented sandstone; powdery carbonate and carbonate coating on gravel
2												0-2'		
3	4" schedule 40 PVC casing													
4														
5														
6	10' concrete surface seal													
7														
8													SW	7'-11' Well Graded Sand with Gravel, very fine grained sand, tan to light reddish brown, dry, loose, non-plastic, non-cohesive gravel varies in size, shape and color; light to dark gray angular to subrounded gravel (<2.5"), dolomite and volcanics, weakly to strongly cemented sandstone gravel, and coarse sand
9			9/9'									9' G		
10														
11									Alluvium					
12	bentonite grout								Muddy Creek				SP	11'-28' Sand, reddish brown, poorly graded, fine grained, dry, non-cohesive, non-plastic, trace moderately cemented sandstone clasts
13			4/4'											@11' - 4" clay, reddish brown, dry, hard
14														
15														
16														
17			4/4'											@16.5' - 2" thick strongly cemented sandstone layer light reddish brown
18														
19														
20			3/3'											@ 19' - 4" moderately cemented sandstone clasts, <1.5", subangular
21		30 50/5.5"										20'-21		@20' - 2" clay, reddish brown, dry, stiff, crumbly
22							3.51	109.36	7.21E-05					
23				NP	NV	NP				0.2	8.33	19'-22'		
24														@23' - 4" strongly cemented sandstone clasts, <2", subangular
25			5/5'											
26														@25' - 2" clay, dark reddish brown, hard, dry, with silt and fine sand laminations
27														
28												28' G	CH	28' - 30' Fat Clay, dark reddish brown, hard, blocky, massive, dry, few gray oval gypsum nodules (<0.5")
29														
30			5/5'										SM	30'-36' Silty Sand, very fine grained, poorly graded, reddish brown, loose, dry, non-cohesive, non-plastic

Stanley Consultants INC

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-6D	NV Energy- Reid Gardner Station	Clark County, NV	2 of 4

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
31								10.50						
32														@ 31.5' - 4" sandstone and carbonate, light gray powdery carbonate; strongly cemented sandstone clasts (<3")
33	4" schedule 40 PVC casing													
34			4/4'											**2/6/12 end of day - Core barrel stuck in boring**
35														
36														36' - 37.5' - Sandstone and Carbonate, tan, strongly cemented sandstone layer and 1 " clasts, powdery carbonate
37													CH	37.5' - 38.5' - Fat Clay, reddish brown, hard, dry, high plasticity, cohesive, uniform color, some sandy red and brown mottles
38													ML	38.5' - 39' - Sandy Silt, soft, light reddish brown, very fine grained sand, dry, loose, with powdery carbonate
39														@39' - 2" sandstone layer, core diameter, light reddish brown
40			6/6'										CH	39'-40.5' - Fat Clay, reddish brown, hard, dry, high plasticity, cohesive, uniform color
41	bentonite grout	29 50 50/3.5"					2.99	101.19	1.47E-02			40.5'-41.5	SM	40.5'- 44'- Silty Sand, fine grained, reddish brown, poorly graded, loose, dry, non-plastic, non-cohesive, some clay nodules (<1.5")
42														@42' - grades lighter reddish brown with powdery carbonate
43				NP	NV	NP				0.2	8.62	40'-42'		
44														44'-45' - Sandstone and Carbonate, tan, strongly cemented subangular sandstone clasts (<2 '), with powdery carbonate
45			5/5'										SM	45'-48'- Silty Sand, fine grained, loose, reddish brown, poorly graded, dry, non-plastic, non-cohesive, trace moderately cemented sandstone
46														
47														
48														
49													CH	48' - 53.5' - Fat Clay, reddish brown, hard, dry, cohesive, high plasticity, massive, uniform color
50			5/5'											
51														
52	3/15/12													@51 - 2" sandstone layer, strongly cemented, reddish brown, with powdery carbonate
53												53' G	CL/ML/SM	@53' 4" - silty sand, reddish brown, moist, blocky, uniform color 53.5' - 55' - Clay, Silt and Sand, gradational interbeds, reddish brown and light brown laminations, moist
54														@54' - red laminations, black mottles
55			5/5'										CL	@55'-3" sandstone layer, strongly cemented 55' - 57.5' - Lean Clay, reddish brown, soft to stiff, moist, cohesive, medium plasticity, with sand and silt interbeds
56														
57													SM	57.5' - 67' - Silty Sand, fine grained, reddish brown, poorly graded, wet, medium dense, uniform color, with little strongly cemented sandstone clasts <2.5", subangular
58												58' G		
59														
60			5/5'											
61		27 50/4"												
62														@ 61' - 2" silty clay, reddish brown No sample in modified california, sandstone plugged
63														
64			4/4'											
65														

Stanley Consultants INC

Soil Boring Log and Monitoring Well Diagram

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-6D	NV Energy- Reid Gardner Station	Clark County, NV	3 of 4

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
66														
67			3/3'										CL/ML/SM	67'-68.5' Clay, Silt, and Sand, gradational interbeds, <6" each, reddish brown, wet, with little subangular sandstone clasts (<1.5")
68	4" schedule 40 PVC casing													
69													CH	68.5'-74' - Fat Clay, stiff to hard, reddish brown, dry, cohesive, medium to high plasticity, tan and brown thin laminations, sandstone layers
70														
71														
72														@72' very stiff, trace red mottles and gray oval gypsum nodules (<0.5")
73			6/6'											
74		50/4" 44					19.2	108.50	1.29E-08			73'-74		2/7/12 end of day
75				23	63	40				0.5	8.37	72'-74' 75' G	CL/ML/SM	74'-82' Clay, Silt, and Sand, gradational interbeds, 5" to 10" each, reddish brown, with trace subangular sandstone clasts (<1.5")
76	bentonite grout													
77														
78														
79														
80			7/7'											
81		14 32/5"					21.77	107.18	6.19E-03			80'-81'		
82														
83				16	33	17				0.2	8.41	79'-82'	SM	82' - 87' Silty Sand, fine grained, poorly graded, reddish brown, medium dense, non-plastic, non-cohesive, wet, massive with little silt and clay mottles, (< 1.5")
84														
85			4/5'											
86														
87												87' G	CH	@87'-3" sandstone layer, strongly cemented, underlain by clay 87'-89.5' - Fat Clay, hard, reddish brown, dry, cohesive, high plasticity, brown and reddish brown laminations
88														
89													SM	89.5'-90.5' Silty Sand, fine grained, poorly graded, reddish brown, medium dense, non-plastic, non-cohesive, wet, massive
90			5/5'										CH	90.5-91.5' - Fat Clay, very stiff, dark reddish brown, dry, cohesive, high plasticity, massive, trace gray oval gypsum nodules (<0.5")
91														
92													CL/ML/SM	91.5'-95' Clay, Silt, and Sand, gradational interbeds, 2" to 6" each, reddish brown, with trace subangular sandstone clasts (<1.5")
93														
94														
95			5/5'											@94' - 94.5' - sand silty with sandstone clasts (0-4")
96													SM	95' - 103' - Silty Sand, fine grained, poorly graded, reddish brown, medium dense, non-plastic, non-cohesive, wet, massive, with trace subangular sandstone clasts (<1.5")
97														
98												98' G		
99														
100			3/5'											@100' - 3" sandstone layer, strongly cemented, reddish brown

Soil Boring Log and Monitoring Well Diagram

Stanley Consultants INC.

Boring/Well Number:	Facility Name	Facility Street Address	Page
BG-6D	NV Energy- Reid Gardner Station	Clark County, NV	4 of 4

Depth (ft bgs)	Soil Boring/Well Construction	Blow Count (6" interval)	Recovery	Plastic Limit	Liquid Limit	Plasticity Index	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Total Organic Carbon (%)	pH	Sample location	USCS Classification	Description
101		13 50/3"					18.92	103.39	1.15E-03			100'-101		@100'-103' saturated flowing sand
102				NP	NV	NP				0.1	8.64	99'-102'		
103	4" schedule 40 PVC casing												CL/ML/SM	103'-106' Sandy Silt, with gradational interbeds of sand and lean clay, 2" to 6" each, reddish brown, medium stiff, wet, non-plastic to medium plasticity, non-cohesive to cohesive
104														
105														
106			6/6'											**2/8/12 end of day**
107													SM	106' - 107' - Silty Sand, fine grained, poorly graded, reddish brown, non-cohesive, with trace subangular sandstone clasts (<2") and clay mottles
108													ML	107'-108' Sandy Silt, medium stiff, reddish brown to brown, blocky, wet, non-cohesive, non-plastic, very fine grained sand
109													SM	108'-109' - Silty Sand, fine grained, poorly graded, reddish brown, non-cohesive, non-plastic, with trace subangular sandstone clasts
110			4/4'										ML	and clay mottles (<1.5") 109'-110.5' Sandy Silt, medium stiff, reddish brown to brown, blocky,
111	bentonite grout												CH	wet, non-cohesive, non-plastic, very fine grained sand, with trace clay 110.5'-112' - Fat Clay, stiff, reddish brown, dry, cohesive, high plasticity, massive, trace gray oval gypsum clasts
112													ML	112'-115' Sandy Silt, medium stiff, reddish brown to brown, blocky, wet, non-cohesive, non-plastic, very fine grained sand
113														
114												114' G		
115														
116													CH	115'-119.5' - Fat Clay, stiff, reddish brown, dry, cohesive, high plasticity, massive, trace gray oval gypsum nodules
117														
118			6/6'											
119	#12 sand filter pack													
120			2/2'										ML	119.5'-122' Sandy Silt, with gradational interbeds of sand and lean clay, 2" to 6" each, reddish brown, medium stiff, wet, non-plastic to medium plasticity, non-cohesive to cohesive, very fine grained sand
121		7 6												
122		15					22.31	103.29	3.12E-05			120.5'-121.5'		
123	15'-0.01" slot PVC screen			NP	NV	NP				0.1	8.26	119'-122'	CH	122'-123' - Fat Clay, stiff, reddish brown, dry, cohesive, high plasticity, massive, trace gray oval gypsum clasts
124													ML	123'-126' Sandy Silt, with gradational interbeds of sand and lean clay, 2" to 6" each, reddish brown, medium stiff, wet, non-plastic to medium plasticity, non-cohesive to cohesive, very fine grained sand
125			5/5'											
126													CL/ML/SM	126'-129' Clay, Silt, and Sand, gradational interbeds, 2" to 4" each, reddish brown
127												127' G		
128														
129														
130			5/5'										ML	129'-135' Sandy Silt, reddish brown, medium stiff, wet, non-plastic to medium plasticity, non-cohesive to cohesive, very fine grained sand, with some gradational interbeds of sand and lean clay, 2" to 6" each
131	5' tailpipe													
132														
133														**Note: Alluvium observed from 0-11'** **Muddy Creek Formation observed from 11'-135'**
134			No Recovery flowing sand											**Gradational changes between lithologies unless otherwise noted**
135	TD=135'													**Total Drilling Depth 135' - 2/9/12**

Well Development Data Collection Form

Date: 3/12/12

Page 1 of 1

Project Name:	Evaluation of Background Conditions	Project Number:	20618.06/ICLW2
Project Location:	RGS - Moapa, NV	Weather:	60°, dry, sunny
Well ID:	BG-1S	Well Type:	Monitoring
Well Diameter:	4-inch	Stickup:	~2.5'
Reference Point:	Top of PVC Casing	Well Depth:	43'
Depth to Water:	27.87 @ static	Screen interval:	18-38' (~20.5-40.5 below top casing)
Data Type:	Drawdown	Well Use:	Pumping

Time			Water Level Data			Imhoff Cone Readings (per 1,000 mL)			Water Quality				Comments
Person	Clock	Lapsed	Tape	Meter	Transducer	Sand mL	Silt mL	Clay mL	pH	Temp °C	EC µS/m	Turb NTU	
JD	7:50	static	27.87										Small pump
	8:02	On	28.40										27.55 ID 27.93 IM
	8:12	10	28.07			1	30	.5	7.96	13.3	0.17	X	27.55 ID 27.93 IM brown
	8:17	15	28.70			no	no	no	7.59	21.2	.264	220	Cloudy
	8:20	18	27.89			no	no	no	7.54	22.2	.276	58	45.75 sec/5 gal clear
	8:32	30	28.15			no	no	no	7.55	22.2	.274	95	choked back pump back up
	8:39	37	28.73			no	no	no	7.56	22.2	.274	43	58.24 sec/5 gal
	end					no	no	no	7.55	22.2	.274	38	27.52 ID 27.99 IM
													27.52 ID 27.98 IM end.
	1800 gallons total												
	emptied tank in pond												

Small pump - Pump Grundfos 10SQ EOS-110, 1/2 HP

X = > 1,000 ntu

Signature: J. Orr

Well Development Data Collection Form

Date: 03-09-2012

Project Name:	Evaluation of Background Conditions	Project Number:	20618.06/ICLW2
Project Location:	RGS - Moapa, NV	Weather:	Sunny, hot, clear, ~75°F
Well ID:	BG-1M	Well Type:	Monitoring
Well Diameter:	4-inch	Stickup:	3.10 Ft AGS
Reference Point:	Top of PVC Casing	Well Depth:	75.50 Ft BTOC
Depth to Water:	28.07 Ft BTOC	Screen interval:	55.50-70.50 Ft BTOC
Data Type:	Drawdown	Well Use:	Pumping

Time			Water Level Data			Imhoff Cone Readings			Water Quality				Comments
Person	Clock	Lapsed	Tape	Meter	~~Transducer~~	%Sand	%Silt	%Clay	pH (s.u.)	T (°C)	EC (µS)	Turb (ntu)	
Knause	1425	0		Solinst	Pump	0	025	10	7.80	28.2	200	100	Static, Clear
~4gpm	1438	13		53.80	5300 RPM	0	25	10	7.64	23.9	228	-5	50gal, V.silty
initial	1445	20		66.60			20	10	7.64	23.7	210	-5	100gal, V.silty
rate	1500	35		69.25			15	5	7.62	23.8	207	-5	140gal, V.silty
2gpm	1515	50		70.35			10	5	7.46	23.6	209	380	160gal, V.silty
2gpm	1525	60		70.05			5	1	7.63	23.4	207	820	180gal, V.silty
1.5gpm	1538	73		69.95			1	0	7.64	23.4	204	260	200gal, V.silty
2gpm	1545	80		69.95		↓	0	0	7.64	23.4	205	160	220gal, Clear
	1555	90		69.80	↓	0	0	0	7.62	23.2	206	120	240gal, Clear
	Stop												

Signature: Todd Knause

Well Development Data Collection Form

Date: 03-09-2012

Project Name:	Evaluation of Background Conditions	Project Number:	20618.06/ICLW2
Project Location:	RGS - Moapa, NV	Weather:	Sunny, clear, warm, ~54°F
Well ID:	BG-1D	Well Type:	Monitoring
Well Diameter:	4-inch	Stickup:	3.0 FT AGS
Reference Point:	Top of PVC Casing	Well Depth:	105.60 FT BTOC
Depth to Water:	27.64 FT BTOC	Screen interval:	85.60-100.60 FT TOC
Data Type:	Drawdown	Well Use:	Pumping

Time			Water Level Data			Imhoff Cone Readings			Water Quality				Comments
Person	Clock	Lapsed	Tape	Meter	Transducer	%Sand	%Silt	%Clay	pH (s.u.)	T (°C)	EC (µS)	Turb (ntu)	
Knause	1038	0		Solinst	Pump	0	0	0	7.50	26.0	200	70	Static, clear
~5gpm	1048	10		49.40	5300RPM	0	20	10	7.51	25.30	467	-5	50 gals, V.Silty
initial	1053	15		51.00	~5gpm	↓	15	5	7.76	23.30	209	-5	75 gals, V.silty
rate	1100	22		51.00	~3.5gpm	↓	20	1	7.60	23.20	203	-5	100 gals, V.silty
	1110	32		51.80	~5gpm	↓	15	0	7.64	23.46	203	710	150 gals, silty
	1120.	42		52.50	~2.5gpm	↓	20	↓	7.48	23.30	203	-5	175 gals, V.silty
	1133	55		52.70	~2gpm	↓	10	↓	7.58	23.40	204	390	200 gals, clear
	1145	67		52.80	~4gpm	0	10	0	7.55	23.40	204	820	250 gals, silty
	Stop												
~3gpm	1228	0		31.50	5300RPM	0	0	0	7.73	24.70	206	250	Static, clear
initial	1245	17		52.35		0	10	5	7.41	23.70	208	-5	300 gal, V.silty
rate	1255	27		53.70	~7gpm	↓	0	0	7.42	24.30	206	130	370 gal, Clear
	1315	47		54.00	~4gpm	↓	0	0	7.58	23.60	208	120	450 gal, clear
	1325	57		54.50	~5gpm	0	0	0	7.48	23.50	205	80	500 gal, clear
	Stop												

Signature: Todd Knause

-5 ntu = 71,000 ntu

Well Development Data Collection Form

Date: 03-09-2012

Project Name:	Evaluation of Background Conditions	Project Number:	20618.06/ICLW2
Project Location:	RGS - Moapa, NV	Weather:	Sunny, clear, cool, ~40°F
Well ID:	BG-2S	Well Type:	Monitoring
Well Diameter:	4-inch	Stickup:	3.50 Ft AGS
Reference Point:	Top of PVC Casing	Well Depth:	42.50 Ft BTOC
Depth to Water:	24.71 Ft BTOC	Screen interval:	17.50-37.50 Ft TOC
Data Type:	Drawdown	Well Use:	Pumping

Time			Water Level Data			Imhoff Cone Readings			Water Quality				Comments
Person	Clock	Lapsed	Tape	Meter	~~Transducer~~	%Sand	%Silt	%Clay	pH (s.u.)	T (°C)	EC (µS)	Turb (ntu)	
Knause	0800	0		Solinst	Pump	0	0	0	7.50	24.0	360	76	Static, clear
~5gpm	0805	5		34.95	5300 RPM		40	10	7.45	21.3	348	890	25gal, silty
initial	0813	13		36.10	↓		30	5	7.42	21.7	332	-5	50gal, V. silty
rate	0820	20		34.30	4500 RPM		20	1	7.20	22.0	389	-5	75gal, V. silty
~7gpm	0827	27		36.20			10	0	7.42	22.0	401	440	125gals, silty
~2gpm	0837	37		36.30			5		7.31	22.2	415	260	140gal, clear
~3gpm	0845	45		38.60			0		7.40	22.3	413	130	166gal, clear
~3gpm	0858	58		35.30					7.40	22.4	423	100	200gal, clear
~4gpm	0907	67		35.30		↓	↓	↓	7.42	22.4	425	85	240gal, clear
~4gpm	0912	72		35.30	↓	0	0	0	7.23	22.2	435	72	260gal, clear
	Stop												

Signature: Todd Knause

-5ntu = 71000ntu

Well Development Data Collection Form

Date: 03-08-2012

Project Name:	Evaluation of Background Conditions	Project Number:	20618.06/ICLW2
Project Location:	RGS - Moapa, NV	Weather:	Sunny, clear, breezy, ~65°F
Well ID:	BG-2M	Well Type:	Monitoring
Well Diameter:	4-inch	Stickup:	3.50 Ft AGS
Reference Point:	Top of PVC Casing	Well Depth:	66.25 Ft BTOC
Depth to Water:	24.75 Ft BTOC	Screen interval:	41.25-61.25 Ft BTOC
Data Type:	Drawdown	Well Use:	Pumping

Time			Water Level Data			Imhoff Cone Readings			Water Quality				Comments
Person	Clock	Lapsed	Tape	Meter	~~Transducer~~	%Sand	%Silt	%Clay	pH (s.u.)	T (°C)	EC (µS)	Turb (ntu)	
Krause	1423	0		Solinst	Pump	0	0	0	7.60	24.1	100	80	Static, clear
~7gpm	1430	7		52.50'	5300RPM	0	10	10	7.47	22.90	205	-5	50gal, v.silty
Initial	1435	12		DRYP	64.75'								
rate	1440	17	Slow	Pump	4000RPM	0	10	10	7.53	22.60	209	-5	75gal, v.silty
~2.5gpm	1450	27		51.70	↓	↓	7	5	7.80	23.30	209	-5	100gal, v.silty
~2gpm	1505	42		51.75	↓	↓	5	0	7.67	23.10	214	-5	125gal, v.silty
~3gpm	1512	49		51.80	↓	↓	3	↓	7.35	22.80	205	340	150gal, less silty
	1520	57		51.75	↓	↓	1	↓	7.37	22.80	212	130	175gal, clear
	1530	67		51.70	↓	↓	0	↓	7.35	22.80	213	96	200gal, clear
	Stop												

Signature: Todd Krause

-5 ntu = >1,000 ntu

Well Development Data Collection Form

Date: 03-08-2012

Project Name:	Evaluation of Background Conditions	Project Number:	20618.06/ICLW2
Project Location:	RGS - Moapa, NV	Weather:	Sunny, breezy, warm ~60°F
Well ID:	BG-2D	Well Type:	Monitoring
Well Diameter:	4-inch	Stickup:	3.50 Ft AGS
Reference Point:	Top of PVC Casing	Well Depth:	100.00 Ft ~~BGS~~ TOC
Depth to Water:	19.55 Ft BTOC	Screen interval:	80-95 Ft ~~BGS~~ TOC
Data Type:	Drawdown	Well Use:	Pumping

Time			Water Level Data (TOC)			Imhoff Cone Readings			Water Quality				Comments
Person	Clock	Lapsed	Tape	Meter	~~Transducer~~	%Sand	%Silt	%Clay	pH (s.u.)	T (°C)	EC (µS)	Turb (ntu)	
Knause	1153	0		Solinst	Pump	0.0	0.0	0.0	7.60	22.2	97.0	70	Static, clear
~8gpm	1157	4		35.50	5800 RPM	0.5	10.0	0.5	7.60	22.5	800	180	60gal, silty
initial	1203	10		49.60		0.1	7.0		7.52	22.5	140	-5	120gal, v.silty
rate.	1208	15		55.15		0	5.0		7.55	22.7	189	480	150gal, v.silty
Surge	1215	22		43.30			3.0		7.39	22.8	130	180	200gal, v.silty
	1218	25		45.50			2.0		7.32	22.7	190	590	225gal, v.silty
	1223	30		53.80			1.0		7.36	22.0	204	-5	250gal, v.silty
	1235	38		55.00		0	0	0.5	7.44	24.4	198	550	300gal, v.silty
	Stop												Empty Tank
Start	1300	0		21.00	6000 RPM	0	0	0					1gal, v.silty
~15gpm	1303	3		44.60			5.0	0.5	7.44	24.4	200	500	25gal, v.silty
initial	1306	6		48.80			2.0	0.4	7.36	22.6	190	310	50gal, v.silty
rate	1310	10		49.50			1.0	0.3	7.34	22.6	190	350	100gal, v.silty
	1313	13		50.05			1.0	0.2	7.32	22.4	189	260	150gal, v.silty
	1330	30		50.30			0	0.1	7.30	22.7	190	190	200gal, v.silty
	1350	50		50.65			0	0	7.29	22.7	190	86	250gal, less silty
	1400	60		50.65	6000 RPM		0	0	7.26	22.6	190	100	300gal, clear
	Stop												
													600gal Total

Signature: Todd Knause

-5 ntu = >1000 ntu

Well Development Data Collection Form

Date: 3/15/12

Page 1 of 1

Project Name:	Evaluation of Background Conditions	Project Number:	20618.06/ICLW2
Project Location:	RGS - Moapa, NV	Weather:	Warm 60°, sunny
Well ID:	BG-35	Well Type:	Monitoring
Well Diameter:	4-inch	Stickup:	~25'
Reference Point:	Top of PVC Casing	Well Depth:	80
Depth to Water:	65.42 CS static	Screen interval:	60-75
Data Type:	Drawdown	Well Use:	Pumping

Time			Water Level Data			Imhoff Cone Readings (per 1000 mL)			Water Quality				Comments
Person	Clock	Lapsed	Tape	Meter	Transducer	Sand mL	Silt mL	Clay mL	pH	Temp °C	EC S/m	Turb NTU	
JD	1050	Static	65.42										small pump
	1055	Start	78.46	(2:48.57 min/5gal)		.5	200	.5	8.12	24.2	.132	X	M 65.55 67.30 D
	1715	20min	77.42			—	65	.5	8.17	24.7	.126	X	Brown
	1720	25min	77.46	(3:29.18 min/5gal)		no	no	no	8.01	24.0	.147	X	20 gallons
	1730	35min	77.31	↓		no	no	no	7.93	23.9	.152	850	50 gallons
	1732	pump shut off											clear
	1734	on				no	no	no	.794	23.9	.157	1050	90 gallon
	1735	30	70.14			no	no	no	7.93	23.8	.160	490	180 gallons clear
	1742	45	77.21			no	no	no	7.85	23.8	.163	370	65.54 m 67.35 D
	1749	52	77.30			no	no	no	7.81	23.8	.165	300	Clear
	1756	59	77.29			no	no	no	7.68	23.6	.167	310	Clear
	1810	off on 13	77.20			no	no	no	7.67	23.5	.168	300	Clear
	1815	19	77.25			no	no	no	7.67	23.4	.168	240	130 gallons
	130 gallons		total										
													small pump

X = 71000 ntu

Signature: [signature]

Well Development Data Collection Form

Date: 3/16/12

Page 1 of 1

Project Name:	Evaluation of Background Conditions	Project Number:	20618.06/ICLW2
Project Location:	RGS - Moapa, NV	Weather:	55, dry, sunny
Well ID:	BG-3m	Well Type:	Monitoring
Well Diameter:	4-inch	Stickup:	~3'
Reference Point:	Top of PVC Casing	Well Depth:	117
Depth to Water:	65.60 static	Screen interval:	97-112
Data Type:	Drawdown	Well Use:	Pumping

Time			Water Level Data			Imhoff Cone Readings (per 1,000 mL)			Water Quality				Comments
Person	Clock	Lapsed	Tape	Meter	Transducer	Sand mL	Silt mL	Clay mL	pH	Temp °C	EC S/m	Turb NTU	
JP	9:32	static	65.60										(67.39D) 65.34S brown
	9:54	start	89.88			no	5	.5	7.90	23.0	.154	X	measured from metal brown
	10:02	8 min	90.02			.5	10	.5	7.60	23.0	.154	X	pump reset. cloudy
	10:07	13 min	90.05	(584.5 sec/5 gal)		no	no	.4	7.60	23.1	.170	440	110 gallons cloudy
	10:15	21 min	84.31			no	no	no	7.09	23.1	.173	190	130 gallons clear
	10:20	26 min	90.45	(516.72 sec/5 gal)					7.76	23.0	.174	100	(67.40D) (65.40S) clear
	10:30	31 min	90.06			no	no	no	7.57	23.0	.174	90	clear
	10:34	end	90.13			no	no	no					180 gallons
↓	180 gallons total												
													small pump

X > 1,000 NTU

Signature: Julie Ann

Well Development Data Collection Form

Date: 3/16/12

Page 1 of 1

Project Name:	Evaluation of Background Conditions	Project Number:	20618.06/ICLW2
Project Location:	RGS - Moapa, NV	Weather:	55°, Sunny, windy
Well ID:	B-3D	Well Type:	Monitoring
Well Diameter:	4-inch	Stickup:	~2.5'
Reference Point:	Top of PVC Casing	Well Depth:	151'
Depth to Water:	67.39 Static	Screen interval:	136-145'
Data Type:	Drawdown	Well Use:	Pumping

Time			Water Level Data			Imhoff Cone Readings (per 1,000 mL)			Water Quality				Comments
Person	Clock	Lapsed	Tape	Meter	Transducer	Sand mL	Silt mL	Clay mL	pH	Temp °C	EC S/m	Turb NTU	
JO	8:20	Static	67.41										65.58m 63.34S
			Waiting for new pump, started pump to try, stopped, pulled pipe										30 gallons
	12:30	Start	72.33										tape measure from metal marking
	12:35	3min	85.5			no	13	.5	7.95	24.3	.172	X	oily, dirty brown
	12:40	10min	87.20	(31.25sec/5gal		no	no	no	7.69	23.7	.1666	240	clear
	12:55	25min	88.57			no	no	no	7.93	24.1	.1667	70	160 gallons, clear
	1310	40min		(30.50 sec/5gal		no	no	no	7.75	23.3	.1668	42	65.61m 65.31S, clear
	1317	47min	88.72			no	no	no	7.76	23.1	.1660	35	240 gal. Clear
✓	1320	end.	240 gallons total										
	240 gallons total												
													large pump
													X=>1,000 NTU

Signature: [signature]

Well Development Data Collection Form

Date: 3/13/12

Project Name:	Evaluation of Background Conditions	Project Number:	20618.06/ICLW2
Project Location:	RGS - Moapa, NV	Weather:	60°, dry, sunny
Well ID:	B645	Well Type:	Monitoring
Well Diameter:	4-inch	Stickup:	~2 1/2'
Reference Point:	Top of PVC Casing	Well Depth:	102
Depth to Water:	82.77	Screen interval:	72-97
Data Type:	Drawdown	Well Use:	Pumping

Time			Water Level Data			Imhoff Cone Readings (1 liter 1000 ml)			Water Quality X=7/1000				Comments
Person	Clock	Lapsed	Tape	Meter	Transducer	Sand ml	Silt ml	Clay ml	pH	Temp °C	EC S/m	Turb NTU	
JD	7:55	static	82.77	large pump									81.62D 82.65m
	7:57	start	93.5'			.5	15	.2	7.96	18.2	.218	X	Brown
	8:00	3min	99.80										
	8:10	13min	99.90	(1min 22.84sec/sgal)		0	7	.2	7.90	22.3	.238	X	Cloudy
	8:20	23min	<100			no	no	no	7.67	22.8	.238	X	100gal
	8:35	38min	<100			no	no	no	7.61	23.2	.243	490	138gal
	8:40	43min	<100	(1min 46.75sec/sgal)		no	no	no	7.60	23.4	.244	440	
	8:42	on 45	Pump kicked off										
	8:53	on	85.60										
	8:55	47min	85.20										cloudy
	9:00	60	89.42			no	no	no	7.68	23.1	.242	980	cloudy
	9:20	off 72min	Pump kicked off										180 gallons
Switched pump - downsize to smaller pump - still too much flow.													
	10:17	on	82.43			no	no	no	7.68	24.7	.259	840	cloudy
	10:45	100min											
	10:52	107min	81.31			no	no	no	7.60	24.2	.251	210	clear
	10:56	113min		(1min 40.88sec/sgal)		no	no	no	7.59	24.2	.245	160	clear
	11:05	120min	99.80			no	no	no	7.59	24.2	.245	95	270 gallons
270 gallons total													81.52D 82.70m
	11:10	on 125min											
	11:34	83.51											

Signature: [signature]

8:45-9:05 - Trying to fix pump, adjust flow
9:20-9:30 Trying to adjust pump, kicked one off, adjusted speeds, etc.
9:30-9:45 pulled pump
9:45-10:15 - with smaller pump.

Well Development Data Collection Form

Date: 3/17/12

Project Name:	Evaluation of Background Conditions	Project Number:	20618.06/ICLW2
Project Location:	RGS - Moapa, NV	Weather:	60° Warm, Sunny
Well ID:	BG-4M	Well Type:	Monitoring
Well Diameter:	4-inch	Stickup:	3'
Reference Point:	Top of PVC Casing	Well Depth:	135'
Depth to Water:	82.53	Screen interval:	115-130'
Data Type:	Drawdown	Well Use:	Pumping

Time			Water Level Data			Imhoff Cone Readings per 1000 mL			Water Quality				Comments
Person	Clock	Lapsed	Tape	Meter	Transducer	Sand mL	Silt mL	Clay mL	pH	Temp °C	EC S/m	Turb NTU	
JD	1450	Static	82.53										80.87D 82.77S
	1516	Start	110.45	(27.65sec. 15gal)		.5	17	.5	7.68	23.5	.232	X	80gallons grey
	1525	9 min	119.67			no	12	.5	7.61	23.3	.231	X	100gal-brown
	1530	14 min	118.70			no	no	.5	7.67	23.4	.231	370	
	1540	24 min	118.21	(30.03sec. 15gal)		no	no	no	7.55	23.3	.230	300	160gal Clear
	1549	33 off (water below pump)				no	no	no					
	1550	on	112.32			no	no	no	7.63	23.5	.231	560	cloudy
	1553	off 36											
	1554	on	110.34			no	no	no	7.65	23.3	.231	410	cloudy
	1558	off 40	sandy, 40gallons,			86.38	DTW						220gallons
	1615	on	112.41			no	no	no	7.65	23.2	.231	540	
	1628	off 53	118.76						7.70	23.4	.229	210	Clear 310gal
	1633	on 58min							7.68	23.2	.230	180	Clear
	1649	off 74min	112.26										360gal
													80.84m 82.80S
		360 gallons total											
													Large Pump 41" tall

Signature: [illegible]

K=71000 µS

Well Development Data Collection Form

Date: BG-4D 3/12/12

Project Name:	Evaluation of Background Conditions	Project Number:	20618.06/ICLW2
Project Location:	RGS - Moapa, NV	Weather:	60° warm, sunny
Well ID:	BG-4D	Well Type:	Monitoring
Well Diameter:	4-inch	Stickup:	~3'
Reference Point:	Top of PVC Casing	Well Depth:	172'
Depth to Water:	79.94	Screen interval:	152-167'
Data Type:	Drawdown	Well Use:	Pumping

Time			Water Level Data			Imhoff Cone Readings (100ml)			Water Quality X=7100				
Person	Clock	Lapsed	Tape	Meter	Transducer	Sand	Silt	Clay	pH	Temp °C	EC S/m	Turb NTU	Comments
JO	10:34	Static	79.94										82.634m 82.745
	11:06	Start	81.91			no	no	no	7.51	24.5	.298	190	
	11:15	9 min	122.54				@11:39						82.65m 82.775
120gal	11:18	12 min	<135	(11.31sec/5gal)		2ml	72	.5	7.58	23.9	.214	X	dry brown sediment
	11:30	24 min	125.64				@1:45		7.77	24.2	.217	X	82.65m 82.775
*180gal	11:45	27 min	<135	(water level		.5 @1:39	5 @2:24	no	7.70	23.6	.213	820	cloudy
emptied tank		off		catching on									
	12:00	on	95.13	hose)		no	no	no	7.76	24.1	.214	710	cloudy
	12:05	on 32 min											
	12:10	on 37 min											cloudy
	12:15	on	<135	(21.57sec/5gal)		no	1.5	no	7.75	24.3	.220	950	82.65m 82.775
	12:35	on 40 min											
160gal	12:44	1245 off				no	no	no	7.73	23.7	.215	X	cloudy
200gal	1310	91 min	<135			no	no	no	7.67	23.7	.216	820	
240gal	1325	106	<135	(30.16sec/5gal)		no	no	no	7.76	23.5	.211	X	82.64m 82.745
	1342	123 min				no	no	no	7.57	23.3	.214	150	clear
*300gal	1347	128 off 1400 1430				no	no	no	7.62	23.3	.213	340	clear
120gal	1440	on	<135			no	no	no	7.59	233	.215	160	clear
180gal	1445	off 133 min											
	1000 gallons total today.												
									large pump- Grundfos 10SQ15-330				1½ HP

cloudy, windy

clear water 480gal.

Signature: J. O'Neill

-pumped dry at 11:18. Choked back flow.
@11:45 pumped dry, pump overheated, shut off.
12:05-12:15 Ran, overheated, off.
12:45-1305 down
1330-1340, Pumped water to tower tank, 120 gal.

@1440 started pump, ran 5 min. off. pulled pump @ 3 pm.

Well Development Data Collection Form

Date: 3/15/12

Project Name:	Evaluation of Background Conditions	Project Number:	20618.06/ICLW2
Project Location:	RGS - Moapa, NV	Weather:	warm, 60°, sunny
Well ID:	BF40	Well Type:	Monitoring
Well Diameter:	4-inch	Stickup:	
Reference Point:	Top of PVC Casing	Well Depth:	
Depth to Water:	81.35	Screen interval:	
Data Type:	Drawdown	Well Use:	Pumping

Time			Water Level Data			Imhoff Cone Readings			Water Quality				Comments
Person	Clock	Lapsed	Tape	Meter	Transducer	Sand	Silt	Clay	pH	Temp	EC	Turb	
JP	7:59	Start	81.35										
	8:48	Start	99.42			no	no	no	8.20	21.8	.240	500	82.77m 83025
	9:00	off											
	30 gallons												
		145 total min pumped											
		130 gallons total from 40.											
		Too many pump problems. Did not pump any longer!											

Signature: [signature]

@ 9:00 pump overheated, not working

Well Development Data Collection Form

Date: 3/15/12

Page 1 of 1

Project Name:	Evaluation of Background Conditions	Project Number:	20618.06/ICLW2
Project Location:	RGS - Moapa, NV	Weather:	60° warm, dry
Well ID:	BG-6S	Well Type:	Monitoring
Well Diameter:	4-inch	Stickup:	~2.5'
Reference Point:	Top of PVC Casing	Well Depth:	72
Depth to Water:	54.25	Screen interval:	47-67
Data Type:	Drawdown	Well Use:	Pumping

Time			Water Level Data			Imhoff Cone Readings (per 1,000 mL)			Water Quality (X=>1000)				Comments
Person	Clock	Lapsed	Tape	Meter	Transducer	Sand mL	Silt mL	Clay mL	pH	Temp °C	EC S/m	Turb NTU	
	1415												
	1500	Start	54.25										bM 55.34 bD 55.52
	1515	15min	66.30	(44.13sec/5gal)		2	65	.5	7.87	23.7	.228	X	Brown
	1525	25m	66.43			no	no	1	7.85	23.7	.309	X	90gal.
	1530	30m	57.88	Pump off/reset		no	no	no	7.64	23.6	.312	690	Clear
	1538	Run	66.45			no	no	no	7.66	23.7	.314	250	Clear
	1540	38min	66.32			no	no	no	7.67	23.6	.314	220	150gallons
	1543	41min	66.40	(46.06sec/5gal)		no	no	no	7.62	23.6	.316	170	180gal
	1547	end 47min				no	no	no	7.89	23.6	.316	90	Clear
	210 gallons total												

small pump

Signature: [illegible]

Well Development Data Collection Form

Date: 3/15/12

Page 1 of 1

Project Name:	Evaluation of Background Conditions	Project Number:	20618.06/ICLW2
Project Location:	RGS - Moapa, NV	Weather:	Warm - 70°
Well ID:	B6-6	Well Type:	Monitoring
Well Diameter:	4-inch	Stickup:	~3'
Reference Point:	Top of PVC Casing	Well Depth:	104
Depth to Water:	55.35	Screen interval:	84-99
Data Type:	Drawdown	Well Use:	Pumping

Time			Water Level Data			Imhoff Cone Readings (per 1000 ml)			Water Quality				Comments
Person	Clock	Lapsed	Tape	Meter	Transducer	Sand ml	Silt ml	Clay ml	pH	Temp °C	EC S/m	Turb NTU	
JO	1311	Static	55.35										54.26 S
	1325	Start	74.79			.5	19	.5	7.86	23.4	0.173	X	Grey
	1330	5min	76.3	(35.62 sec/5gal)		no	10	.5	7.75	23.3	0.229	X	90 gallons brown
	1345	20min	77.48			no	1	no	7.51	23.3	0.225	140	180 gallons brown
	1400	35min	78.20	(36.67 sec/5gal)		no	no	no	7.68	23.5	.232	190	270 gallons clear
	1403	38min	78.72			no	no	no	7.45	23.5	.229	90	54.24 S 55.50 clear
	1404 end 40		280 gal pumped			no	no	no					
	280 gallons total												
											small pump X=7000 ntu		

Signature: [signature]

Well Development Data Collection Form

Date: 3/15/12

Page 1 of 1

Project Name:	Evaluation of Background Conditions	Project Number:	20618.06/ICLW2
Project Location:	RGS - Moapa, NV	Weather:	Warm - 65°
Well ID:	BG-6D	Well Type:	Monitoring
Well Diameter:	4-inch	Stickup:	~3'
Reference Point:	Top of PVC Casing	Well Depth:	135'
Depth to Water:	54.91	Screen interval:	115-130'
Data Type:	Drawdown	Well Use:	Pumping

per 1,000 mL
ml/43

Time			Water Level Data			Imhoff Cone Readings			Water Quality				Comments
Person	Clock	Lapsed	Tape	Meter	Transducer	Sand mL	Silt mL	Clay mL	pH	Temp °C	EC S/m	Turb NTU	
JO	11:10	Static	54.91										54.30 s 55.30 m
	11:49	Start							7.94	23.0	0.235	490	
	11:55	6 min	94.52			3	200	.5	7.87	22.8	0.268	X	brown
	12:00	11 min	88.34	seconds	5 gallons	1	1.5 sandy silt	.5	7.59	22.8	0.237	X	100 gallons pumped
	12:15	26 min	96.31			no	no	no	7.37	22.9	0.234	300	1090 min
	12:20	31 min	360.19	seconds	5 gallons	0	no	no	7.39	22.9	0.237	210	190 gallons pumped
	12:30	41 min	98.32			no	no	no	7.33	22.8	0.239	140	54.28 s 55.34 m 240 gallons
	1240	51 min	98.47			no	no	no	7.39	22.8	0.239	95	54.29 s 55.35 m
	1243	end -	~~300~~ 320	gallons total									
	320	gallons	total										

Small pump.
Pump to 105 GPM - 1/2 HP pump
X = >1000 NTU

Signature: [signature]

Appendix D

Laboratory Data Summary

Table D-1 Soil Chemical Analysis Results
Table D-2 Soil Physical Analysis Results
Table D-3 Groundwater Chemical Analysis Results
Table D-4 Groundwater Quality Control - Blanks
Table D-5 Groundwater Quality Control - Duplicates

Table D-1 - Soil Chemical Analytical Results Summary

Soil Boring	BG-1D		BG-1D		BG-1D		BG-1D		BG-1D		BG-1D		BG-1D		BG-1D		BG-1D		BG-2D		BG-2D		BG-2D	
Date	1/9/2012		1/9/2012		1/9/2012		1/9/2012		1/9/2012		1/9/2012		1/9/2012		1/9/2012		1/9/2012		12/27/2011		12/27/2011		12/27/2011	
Sample Depth	0 - 2 ft		10 ft		29 ft		40 ft		43 ft		46 ft		55 ft		78 ft		92 ft		0 - 2 ft		10 ft		19 ft	
Parameter Name	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier
Asbestos																								
Asbestos	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-
General Chemistry (units listed below)																								
Nitrogen, Ammonia (as N) (mg/kg)	5.2	-	< 5	J6	< 5	-	< 5	-	10	-	< 5	-	< 5	-	< 5	-	< 5	-	< 5	-	< 5	-	< 5	-
Chloride (mg/kg)	2200	-	490	-	89	-	65	-	210	-	67	-	81	-	66	-	77	-	8.2	J	25	-	7.6	J
Fluoride (mg/kg)	6.1	-	4.4	-	11	-	4.2	-	14	-	4.9	-	3.0	-	7.0	-	3.5	-	2.1	-	4.1	-	2.7	-
Nitrogen, Nitrate (as N) (mg/kg)	0.40	J	0.30	J	0.33	J	0.32	J	0.55	J	< 1	-	< 1	-	< 1	-	< 1	-	1.3	-	0.54	J	< 1	-
pH	8.7	T8	8.6	T8	8.2	T8	9.1	T8	8.2	T8	8.6	T8	8.7	T8	8.2	T8	8.1	T8	8.4	T8	8.2	T8	8.0	T8
Phosphate as P (mg/kg)	< 1	-	0.40	J	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	0.72	J	0.41	J	< 1	-
Sulfate (mg/kg)	6400	-	1700	-	170	-	58	-	140	-	88	-	120	-	120	-	110	-	62	-	220	-	16,000	-
Metals (mg/kg)																								
Aluminum	**17,000**	-	**6400**	V	**8600**	-	**2800**	-	**22,000**	-	**5600**	-	**1900**	-	**15,000**	-	**3100**	-	**4600**	-	**3500**	-	**5400**	-
Antimony	< 1	-	< 1	J6	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 10	O
Arsenic	**3.6**	-	**1.0**	P1	< 1	-	**0.97**	J	**9.1**	-	**1.8**	-	**4.0**	-	**2.6**	-	**3.4**	-	**6.5**	-	**6.0**	-	**56**	-
Barium	37	-	37	J3	34	-	22	-	23	-	**140**	-	7.8	-	**200**	-	**92**	-	44	-	40	-	**190**	-
Beryllium	0.050	J	< 0.5	O	< 0.5	O	< 0.5	O	1.1	-	0.13	-	< 0.1	-	0.59	-	0.058	J	< 0.5	O	< 0.5	O	< 1	O
Boron	**30**	-	6.5	J, P1	3.3	J	< 10	-	**16**	-	**11**	-	1.2	J	**16**	J	3.1	J	9.3	J	8.5	J	**13**	-
Cadmium	< 0.25	-	< 0.25	-	< 0.25	-	< 0.25	-	< 0.25	-	< 0.25	-	< 0.25	-	< 0.25	-	< 0.25	-	< 0.25	-	< 0.25	-	0.11	J
Calcium	100,000	-	79,000	V	48,000	-	140,000	-	31,000	-	46,000	-	38,000	-	71,000	-	26,000	-	23,000	-	19,000	-	160,000	-
Chromium (hexavalent)	< 2	-	**1.1**	J	**0.92**	J	< 2	-	< 2	-	< 2	-	< 2	-	< 2	-	**1.4**	J	< 2	-	< 2	-	< 2	-
Chromium (total)	13	-	5.5	-	7.5	-	3.2	-	20	-	5.3	-	2.8	-	15	-	5.3	-	5.3	-	4.6	-	8.8	-
Cobalt	**4.9**	-	**2.6**	-	**2.7**	-	**0.89**	-	**5.9**	-	**1.8**	-	**1.2**	-	**4.7**	-	**1.2**	-	**2.0**	-	**1.9**	-	**1.6**	-
Copper	11	-	4.2	-	5.8	-	2.9	-	12	-	3.3	-	2.1	-	20	-	2.7	-	2.5	-	1.9	-	3.2	-
Iron	**12,000**	-	**6500**	V	**8000**	-	**3800**	-	**17,000**	-	**4500**	-	**3600**	-	**10,000**	-	**3800**	-	**5800**	-	**5300**	-	**5400**	-
Lead	6.8	-	3.8	-	4.3	-	0.76	-	11	-	3.1	-	2.7	-	7.8	-	2.4	-	3.9	-	3.4	-	8.7	-
Magnesium	**19,000**	-	**13,000**	V	**11,000**	-	**30,000**	-	**10,000**	-	**5500**	-	**6000**	-	**11,000**	-	**3600**	-	**4000**	-	**3100**	-	**9200**	-
Manganese	**270**	-	**140**	J6	**110**	-	**68**	-	**160**	-	**300**	-	**240**	-	**450**	-	**130**	-	**100**	-	**85**	-	**90**	-
Mercury	0.012	J	0.0050	J	0.0093	J	0.0068	J	0.0091	J	0.0018	J	< 0.02	-	**0.036**	-	< 0.02	-	0.0028	J	< 0.02	-	0.0047	J
Molybdenum	0.39	-	0.41	P1	< 0.25	-	0.61	-	< 1.3	O	< 0.25	-	0.18	J	< 0.25	J	0.24	J	0.62	-	0.63	-	**8.7**	-
Nickel	**14**	-	5.9	P1	6.5	-	< 5	O	**20**	-	4.1	-	2.7	-	**12**	-	3.3	-	2.6	-	2.2	-	4.7	J
Potassium	5100	-	2000	V	2400	-	670	-	6700	-	2100	-	620	-	4400	-	1000	-	1800	-	1300	-	2100	-
Selenium	**0.71**	J	**0.66**	J, P1	< 1	-	< 1	-	**1.4**	-	< 1	-	< 1	-	**1.0**	-	< 1	-	< 1	-	< 1	-	< 10	O
Silica	830	-	740	-	720	-	550	-	1300	-	760	-	750	-	940	-	850	-	600	-	530	-	570	-
Silver	< 0.5	-	< 0.5	-	< 0.5	-	< 0.5	-	< 0.5	-	< 0.5	-	< 0.5	-	< 0.5	-	< 0.5	-	0.25	J	0.20	J	< 0.5	-
Sodium	6100	-	2300	V	370	-	350	-	440	-	130	-	110	-	250	-	100	-	160	-	220	-	260	-
Thallium	< 5	O	< 5	O	< 5	O	**1.6**	-	< 5	O	< 5	O	< 5	O	< 5	O	< 1	-	< 1	-	< 1	-	< 10	O
Titanium	260	-	300	-	280	-	160	-	21	-	34	-	36	-	59	-	26	-	180	-	170	-	190	-
Vanadium	23	-	13	-	18	-	8.1	-	27	-	8.5	-	7.4	-	27	-	6.7	-	12	-	12	-	14	-
Zinc	78	-	52	-	41	-	63	-	64	-	31	-	23	-	69	-	19	-	13	-	11	-	16	-
PAHs (ug/kg)																								
Acenaphthene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-
Anthracene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-
Benzo(a)anthracene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-
Benzo(a)pyrene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-
Benzo(b)fluoranthene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-
Benzo(g,h,i)perylene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-
Benzo(k)fluoranthene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-
Chrysene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-
Fluoranthene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-
Indeno(1,2,3-cd)pyrene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-
Naphthalene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-
Phenanthrene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-
Pyrene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-
SVOC (ug/kg)																								
Biphenyl	< 330	-	< 330	-	< 330	-	< 330	-	< 330	-	< 330	-	< 330	-	< 330	-	< 330	-	< 330	-	< 330	-	< 330	-
Bis(2-ethylhexyl)phthalate	**21**	J	< 330	-	< 330	-	< 330	-	< 330	-	< 330	-	540	-	< 330	-	< 330	-	< 330	-	< 330	-	< 330	-

Notes:

NA - Not Applicable, ND - Non-detect

Results that exceed a screening level are in **bold**.

Laboratory Qualifiers

B4 = The indicated compound was found in the associated instrument blank, but all reported samples were non-detect

J = Estimated value below the lowest calibration point.

J3 = The associatedbatch QC was outside the established quality control range for precision

J6 = The sample matrix interfered with the ability to make any accurate getermination; spike value is low

O = Sample diluted due to matrix interferences that impaired the ability to make an accurate analytical determination. The detection limit is elevated in order to reflect the necessary dilution.

P1 = RPD value not applicable for sample concentrations less than 5 times the reporting limit

T8 = Additional method/sample information - samples received past/ too close to holding time.

Table D-1 - Soil Chemical Analytical Results Summary

Soil Boring	BG-2D		BG-2D		BG-2D		BG-2D		BG-2D		BG-3D		BG-3D		BG-3D		BG-3D		BG-3D		BG-3D		BG-3D	
Date	12/27/2011		12/27/2011		12/27/2011		12/27/2011		12/27/2011		2/28/2012		2/28/2012		2/28/2012		2/28/2012		2/28/2012		2/28/2012		2/28/2012	
Sample Depth	21 ft		30 ft		32 ft		75 ft		81 ft		0 - 2 ft		10 ft		17 ft		22 ft		29 ft		63 ft		65 ft	
Parameter Name	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier
Asbestos																								
Asbestos	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-
General Chemistry (units listed below)																								
Nitrogen, Ammonia (as N) (mg/kg)	< 5	-	7.1	-	< 5	-	< 5	-	7.2	P1	2.6	J	3.0	J	3.2	J	2.3	J	2.4	J	2.8	J	3.8	J
Chloride (mg/kg)	18	-	9.4	J	14	-	< 10	-	75	-	110	-	1900	-	120	-	62	-	120	-	88	-	69	-
Fluoride (mg/kg)	4.4	-	13	-	6.2	-	7.6	-	18	-	7.6	-	12	-	5.4	-	4.2	-	3.7	-	5.0	-	5.3	-
Nitrogen, Nitrate (as N) (mg/kg)	< 1	-	< 1	-	< 1	-	< 1	-	0.56	J	4.8	-	0.71	J	0.36	J	0.31	J	0.61	J	0.28	J	< 1.2	-
pH	7.8	T8	9.0	T8	8.0	T8	8.2	-	8.9	J3	8.0	T8	8.0	T8	9.1	T8	8.8	T8	9.1	T8	8.5	T8	8.5	T8
Phosphate as P (mg/kg)	< 1	-	0.72	J	< 1	-	< 1	-	< 1	-	< 1	B4	0.69	J	0.60	J, P1	< 1	B4	< 1	B4	< 1.2	B4	< 1.2	B4
Sulfate (mg/kg)	16,000	-	350	-	410	-	320	-	190	-	10,000	-	2300	-	480	-	650	J3	160	-	160	-	120	-
Metals (mg/kg)																								
Aluminum	**4800**	-	**18,000**	-	**5700**	-	**3600**	-	**18,000**	-	**4500**	-	**10,000**	-	**3900**	-	**3300**	-	**3700**	-	**4300**	-	**6800**	-
Antimony	< 1	-	< 1	-	< 1	-	< 1	-	< 5	O	< 1	-	< 1.1	-	< 1	-	< 1	-	< 1	-	< 1.2	-	**0.58**	J
Arsenic	**140**	-	**10**	-	**8.9**	-	**68**	-	**6.7**	-	**20**	-	**40**	-	**15**	-	**8.5**	J	**12**	-	**15**	-	**27**	-
Barium	35	-	34	-	12	-	6.9	-	26	-	**140**	-	67	-	**200**	-	**220**	-	**85**	-	**84**	-	76	-
Beryllium	< 0.5	O	0.33	-	< 0.5	O	0.13	-	0.87	-	0.022	J	0.28	-	0.078	J	0.032	J	0.055	J	0.19	-	0.17	-
Boron	**13**	-	**25**	-	**10**	-	9.3	J	**29**	-	6.6	J	8.1	J	6.4	J	5.3	J	3.5	J	**12**	J	**11**	J
Cadmium	< 0.25	-	< 0.25	-	< 0.25	-	< 0.25	-	**0.46**	-	0.16	J	0.070	J	0.057	J	**0.48**	-	< 0.25	-	< 0.31	-	0.052	J
Calcium	42,000	-	17,000	-	4000	-	19,000	-	57,000	-	100,000	-	70,000	-	76,000	-	150,000	-	36,000	-	25,000	-	38,000	-
Chromium (hexavalent)	< 2	-	< 2	-	< 2	-	< 2	-	< 2	-	**1.3**	J	**1.4**	J, P1	< 2.1	-	**1.2**	J	< 2	-	< 2.5	-	**1.8**	J
Chromium (total)	5.1	-	15	-	6.1	-	4.4	-	17	-	5.1	-	14	-	4.8	-	5.0	-	4.5	-	5.0	-	8.4	-
Cobalt	**1.4**	-	**6.9**	-	**2.2**	-	**1.6**	-	**4.3**	-	**1.6**	-	**3.9**	-	**1.8**	-	**1.3**	-	**1.6**	-	**1.8**	-	**3.9**	-
Copper	1.2	-	16	-	2.9	-	3.0	-	22	-	3.0	-	9.3	-	4.4	-	3.0	-	3.5	-	4.3	-	7.1	-
Iron	**10,000**	-	**17,000**	-	**6300**	-	**6800**	-	**18,000**	-	**4400**	-	**11,000**	-	**4900**	-	**3200**	-	**4700**	-	**5500**	-	**9400**	-
Lead	4.3	-	11	-	3.5	-	3.2	-	**16**	-	5.9	-	5.5	-	4.0	-	6.6	-	3.6	-	3.8	-	5.5	-
Magnesium	**6200**	-	**15,000**	-	**3900**	-	**4400**	-	**14,000**	-	**2600**	-	**3700**	-	**1600**	-	**1400**	-	**1300**	-	**1500**	-	**2800**	-
Manganese	**520**	-	**270**	-	**63**	-	**69**	-	**250**	-	**200**	-	**180**	-	**160**	-	**1200**	-	**75**	-	**69**	-	**130**	-
Mercury	0.0021	J	0.020	-	0.0017	J	< 0.02	-	**0.36**	-	0.0026	J	0.0041	J	0.0034	J	0.0048	J	0.0039	J	< 0.025	-	0.0025	J
Molybdenum	**12**	-	**10**	-	1.5	-	**3.7**	-	**3.8**	-	1.6	-	**2.6**	-	**1.7**	-	**2.6**	-	0.39	-	0.62	-	0.57	-
Nickel	2.0	-	**24**	-	3.2	-	3.6	-	**16**	-	4.0	J	**11**	-	4.2	J	< 10	O	3.4	-	4.0	-	**8.3**	-
Potassium	2000	-	6800	-	2200	-	1400	-	6600	-	1100	-	2200	-	1000	-	930	-	940	-	1200	-	1700	-
Selenium	< 5	O	< 5	O	< 1	-	< 1	-	**11**	-	< 10	O	< 5.4	O	< 5.2	O	< 10	O	< 5.1	O	< 1.2	-	< 2.4	O
Silica	520	-	1100	-	630	-	700	-	1100	-	520	-	730	-	460	-	520	-	470	-	790	-	820	-
Silver	0.48	J	**0.79**	-	0.31	J	0.43	J	< 0.5	-	< 0.51	-	< 0.54	-	< 0.52	-	< 0.51	-	< 0.51	-	< 0.63	-	< 0.59	-
Sodium	330	-	520	-	180	-	72	-	230	-	240	-	980	-	390	-	250	-	320	-	99	-	150	-
Thallium	< 5	O	< 5	O	< 1	-	< 1	-	< 5	O	< 5.1	O	< 5.4	O	< 5.2	O	< 51	O	< 5.1	O	< 1.2	-	< 2.4	O
Titanium	160	-	150	-	210	-	35	-	84	-	56	-	85	-	44	-	30	-	42	-	34	-	75	-
Vanadium	12	-	25	-	14	-	7.4	-	27	-	9.4	-	19	-	9.9	-	6.6	-	8.7	-	8.4	-	14	-
Zinc	13	-	49	-	16	-	13	-	62	-	12	-	31	-	15	-	9.8	-	13	-	16	-	30	-
PAHs (ug/kg)																								
Acenaphthene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6.1	-	< 6.5	-	< 6.3	-	< 6.1	-	< 6.1	-	< 7.5	-	< 7.1	-
Anthracene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6.1	-	< 6.5	-	< 6.3	-	< 6.1	-	< 6.1	-	< 7.5	-	< 7.1	-
Benzo(a)anthracene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6.1	-	< 6.5	-	< 6.3	-	< 6.1	-	< 6.1	-	< 7.5	-	< 7.1	-
Benzo(a)pyrene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6.1	-	< 6.5	-	< 6.3	-	< 6.1	-	< 6.1	-	< 7.5	-	< 7.1	-
Benzo(b)fluoranthene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6.1	-	< 6.5	-	< 6.3	-	< 6.1	-	< 6.1	-	< 7.5	-	< 7.1	-
Benzo(g,h,i)perylene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6.1	-	< 6.5	-	< 6.3	-	< 6.1	-	< 6.1	-	< 7.5	-	< 7.1	-
Benzo(k)fluoranthene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6.1	-	< 6.5	-	< 6.3	-	< 6.1	-	< 6.1	-	< 7.5	-	< 7.1	-
Chrysene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6.1	-	< 6.5	-	< 6.3	-	< 6.1	-	< 6.1	-	< 7.5	-	< 7.1	-
Fluoranthene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6.1	-	< 6.5	-	< 6.3	-	< 6.1	-	< 6.1	-	< 7.5	-	< 7.1	-
Indeno(1,2,3-cd)pyrene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6.1	-	< 6.5	-	< 6.3	-	< 6.1	-	< 6.1	-	< 7.5	-	< 7.1	-
Naphthalene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6.1	-	< 6.5	-	< 6.3	-	< 6.1	-	< 6.1	-	< 7.5	-	< 7.1	-
Phenanthrene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6.1	-	< 6.5	-	< 6.3	-	< 6.1	-	< 6.1	-	< 7.5	-	< 7.1	-
Pyrene	< 6	-	< 6	-	< 6	-	< 6	-	< 6	-	< 6.1	-	< 6.5	-	< 6.3	-	< 6.1	-	< 6.1	-	< 7.5	-	< 7.1	-
SVOC (ug/kg)																								
Biphenyl	< 330	-	< 330	-	< 330	-	< 330	-	< 330	J3	< 340	-	< 360	-	< 350	-	< 340	-	< 340	-	< 420	-	< 400	-
Bis(2-ethylhexyl)phthalate	< 330	-	< 330	-	< 330	-	< 330	-	< 330	J3	< 340	-	< 360	-	< 350	-	< 340	-	< 340	-	< 420	-	< 400	-

Table D-1 - Soil Chemical Analytical Results Summary

Soil Boring	BG-3D		BG-3D		BG-3D		BG-3D		BG-3D		BG-4D		BG-4D		BG-4D		BG-4D		BG-4D		BG-4D		BG-4D	
Date	2/28/2012		2/28/2012		2/28/2012		2/28/2012		2/28/2012		1/26/2012		1/26/2012		1/26/2012		1/26/2012		1/26/2012		1/26/2012		1/26/2012	
Sample Depth	69 ft		95 ft		105 ft		131 ft		136 ft		0 - 2 ft		10 ft		19 ft		40 ft		65 ft		79 ft		82 ft	
Parameter Name	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier
Asbestos																								
Asbestos	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-
General Chemistry (units listed below)																								
Nitrogen, Ammonia (as N) (mg/kg)	4.1	J, P1	2.8	J	4.8	J	2.8	J	5.0	J	< 5.3	-	< 5.4	J6	< 5.9	-	< 5.8	-	< 5.1	-	< 5.9	-	< 6	-
Chloride (mg/kg)	59	-	60	-	66	-	55	-	69	-	3800	-	310	-	340	-	180	-	52	-	120	-	110	-
Fluoride (mg/kg)	9.4	-	5.4	-	10	-	3.8	-	16	-	3.7	-	7.0	-	7.6	-	9.5	-	2.9	-	6.3	-	4.6	-
Nitrogen, Nitrate (as N) (mg/kg)	< 1.1	-	0.47	J	0.31	J	0.25	J	< 1.2	-	**25**	-	< 1.1	J	< 1.2	J	< 1.2	J	< 1	J	< 1	J	< 1.2	J
pH	8.6	T8	8.5	T8	8.6	T8	8.8	T8	8.8	T8	8.6	-	8.7	-	8.2	-	8.4	-	8.8	-	8.4	-	8.4	-
Phosphate as P (mg/kg)	0.38	J, P1	< 1.1	B4	< 1.2	B4	< 1.1	B4	< 1.2	B4	< 1	-	< 1.1	B4	< 1.2	B4	< 1.2	B4	< 1	B4	< 1.2	B4	< 1.2	B4
Sulfate (mg/kg)	110	-	95	-	110	-	63	-	95	-	8100	-	230	-	250	-	72	-	< 51	J	140	J	200	-
Metals (mg/kg)																								
Aluminum	**11,000**	V	**2900**	-	**9600**	-	**2300**	-	**19,000**	V	**10,000**	-	**12,000**	-	**28,000**	-	**21,000**	-	**3900**	V,J3	**16,000**	-	**8200**	-
Antimony	< 1.1	J6	< 1.1	-	< 1.2	-	< 1.1	-	< 1.2	J6	< 1	-	< 1.1	-	< 1.2	-	< 1.2	-	< 1	J6	< 1.2	-	< 1.2	-
Arsenic	**41**	J3	**13**	-	**35**	-	**9.1**	J	**66**	J6	**12**	-	**15**	-	**24**	-	**12**	-	**6.7**	-	**18**	-	**17**	-
Barium	66	J3	55	-	**120**	-	**97**	-	33	-	16	-	24	-	36	-	**93**	-	9.9	-	29	-	18	-
Beryllium	0.59	-	< 0.11	-	0.20	-	0.046	J	0.58	-	0.46	-	0.46	-	1.6	-	1.0	-	0.11	P1	0.69	-	< 0.12	-
Boron	**14**	-	2.4	J	6.8	J	3.4	J	**12**	-	**24**	-	**13**	-	**28**	-	**28**	-	7.0	J,P1	**19**	-	**12**	J
Cadmium	0.11	J, P1	< 0.29	-	< 0.3	-	0.23	J	< 0.3	-	0.061	J	0.080	J	0.18	J	0.13	J	0.043	J,P1	0.22	J	0.092	J
Calcium	55,000	V	29,000	-	32,000	-	120,000	-	48,000	V	35,000	-	46,000	-	47,000	-	57,000	-	30,000	V	70,000	-	50,000	-
Chromium (hexavalent)	< 2.3	-	< 2.3	-	< 2.4	-	< 2.2	-	**1.0**	J, P1	< 2.1	-	< 2.2	-	< 2.4	J	< 2.3	-	< 2	-	< 2.3	-	< 2.4	-
Chromium (total)	15	-	4.6	-	12	-	2.6	-	20	-	12	-	14	-	32	-	23	-	5.5	-	19	-	10	-
Cobalt	**4.8**	-	**1.4**	-	**4.1**	-	**1.0**	-	**7.9**	-	**3.8**	-	**5.3**	-	**8.4**	-	**6.1**	-	**1.6**	-	**6.6**	-	**4.0**	-
Copper	11	-	2.5	-	7.3	-	2.2	-	17	-	8.3	-	11	-	20	-	14	-	3.2	-	14	-	8.4	-
Iron	**14,000**	V	**4000**	-	**11,000**	-	**3100**	-	**19,000**	V	**9900**	-	**13,000**	-	**24,000**	-	**17,000**	-	**4800**	V	**15,000**	V	**10,000**	-
Lead	8.1	-	3.1	-	5.4	-	5.3	-	11	-	6.4	-	9.4	-	14	-	12	-	4.0	-	11	-	7.3	-
Magnesium	**4300**	V	950	-	**3100**	-	970	-	**6300**	V	**8100**	-	**12,000**	-	**13,000**	-	**11,000**	-	**5300**	V	**13,000**	-	**12,000**	-
Manganese	**170**	-	**69**	-	**110**	-	**500**	-	**180**	J6	**130**	-	**200**	-	**260**	-	**260**	-	**90**	-	**360**	-	**190**	-
Mercury	0.0055	J	0.0017	J	0.0032	J	0.0010	J	0.0048	J	< 0.021	-	< 0.022	J	< 0.024	J	< 0.023	J	< 0.02	J	< 0.02	J	< 0.024	J
Molybdenum	**2.0**	-	0.48	-	0.47	-	**2.3**	J	0.40	-	0.44	-	0.38	-	0.24	J	0.34	J	0.32	J	0.27	J	0.43	-
Nickel	**14**	-	2.6	-	**8.7**	-	< 11	O	**19**	-	**9.0**	-	**11**	-	**22**	-	**17**	-	3.4	-	**15**	-	**8.0**	-
Potassium	2800	V	770	-	2400	-	740	-	4500	V	3100	-	3100	-	7500	-	6300	-	1200	V	4900	-	2800	-
Selenium	< 5.7	O	< 2.3	O	< 1.2	-	< 11	O	< 1.2	-	< 5.3	O	< 5.4	O	< 5.9	O	< 5.8	O	< 5.1	O,J6	< 5.9	O	< 12	O
Silica	940	-	720	-	840	-	520	-	950	-	670	-	810	-	840	-	830	-	480	-	730	-	770	-
Silver	< 0.57	-	< 0.57	-	< 0.59	-	< 0.55	-	< 0.6	-	< 0.53	-	< 0.54	-	< 0.59	-	< 0.58	-	< 0.51	-	< 0.59	-	< 0.6	-
Sodium	300	-	150	-	280	-	77	-	290	-	5400	-	1200	-	740	-	390	-	60	-	220	-	170	-
Thallium	< 5.7	O	< 2.3	O	< 2.4	O	< 11	O	< 6	O	< 5.3	O	< 5.4	O	< 5.9	O	< 5.8	O	< 5.1	O	< 5.9	O	< 6	O
Titanium	63	J5, J3	44	-	85	-	23	-	120	J6, J3	62	-	84	-	56	-	88	-	40	-	110	-	140	-
Vanadium	18	-	6.6	-	18	-	5.1	-	31	-	19	-	25	-	46	-	35	-	9.6	-	32	-	20	-
Zinc	39	-	9.6	-	30	-	7.7	-	57	-	30	-	39	-	73	-	52	-	13	-	52	-	29	-
PAHs (ug/kg)																								
Acenaphthene	< 6.8	-	< 6.9	-	< 7.1	-	< 6.6	-	< 7.2	-	< 6.3	Q	< 6.5	Q	< 7.1	Q	< 7	Q	< 6.2	Q	< 7	-	< 7.2	-
Anthracene	< 6.8	-	< 6.9	-	< 7.1	-	< 6.6	-	< 7.2	-	< 6.3	Q	< 6.5	Q	< 7.1	Q	< 7	Q	< 6.2	Q	< 7	-	< 7.2	-
Benzo(a)anthracene	< 6.8	-	< 6.9	-	< 7.1	-	< 6.6	-	< 7.2	-	< 6.3	Q	< 6.5	Q	< 7.1	Q	< 7	Q	< 6.2	Q	< 7	-	< 7.2	-
Benzo(a)pyrene	< 6.8	-	< 6.9	-	< 7.1	-	< 6.6	-	< 7.2	-	< 6.3	Q	< 6.5	Q	< 7.1	Q	< 7	Q	< 6.2	Q	< 7	-	< 7.2	-
Benzo(b)fluoranthene	< 6.8	-	< 6.9	-	< 7.1	-	< 6.6	-	< 7.2	-	< 6.3	Q	< 6.5	Q	< 7.1	Q	< 7	Q	< 6.2	Q	< 7	-	< 7.2	-
Benzo(g,h,i)perylene	< 6.8	-	< 6.9	-	< 7.1	-	< 6.6	-	< 7.2	-	< 6.3	Q	< 6.5	Q	< 7.1	Q	< 7	Q	< 6.2	Q	< 7	-	< 7.2	-
Benzo(k)fluoranthene	< 6.8	-	< 6.9	-	< 7.1	-	< 6.6	-	< 7.2	-	< 6.3	Q	< 6.5	Q	< 7.1	Q	< 7	Q	< 6.2	Q	< 7	-	< 7.2	-
Chrysene	< 6.8	-	< 6.9	-	< 7.1	-	< 6.6	-	< 7.2	-	< 6.3	Q	< 6.5	Q	< 7.1	Q	< 7	Q	< 6.2	Q	< 7	-	< 7.2	-
Fluoranthene	< 6.8	-	< 6.9	-	< 7.1	-	< 6.6	-	< 7.2	-	< 6.3	Q	< 6.5	Q	< 7.1	Q	< 7	Q	< 6.2	Q	< 7	-	< 7.2	-
Indeno(1,2,3-cd)pyrene	< 6.8	-	< 6.9	-	< 7.1	-	< 6.6	-	< 7.2	-	< 6.3	Q	< 6.5	Q	< 7.1	Q	< 7	Q	< 6.2	Q	< 7	-	< 7.2	-
Naphthalene	< 6.8	-	< 6.9	-	< 7.1	-	< 6.6	-	< 7.2	-	< 6.3	Q	< 6.5	Q	< 7.1	Q	< 7	Q	< 6.2	Q	< 7	-	< 7.2	-
Phenanthrene	< 6.8	-	< 6.9	-	< 7.1	-	< 6.6	-	< 7.2	-	< 6.3	Q	< 6.5	Q	< 7.1	Q	< 7	Q	< 6.2	Q	< 7	-	< 7.2	-
Pyrene	< 6.8	-	< 6.9	-	< 7.1	-	< 6.6	-	< 7.2	-	< 6.3	Q	< 6.5	Q	< 7.1	Q	< 7	Q	< 6.2	Q	< 7	-	< 7.2	-
SVOC (ug/kg)																								
Biphenyl	< 380	-	< 380	-	< 390	-	< 370	-	< 400	-	< 350	-	< 360	-	< 390	-	< 380	-	< 340	-	< 390	-	< 400	-
Bis(2-ethylhexyl)phthalate	17	J	< 380	-	< 390	-	< 370	-	< 400	-	< 350	-	< 360	-	< 390	-	< 380	-	< 340	-	< 390	-	< 400	-

Table D-1 - Soil Chemical Analytical Results Summary

Soil Boring	BG-4D		BG-4D		BG-4D		BG-4D		BG-4D		BG-6D		BG-6D		BG-6D		BG-6D		BG-6D		BG-6D		BG-6D	
Date	1/26/2012		1/26/2012		1/26/2012		1/26/2012		1/26/2012		2/10/2012		2/10/2012		2/10/2012		2/10/2012		2/10/2012		2/10/2012		2/10/2012	
Sample Depth	95 ft		117 ft		120 ft		161 ft		163 ft		0 - 2 ft		9 ft		28 ft		53 ft		58 ft		75 ft		87 ft	
Parameter Name	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier
Asbestos																								
Asbestos	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-	< 1	-
General Chemistry (units listed below)																								
Nitrogen, Ammonia (as N) (mg/kg)	< 6.1	-	< 5.9	-	< 6	-	< 6	-	< 5.9	-	< 5.1	-	< 5.1	-	17	-	10	-	< 6	-	< 5.9	-	< 6.2	-
Chloride (mg/kg)	110	-	140	-	140	-	98	-	80	-	190	-	240	-	170	-	110	-	120	-	110	-	110	-
Fluoride (mg/kg)	2.6	-	2.5	-	9.4	-	4.3	-	9.4	-	4.8	-	3.3	-	12	-	6.6	-	5.2	-	3.8	-	10	-
Nitrogen, Nitrate (as N) (mg/kg)	< 1.2	J	< 1.2	-	< 1.2	J	< 1.2	J	< 1.2	J	**150**	-	**25**	-	1.2	-	< 1.2	J	< 1.2	J	< 1.2	J	< 1.2	J
pH	8.7	-	8.4	-	8.6	-	8.5	-	8.5	-	8.6	-	9.2	-	8.9	-	9.1	-	8.9	-	8.5	T8	8.3	T8
Phosphate as P (mg/kg)	< 1.2	B4	< 1.2	B4	< 1.2	B4	< 1.2	B4	< 1.2	B4	< 1	B4	< 1	B4	< 1.2	B4	< 1.2	B4	< 1.2	B4	< 1.2	B4	< 1.2	B4
Sulfate (mg/kg)	200	-	300	-	210	-	160	-	130	-	820	-	83	-	750	-	290	-	300	-	270	-	190	-
Metals (mg/kg)																								
Aluminum	**3300**	-	**1500**	-	**15,000**	-	**8300**	-	**13,000**	-	**7800**	-	**5000**	-	**17,000**	-	**12,000**	-	**4500**	-	**4500**	-	**32,000**	-
Antimony	< 1.2	-	**1.3**	-	< 1.2	-	< 1.2	-	< 1.2	-	< 1	-	< 1	-	< 1.2	-	< 1.2	-	< 1.2	-	< 1.2	-	< 1.2	-
Arsenic	**6.4**	-	**5.7**	-	**19**	-	**11**	-	**16**	-	**9.3**	-	**6.1**	-	**16**	-	**13**	-	**6.3**	-	**8.4**	-	**16**	-
Barium	20	-	58	-	21	-	**250**	-	26	-	**100**	-	32	-	41	-	24	-	17	-	**150**	-	39	-
Beryllium	0.057	J	< 0.12	-	0.79	-	0.29	-	0.48	-	< 0.51	O	< 0.51	O	0.81	-	0.29	-	0.11	J	0.046	J	1.6	-
Boron	5.5	J	2.8	J	**12**	-	8.3	J	**10**	J	8.8	J	5.5	J	**20**	-	**10**	J	5.1	J	2.6	J	8.2	J
Cadmium	< 0.3	-	0.057	J	0.083	J	0.14	J	0.32	-	< 0.26	-	0.052	J	0.049	J	0.098	J	0.070	J	0.15	J	0.31	J
Calcium	30,000	-	25,000	-	39,000	-	52,000	-	90,000	-	96,000	-	38,000	-	44,000	-	49,000	-	25,000	-	54,000	-	51,000	-
Chromium (hexavalent)	< 2.4	-	< 2.4	-	< 2.4	J	< 2.4	-	< 2.3	-	< 2	-	< 2	-	< 2.3	-	< 2.4	-	< 2.4	J	< 2.4	-	< 2.5	-
Chromium (total)	4.2	-	2.8	-	18	-	10	-	16	-	8.3	-	6.0	-	21	-	14	-	6.4	-	6.1	-	38	-
Cobalt	**1.2**	-	**0.89**	-	**5.2**	-	**2.9**	-	**4.8**	-	**3.1**	-	**1.8**	-	**6.5**	-	**4.7**	-	**1.7**	-	**2.0**	-	**9.4**	-
Copper	2.6	-	1.9	-	12	-	7.0	-	13	-	4.8	-	2.6	-	13	-	10	-	3.8	-	4.6	-	**26**	-
Iron	**3800**	-	**2800**	-	**13,000**	-	**8200**	-	**12,000**	-	**7300**	-	**6400**	-	**15,000**	-	**12,000**	-	**4800**	-	**5900**	-	**26,000**	-
Lead	3.3	-	2.7	-	8.6	-	6.7	-	11	-	7.7	-	3.6	-	10	-	8.2	-	3.6	-	5.7	-	**18**	-
Magnesium	**5500**	-	**4500**	-	**9500**	-	**7800**	-	**13,000**	-	**8500**	-	**9900**	-	**9700**	-	**12,000**	-	**4000**	-	**6800**	-	**12,000**	-
Manganese	**79**	-	**73**	-	**170**	-	**290**	-	**360**	-	**140**	-	**140**	-	**210**	-	**190**	-	**99**	-	**270**	-	**260**	-
Mercury	< 0.024	J	< 0.024	J	< 0.024	J	< 0.024	J	< 0.023	J	< 0.02	-	< 0.02	J	< 0.023	J	< 0.024	J	< 0.024	J	< 0.024	J	< 0.025	J
Molybdenum	0.34	-	0.38	-	0.27	J	0.34	-	0.34	J	0.70	J	0.22	J	0.46	-	0.23	J	0.40	-	0.35	-	0.14	J
Nickel	2.4	-	1.8	-	**14**	-	7.0	-	**13**	-	5.8	-	2.8	-	**15**	-	**11**	-	3.9	-	4.0	-	**28**	-
Potassium	1100	-	590	-	4400	-	2400	-	3800	-	2400	-	1300	-	4600	-	3200	-	1300	-	1200	-	6600	-
Selenium	< 6.1	O	< 5.9	O	< 6	O	< 6	O	< 12	O	< 10	O	< 5.1	O	< 5.8	O	< 6	O	< 6	O	< 12	O	**1.2**	-
Silica	600	-	480	-	1100	-	810	-	780	-	420	-	390	-	630	-	630	-	620	-	520	-	840	-
Silver	< 0.61	-	< 0.59	-	< 0.6	-	< 0.6	-	< 0.59	-	< 0.51	-	< 0.51	-	< 0.58	-	< 0.6	-	< 0.6	-	< 0.59	-	< 0.62	-
Sodium	130	-	110	-	330	-	130	-	290	-	430	-	400	-	750	-	340	-	180	-	190	-	650	-
Thallium	< 1.2	-	< 1.2	-	< 6	O	< 6	O	< 12	O	< 5.1	O	< 5.1	O	< 5.8	O	< 6	O	< 6	O	< 5.9	O	< 6.2	O
Titanium	43	-	30	-	43	-	59	-	110	-	240	-	180	-	56	-	100	-	45	-	61	-	38	-
Vanadium	7.3	-	6.0	-	25	-	17	-	30	-	18	-	17	-	31	-	23	-	10	-	12	-	54	-
Zinc	11	-	7.3	-	43	-	24	-	41	-	18	-	14	-	48	-	36	-	13	-	16	-	81	-
PAHs (ug/kg)																								
Acenaphthene	< 7.3	-	< 7.1	-	< 7.2	-	< 7.2	-	< 7	J3	< 6.1	-	< 6.1	-	< 7	-	< 7.2	-	< 7.1	-	< 7.1	-	< 7.5	-
Anthracene	< 7.3	-	< 7.1	-	< 7.2	-	< 7.2	-	< 7	J3	< 6.1	-	< 6.1	-	< 7	-	< 7.2	-	< 7.1	-	< 7.1	-	< 7.5	-
Benzo(a)anthracene	< 7.3	-	< 7.1	-	< 7.2	-	< 7.2	-	< 7	-	< 6.1	-	< 6.1	-	< 7	-	< 7.2	-	< 7.1	-	< 7.1	-	< 7.5	-
Benzo(a)pyrene	< 7.3	-	< 7.1	-	< 7.2	-	< 7.2	-	< 7	-	< 6.1	-	< 6.1	-	< 7	-	< 7.2	-	< 7.1	-	< 7.1	-	< 7.5	-
Benzo(b)fluoranthene	< 7.3	-	< 7.1	-	< 7.2	-	< 7.2	-	< 7	-	< 6.1	-	< 6.1	-	< 7	-	< 7.2	-	< 7.1	-	< 7.1	-	< 7.5	-
Benzo(g,h,i)perylene	< 7.3	-	< 7.1	-	< 7.2	-	< 7.2	-	< 7	-	< 6.1	-	< 6.1	-	< 7	-	< 7.2	-	< 7.1	-	< 7.1	-	< 7.5	-
Benzo(k)fluoranthene	< 7.3	-	< 7.1	-	< 7.2	-	< 7.2	-	< 7	J3	< 6.1	-	< 6.1	-	< 7	-	< 7.2	-	< 7.1	-	< 7.1	-	< 7.5	-
Chrysene	< 7.3	-	< 7.1	-	< 7.2	-	< 7.2	-	< 7	-	< 6.1	-	< 6.1	-	< 7	-	< 7.2	-	< 7.1	-	< 7.1	-	< 7.5	-
Fluoranthene	< 7.3	-	< 7.1	-	< 7.2	-	< 7.2	-	< 7	J3	< 6.1	-	< 6.1	-	< 7	-	< 7.2	-	< 7.1	-	< 7.1	-	< 7.5	-
Indeno(1,2,3-cd)pyrene	< 7.3	-	< 7.1	-	< 7.2	-	< 7.2	-	< 7	-	< 6.1	-	< 6.1	-	< 7	-	< 7.2	-	< 7.1	-	< 7.1	-	< 7.5	-
Naphthalene	< 7.3	-	< 7.1	-	< 7.2	-	< 7.2	-	< 7	-	< 6.1	-	< 6.1	-	< 7	-	< 7.2	-	< 7.1	-	< 7.1	-	< 7.5	-
Phenanthrene	< 7.3	-	< 7.1	-	< 7.2	-	< 7.2	-	< 7	J3	< 6.1	-	< 6.1	-	< 7	-	< 7.2	-	< 7.1	-	< 7.1	-	< 7.5	-
Pyrene	< 7.3	-	< 7.1	-	< 7.2	-	< 7.2	-	< 7	J3	< 6.1	-	< 6.1	-	< 7	-	< 7.2	-	< 7.1	-	< 7.1	-	< 7.5	-
SVOC (ug/kg)																								
Biphenyl	< 400	-	< 390	-	< 390	-	< 400	-	< 390	-	< 340	-	< 330	-	< 380	-	< 400	-	< 390	-	< 390	-	< 410	-
Bis(2-ethylhexyl)phthalate	920	-	< 390	-	< 390	-	< 400	-	< 390	-	< 340	-	< 330	-	< 380	-	< 400	-	< 390	-	< 390	-	< 410	-

Table D-1 - Soil Chemical Analytical Results Summary

Soil Boring Date Sample Depth	BG-6D 2/10/2012 98 ft		BG-6D 2/10/2012 114 ft		BG-6D 2/10/2012 127 ft		EPA MCL-based SSL - November 2012[1]	EPA Risk-based SSL - November 2012[2]	EPA RSL Industrial Soil - November 2012[3]	NDEP BCL Outdoor Worker - January 2013[4]	NDEP LBCL (DAF 1) - January 2013[5]	NDEP LBCL (DAF 20) - January 2013[6]	USGS - Nevada[7]
Parameter Name	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**							
Asbestos													
Asbestos	< 1	-	< 1	-	< 1	-	NA	NA	NA	NA	NA	NA	NA
General Chemistry (units listed below)													
Nitrogen, Ammonia (as N) (mg/kg)	< 5.9	-	< 5.9	-	< 5.9	J6	NA	NA	NA	100,000	NA	NA	NA
Chloride (mg/kg)	93	-	100	-	82	-	NA	NA	NA	NA	NA	NA	NA
Fluoride (mg/kg)	4.0	-	5.3	-	6.6	-	NA	93	41,000	41,000	NA	NA	NA
Nitrogen, Nitrate (as N) (mg/kg)	< 1.2	J	< 1.2	J	< 1.2	J	NA	NA	1,600,000	100,000	7.0	140	NA
pH	8.5	T8	8.3	T8	8.1	T8	NA	NA	NA	NA	NA	NA	NA
Phosphate as P (mg/kg)	< 1.2	B4	< 1.2	B4	< 1.2	B4	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/kg)	190	-	250	-	160	-	NA	NA	NA	NA	NA	NA	NA
Metals (mg/kg)													
Aluminum	**11,000**	-	**10,000**	-	**24,000**	V	NA	23,000	990,000	100,000	75	1500	700 - >1,000
Antimony	< 1.2	-	< 1.2	-	< 1.2	J6	0.27	0.27	410	454	0.3	6	< 1 - 10
Arsenic	**13**	-	**17**	-	**20**	-	0.29	0.0013	1.6	1.77	1	20	< 0.1 - 100
Barium	59	-	22	-	32	-	82	120	190,000	100,000	82	1640	10 - 5,000
Beryllium	0.28	-	0.14	-	1.1	-	3.2	13	2000	2230	3	60	< 1 - 15
Boron	9.9	J	7.0	J	8.5	J, P1	NA	9.9	200,000	100,000	23.4	467	< 20 - 300
Cadmium	0.099	J	0.12	J	0.21	J, P1	0.38	0.52	800	1,110	0.4	8	NA
Calcium	39,000	-	52,000	-	46,000	V	NA	NA	NA	NA	NA	NA	130 - 330,000
Chromium (hexavalent)	< 2.4	-	< 2.4	-	< 2.4	-	NA	0.00059	5.6	1360	2	40	NA
Chromium (total)	13	-	12	-	26	-	180,000	NA	NA	NA	NA	NA	1 - 2,000
Cobalt	**3.6**	-	**4.5**	-	**7.2**	-	NA	0.21	300	337	0.495	9.9	< 3 - 70
Copper	8.8	-	9.8	-	18	-	46	22	41,000	42,200	45.8	915	< 1 - 700
Iron	**10,000**	-	**12,000**	-	**20,000**	V	NA	270	720,000	100,000	7.56	151	100 - >100,000
Lead	6.5	-	8.1	-	13	-	14	NA	800	800	NA	NA	< 10 - 700
Magnesium	**6800**	-	**13,000**	-	**11,000**	V	NA	NA	NA	100,000	973	19,500	200 - >100,000
Manganese	**150**	-	**190**	-	**210**	J6	NA	21	23,000	24,900	1.3	26.1	< 2 - 7,000
Mercury	0.026	-	< 0.024	J	< 0.024	J	0.1	0.033	43	341	0.104	2.09	< 0.01 - 5.1
Molybdenum	0.35	-	0.34	-	0.32	-	NA	1.6	5100	5680	3.69	73.7	< 3 - 15
Nickel	**9.2**	-	**10**	-	**18**	-	NA	20	20,000	21,800	7	140	< 5 - 700
Potassium	3300	-	2600	-	5400	V	NA	NA	NA	NA	NA	NA	2,200 - 65,000
Selenium	< 5.9	O	< 12	O	< 1.2	-	0.26	0.4	5100	5680	0.3	6	< 0.1 - 5
Silica	470	-	650	-	710	-	NA	NA	18,000,000	NA	NA	NA	NA
Silver	< 0.59	-	< 0.59	-	< 0.59	-	NA	0.6	5100	5680	0.85	17	NA
Sodium	180	-	180	-	300	-	NA	NA	NA	NA	NA	NA	3,000 - 100,000
Thallium	< 5.9	O	< 5.9	O	< 5.9	O	0.14	0.011	10	74.9	0.4	8	NA
Titanium	86	-	110	-	44	J6	NA	NA	NA	100,000	146,000	2,920,000	70 - 20,000
Vanadium	21	-	22	-	41	-	NA	78	5200	5680	300	6000	30 - 500
Zinc	30	-	34	-	64	-	NA	290	310,000	100,000	620	12,400	28 - 3,500
PAHs (ug/kg)													
Acenaphthene	< 7.1	-	< 7.1	-	< 7.1	-	NA	4100	33,000,000	2,560,000	29,000	580,000	NA
Anthracene	< 7.1	-	< 7.1	-	< 7.1	-	NA	42,000	170,000,000	9,920,000	590,000	11,800,000	NA
Benzo(a)anthracene	< 7.1	-	< 7.1	-	< 7.1	-	NA	10	2100	2340	80	1600	NA
Benzo(a)pyrene	< 7.1	-	< 7.1	-	< 7.1	-	240	3.5	210	234	400	8000	NA
Benzo(b)fluoranthene	< 7.1	-	< 7.1	-	< 7.1	-	NA	35	2100	2340	200	4000	NA
Benzo(g,h,i)perylene	< 7.1	-	< 7.1	-	< 7.1	-	NA	NA	NA	34,100,000	NA	NA	NA
Benzo(k)fluoranthene	< 7.1	-	< 7.1	-	< 7.1	-	NA	350	21,000	23,400	2000	40,000	NA
Chrysene	< 7.1	-	< 7.1	-	< 7.1	-	NA	1100	210,000	234,000	8000	160,000	NA
Fluoranthene	< 7.1	-	< 7.1	-	< 7.1	-	NA	70,000	22,000,000	24,400,000	210,000	4,200,000	NA
Indeno(1,2,3-cd)pyrene	< 7.1	-	< 7.1	-	< 7.1	-	NA	200	2100	2340	700	14,000	NA
Naphthalene	< 7.1	-	< 7.1	-	< 7.1	-	NA	0.47	18,000	17,400	4000	80,000	NA
Phenanthrene	< 7.1	-	< 7.1	-	< 7.1	-	NA	NA	NA	24,500	NA	NA	NA
Pyrene	< 7.1	-	< 7.1	-	< 7.1	-	NA	9500	17,000,000	19,300,000	210,000	4,200,000	NA
SVOC (ug/kg)													
Biphenyl	< 390	-	< 390	-	< 390	-	NA	8.7	210,000	56,800,000	NA	NA	NA
Bis(2-ethylhexyl)phthalate	< 390	J	< 390	-	< 390	-	1400	1,100	120,000	137,000	180,000	3,600,000	NA

Footnotes:

[1]**EPA MCL-based SSL:** EPA Soil Screening Level (SSL) (MCL-Based)—Maximum Contaminant Level (MCL) based soil contaminant concentrations below which no further action or study regarding the soil at a site is warranted under the Comprehensive Environmental Response, Compensations, and Liability Act (CERCLA). This soil screening level was determined by EPA to be protective The soil leaching to groundwater SSL (Risk-Based) may be used when NDEP has not determined a Leaching Basic Comparison Level (LBCL) for a particular parameter (November, 2012).

[2]**EPA Risk-based SSL:** EPA SSL (Risk-Based)-- Soil concentrations derived for individual chemicals of concern from standardized sets of equations. These equations combine EPA chemical toxicity data with parameters defined by assumed future land uses and exposure scenarios, including receptor characteristics and potential exposure pathways. The soil leaching to groundwater SSL NDEP has not determined a LBCL for a particular parameter (November, 2012).

[3]**EPA RSL Industrial Soil:** EPA Regional Screening Level (RSL) (Industrial Soil)-- Generic screening levels based on default exposure parameters and factors that represent Reasonable Maximum Exposure (RME) conditions for human long-term/chronic exposures and are based on the methods outlined in EPA's Risk Assessment Guidance for Superfund, Part B Manual (1991) and Soil Scr documents (1996 and 2002). The Industrial Soil RSL is protective of the human health of outdoor workers (November 2012).

[4]**NDEP BCL Outdoor Worker:** NDEP Basic Comparison Level (BCL) (Outdoor Industrial/Commercial Worker)-- Screening level determined by NDEP for the BMI Complex to be protective of the human health of outdoor workers from the Updated User's Guide and Tables (January, 2013).

[5]**NDEP LBCL (DAF1):** NDEP Leaching BCL Dilution Attenuation Factor of 1 (LBCL DAF1)-- Developed by NDEP for use at the BMI Complex and Common Areas in Henderson Nevada specifically for the soil leaching to groundwater migration pathway, and for certain constituents (January 2013).

[6]**NDEP LBCL (DAF20):** NDEP Leaching BCL Dilution Attenuation Factor of 20 (LBCL DAF20)-- Developed by NDEP for use at the BMI Complex and Common Areas in Henderson Nevada specifically for the soil leaching to groundwater migration pathway, and for certain constituents (January 2013).

[7]**USGS-Nevada:** Shacklette and Boerngen, 1984. *Element Concentrations in Soils and Other Surficial Materials in Conterminous United States* , Geological Survey Professional Paper 1270, U. S. Geological Survey, 1984

Table D-2 - Soil Physical Analytical Results Summary

Boring Location	Disturbed Soil Samples										Undisturbed Soil Samples					K (m/day)	Aquifer (based on field observations)
	Depth (ft bgs)	Total Organic Content (%)	pH	Atterberg Limits			USCS	Grain Size			Depth (ft bgs)	Description	Dry Density (pcf)	Moisture %	K(cm/sec)		
				PL	LL	PI		% Gravel	% Sand	% Silt & Clay							
BG-1D	**19-22**	0.5	8.79	NP	NV	NP	GP-GM	50.7	39.1	10.2	**20.5-21**	fine to coarse sand with clay	111.24	2.69	4.97E-02 [2]	42.94	Alluvium
	40-42	0.3	9.04	NP	NV	NP	GW	63.4	32.4	4.2	**46.5-47**	sandy clay	114.06	17.45	2.08E-07 [1]	1.80E-04	Alluvium
	45-48	0.9	8.39	13	26	13	CL	0.4	38.8	60.8	**--**	**--**	--	--	--	--	Muddy Creek
	62-65	2.4	8.35	18	34	16	CL	0.1	9.7	90.2	**63.0-63.5**	silty sand	97.52	28.95	4.40E-05 [1]	0.04	Muddy Creek
	99-102	0.7	8.37	15	20	5	CL-ML	0.0	39.8	60.2	**101-101.5**	fine sand with silt	113.39	17.85	2.08E-03 [2]	1.80	Muddy Creek
BG-2D	**19-21**	1.2	7.81	NP	NV	NP	SM	28.0	42.9	29.1	**21-21.5**	sand with plastic fines	123.35	6.42	9.19E-04 [2]	0.79	Alluvium
	42-44	0.2	8.48	20	33	13	CL	0.0	28.4	71.6	**43.5-44**	silty clay	98.50	23.81	5.28E-08 [1]	4.56E-05	Muddy Creek
	58	--	--	NP	NV	--	SM	0.0	64.2	35.8	**--**	**--**	--	--	--	--	Muddy Creek
	59-62	0.3	8.63	29	100	71	CH	0.0	9.6	90.4	**61.5-62**	clay	85.01	34.03	7.25E-09 [1]	6.26E-06	Muddy Creek
	75	0.1	8.08	NP	NV	NP	SM	0.0	69.1	30.9	**76-76.5**	fine sand	111.35	18.58	5.94E-03 [2]	5.13	Muddy Creek
	82-84	0.0	8.32	NP	NV	NP	SM	0.0	87.3	12.7	**82.5-83**	fine sand	108.84	21.22	8.46E-02 [2]	73.09	Muddy Creek
BG-3D	**40-42**	0.4	8.31	17	41	24	CL	0.0	28.0	72.0	**40.5-41**	lean clay	103.25	21.58	2.41E-09 [1]	2.08E-06	Muddy Creek
	58-60	0.3	8.95	NP	NV	NP	SP-SM	0.0	93.5	6.5	**60-60.5**	fine sand with silt	101.78	3.53	2.27E-03 [2]	1.96	Muddy Creek
	80-82	0.3	8.46	NP	NV	NP	SM	1.2	52.6	46.2	**80-80.5**	fine sand with silt	104.74	24.29	1.21E-04 [2]	0.10	Muddy Creek
	100-102	0.5	8.68	NP	NV	NP	SM	0.3	76.9	22.8	**100.5-101**	fine sand with silt	109.35	17.76	6.13E-05 [2]	0.05	Muddy Creek
	120-122	0.9	8.68	NP	NV	NP	SM	8.3	60.6	31.1	**120.5-121**	fine sand with silt	110.85	20.41	5.83E-06 [2]	0.01	Muddy Creek
	142.5-144.5	0.1	8.85	NP	NV	NP	ML	2.6	28.9	68.5	**143-143.5**	fine sand with silt	106.32	19.51	8.46E-07 [2]	7.31E-04	Muddy Creek
BG-4D	**20-22**	1.0	8.10	18	47	29	CL	0.8	14.1	85.1	**20.5-21**	sand with silt	103.56	3.21	1.62E-04 [1]	0.14	Muddy Creek
	40-42	2.4	8.24	16	39	23	CL	0.0	25.2	74.8	**40.5-41**	lean clay	115.16	16.11	1.70E-09 [1]	1.47E-06	Muddy Creek
	60-62	1.1	8.66	NP	NV	NP	ML	5.4	21.6	73.0	**--**	**--**	--	--	--	--	Muddy Creek
	80-82	1.6	8.37	21	28	7	CL-ML	4.8	9.6	85.6	**80.5-81**	silt with sand	108.11	18.80	7.65E-07 [1]	6.61E-04	Muddy Creek
	100-102	0.7	8.22	17	34	17	CL	1.4	29.6	69.0	**101.5-102**	silty sand with lean clay interbeds	109.93	16.83	5.46E-09 [1]	4.72E-06	Muddy Creek
	120-122	0.9	8.34	19	41	22	CL	0.0	25.9	74.1	**120.5-121**	silty sand with lean clay interbeds	106.45	15.24	3.75E-08 [1]	3.24E-05	Muddy Creek
	140-142	1.5	8.44	17	35	18	CL	2.4	24.2	73.4	**141-141.5**	lean clay	111.58	19.69	3.70E-09 [1]	3.20E-06	Muddy Creek
	160-162	1.3	8.71	16	25	9	CL	0.0	14.0	86.0	**161-161.5**	lean clay	114.08	15.15	4.06E-09 [1]	3.51E-06	Muddy Creek
BG-6D	**19-22**	0.2	8.33	NP	NV	NP	SM	3.5	51.3	45.2	**20-20.5**	silty sand with clay pocket	109.36	3.51	7.21E-05 [1]	0.06	Muddy Creek
	40-42	0.2	8.62	NP	NV	NP	SM	0.0	56.4	43.6	**40.5-41**	fine sand with silt	101.19	2.99	1.47E-02 [2]	12.70	Muddy Creek
	72-74	0.5	8.37	23	63	40	CH	0.0	0.4	99.6	**73-73.5**	silty clay with gravel	108.50	19.20	1.29E-08 [1]	1.11E-05	Muddy Creek
	79-82	0.2	8.41	16	33	17	CL	0.3	25.9	73.8	**80-80.5**	fine sand with silt	107.18	21.77	6.19E-03 [1]	5.35	Muddy Creek
	99-102	0.1	8.64	NP	NV	NP	SM	0.5	66.9	32.6	**100.5-101**	fine sand with silt	103.39	18.92	1.15E-03 [2]	0.99	Muddy Creek
	119-122	0.1	8.26	NP	NV	NP	ML	0.2	39.4	60.4	**121-121.5**	fine sand with silt	103.29	22.31	3.12E-05 [2]	0.03	Muddy Creek

Notes:
Atterberg Limits - PL=Plastic Limit, LL=Liquid Limit, PI = Plasticity Index
USCS - Unified Soil Classification System
pcf - pounds per cubic foot
[1] Hydraulic Conductivity (K) by Flexible Wall Hydraulic Conductivity Test - ASTM D5048
[2] Hydraulic Conductivity Corrected (K_{20}) Constant Head Permeability - ASTM D2434

Table D-3 - Groundwater Chemical Analytical Results Summary

Monitoring Well	BG-1D		BG-1D		BG-1D		BG-1D		BG-1M		BG-1M		BG-1M		BG-1M		BG-1S		BG-1S		BG-1S		BG-1S	
Date	3/20/2012		5/24/2012		8/23/2012		11/26/2012		3/20/2012		5/24/2012		8/23/2012		11/26/2012		3/20/2012		5/24/2012		8/23/2012		11/26/2012	
Parameter Name	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier
Asbestos (MFL>10um)																								
Asbestos	< 1	-	< 0.7	-	< 0.5	-	< 0.2	-	< 1	-	< 0.2	-	< 5	-	< 1	-	< 1	-	< 0.7	-	< 9.9	-	< 5	-
General Chemistry (units listed below)																								
Alkalinity - Bicarbonate (mg/L)	180	-	170	-	180	-	170	-	230	-	230	-	200	-	230	-	300	-	310	-	340	-	300	-
Alkalinity - Carbonate (mg/L)	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-
Chloride (mg/L)	220	-	200	-	200	-	210	-	210	-	200	-	220	-	200	-	320	-	280	-	260	-	280	-
Nitrogen, Ammonia(As N) (mg/L)	< 0.1	-	0.10	J, T2	0.13	T2	< 0.1	T2	< 0.1	T2	0.069	J, T2	0.11	T2	< 0.1	T2	< 0.1	T2	0.090	J, T2	0.12	T2	< 0.1	T2
Nitrogen, Nitrate(As N) (mg/L)	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	0.48	-	0.27	-	0.44	-	0.35	-
Nitrogen, Nitrite(As N) (mg/L)	0.015	J	< 0.1	-	< 0.1	-	< 0.1	-	0.016	J	< 0.1	-	< 0.1	-	< 0.1	-	0.016	J	< 0.1	-	< 0.1	-	< 0.1	-
pH (field)	7.29	-	7.42	-	7.38	-	7.29	-	7.28	-	7.13	-	7.36	-	7.11	-	7.24	-	7.05	-	7.22	-	6.98	-
pH (lab)	7.6	T8	NA	-	NA	-	NA	-	7.4	T8	NA	-	NA	-	NA	-	7.5	T8	NA	-	NA	-	NA	-
Phosphorus, Total (As P)(mg/L)	0.042	J	0.045	J, P1	< 0.1	-	< 0.1	T2	0.046	J	0.058	J	0.053	J	0.042	J, T2	0.077	J	0.092	J	0.064	J	0.052	J, T2
Specific Conductance (field) (µmhos/cm)	2190	-	1974	-	1960	-	2110	-	2240	-	2180	-	2170	-	2180	-	3050	-	2920	-	2810	-	2930	-
Specific Conductance (µmhos/cm)	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Sulfate (mg/L)	**710**	-	**660**	-	**650**	-	**670**	-	**670**	-	**630**	-	**700**	-	**630**	-	**950**	-	**880**	-	**790**	-	**850**	-
Total Dissolved Solids(residue, filterable) (mg/L	**1400**	-	**1400**	-	**1600**	-	**1300**	-	**1500**	-	**1400**	-	**1800**	-	**1400**	-	**2100**	-	**2100**	-	**1900**	-	**1500**	-
Metals (mg/L)																								
Aluminum, Dissolved	0.039	J	< 0.1	-	< 0.1	-	**0.068**	J	< 0.1	-	< 0.1	-	< 0.1	-	**0.071**	J	< 0.1	-	0.031	J	< 0.1	-	**0.082**	J
Antimony, Dissolved	**0.0068**	J	< 0.02	-	**0.028**	-	**0.020**	-	< 0.02	-	< 0.02	-	**0.027**	-	< 0.02	-	< 0.02	-	< 0.02	-	**0.028**	-	**0.028**	-
Arsenic, Dissolved	**0.019**	J	**0.0070**	J	< 0.02	-	< 0.02	-	**0.015**	J	**0.010**	J	< 0.02	-	**0.016**	J	**0.033**	-	**0.014**	J	< 0.02	-	**0.030**	-
Barium, Dissolved	0.021	-	0.018	-	0.020	-	0.019	-	0.029	-	0.028	-	0.030	-	0.029	-	0.025	-	0.022	-	0.021	-	0.026	-
Beryllium, Dissolved	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-
Boron, Dissolved	0.45	-	0.47	-	0.52	-	0.60	-	0.58	-	0.58	-	0.61	-	0.71	-	0.89	-	0.94	-	0.96	-	1.1	-
Cadmium, Dissolved	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	0.0020	J	< 0.005	-	< 0.005	-	< 0.005	-	0.0022	J	< 0.005	-	< 0.005	-	< 0.005	-
Calcium, Dissolved	120	-	120	-	130	-	160	-	120	-	120	-	120	-	150	-	150	-	140	-	140	-	180	-
Chromium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Chromium, hexavalent	< 0.01	-	< 0.01	-	**0.0050**	J	< 0.01	-	< 0.01	-	< 0.01	-	**0.0040**	J	< 0.01	-	< 0.01	-	< 0.01	-	**0.0070**	J	< 0.01	-
Cobalt, Dissolved	< 0.01	-	< 0.01	-	0.0040	J	**0.012**	-	0.0025	J	< 0.01	-	0.0037	J	**0.012**	-	< 0.01	-	< 0.01	-	0.0040	J	**0.011**	-
Copper, Dissolved	< 0.02	-	< 0.02	-	0.0033	J	< 0.02	-	< 0.02	-	< 0.02	-	0.0022	J	< 0.02	-	< 0.02	-	< 0.02	-	0.0033	J	< 0.02	-
Fluoride, Dissolved	**0.62**	-	0.57	-	0.60	-	0.53	-	0.58	-	0.54	-	0.59	-	0.50	-	**3.2**	-	**2.9**	-	**2.8**	-	**2.7**	-
Iron, Dissolved	< 0.1	-	< 0.1	-	< 0.1	-	0.094	J	0.047	J	< 0.1	-	< 0.1	-	**0.34**	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-
Lead, Dissolved	0.0058	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	0.0033	J	< 0.005	-	< 0.005	-	< 0.005	-
Magnesium, Dissolved	76	-	74	-	82	-	97	-	74	-	71	-	77	-	90	-	110	-	100	-	110	-	140	-
Manganese, Dissolved	**0.13**	-	**0.086**	-	**0.073**	-	**0.077**	-	**0.22**	-	**0.21**	-	**0.13**	-	**0.17**	-	0.0065	J	< 0.01	-	< 0.01	-	0.011	-
Mercury, Dissolved	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-
Molybdenum, Dissolved	0.0085	-	< 0.005	-	0.0032	J	0.010	-	0.0056	-	< 0.005	-	0.0052	-	0.012	-	0.026	-	0.014	-	0.026	-	0.037	-
Nickel, Dissolved	0.0065	J	0.0073	J	< 0.02	-	< 0.02	-	0.0086	J	0.0071	J	< 0.02	-	< 0.02	-	0.0099	J	0.0070	J	< 0.02	-	< 0.02	-
Potassium, Dissolved	17	-	17	-	19	-	22	-	16	-	16	-	18	-	20	-	20	-	22	-	22	-	26	-
Selenium, Dissolved	< 0.1	O	< 0.04	O	**0.16**	-	< 0.02	-	< 0.1	O	< 0.02	-	**0.15**	-	0.0074	J	< 0.1	O	< 0.1	O	**0.18**	-	0.011	J
Silica, Dissolved	17	-	18	-	16	-	16	-	19	-	19	-	19	-	18	-	46	-	46	-	42	-	43	-
Silver, Dissolved	< 0.01	-	< 0.01	-	0.0063	J	0.0079	J	0.011	-	< 0.01	-	0.0070	J	0.0073	J	< 0.01	-	< 0.01	-	0.0088	J	0.010	J
Sodium, Dissolved	210	-	200	-	220	-	270	-	240	-	250	-	240	-	280	-	330	-	360	-	340	-	410	-
Thallium, Dissolved	< 0.02	-	< 0.02	-	**0.044**	-	**0.070**	-	< 0.02	-	< 0.02	-	**0.047**	-	**0.065**	-	< 0.02	-	< 0.02	-	**0.050**	-	**0.072**	-
Titanium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Vanadium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	0.0064	J	0.0068	J	0.0079	J	0.0066	J
Zinc, Dissolved	0.019	J	< 0.03	-	0.39	-	0.057	-	< 0.03	-	< 0.03	-	0.031	-	0.058	-	< 0.03	-	< 0.03	-	0.014	J	0.065	-
PAH (µg/L)																								
Acenaphthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Anthracene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(a)anthracene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(a)pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(b)fluoranthene	0.010	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(g,h,i)perylene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(k)fluoroanthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Chrysene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Fluoranthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Indeno(1,2,3-cd)pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Naphthalene	0.019	J	< 0.25	-	< 0.25	-	< 0.25	-	0.018	J	0.021	J	0.032	J	< 0.25	-	0.018	J	< 0.25	-	0.034	J	< 0.25	-
Phenanthrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.014	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
SVOC (µg/L)																								
1,1-Biphenyl	< 10	-	< 10	-	< 8	-	< 10	-	< 10	-	< 10	-	< 8	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-
Bis(2-ethylhexyl)phthalate	< 1	-	0.65	J	1.1	J	< 3	-	< 1	-	< 1	-	0.95	J	1.1	J	1.2	-	0.54	J	0.63	J	< 3	-

Notes:

NA - Not Applicable; Results that exceed a screening level are in bold.

Laboratory Qualifiers

J = Estimated value below the lowest calibration point.

J3 = The associated batch QC was outside the established quality control range for precision.

J4 = The associated batch QC was outside the established quality control range for accuracy.

J5 = The sample matrix interfered with the ability to make an accurate determination; spike value is high.

J6 = The sample matrix interfered with the ability to make an accurate getermination; spike value is low.

O = Sample diluted due to matrix interferences that impaired the ability to make an accurate analytical determination. The detection limit is elevated in order to reflect the necessary dilution.

P1 = RPD value not applicable for sample concentrations less than 5 times the reporting limit.

T2 = Additional method/sample information - laboratory analysis was from an unpreserved or improperly preserved sample.

T8 = Additional method/sample information - samples received past/ too close to holding time.

V= The sample concentration is too high to evaluate accurate spike recoveries.

* Duplicate sample value, laboratory compromised sample during handling.

Table D-3 - Groundwater Chemical Analytical Results Summary

Monitoring Well	BG-2D		BG-2D		BG-2D		BG-2D		BG-2M		BG-2M		BG-2M		BG-2M		BG-2S		BG-2S		BG-2S		BG-2S	
Date	3/21/2012		5/24/2012		8/23/2012		11/26/2012		3/21/2012		5/24/2012		8/23/2012		11/26/2012		3/21/2012		5/24/2012		8/23/2012		11/26/2012	
Parameter Name	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier
Asbestos (MFL>10um)																								
Asbestos	< 0.7	-	< 0.7	-	< 5	-	< 0.2	-	< 2.5	-	< 1.7	-	< 5	-	< 1	-	< 5	-	< 1.7	-	< 9.9	-	< 9.9	-
General Chemistry (units listed below)																								
Alkalinity - Bicarbonate (mg/L)	130	-	120	-	130	-	120	-	210	-	210	-	190	-	210	-	260	-	250	-	250	-	230	-
Alkalinity - Carbonate (mg/L)	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-
Chloride (mg/L)	41	-	40	-	40	-	41	-	34	-	35	-	36	-	38	-	72	-	62	-	71	-	69	-
Nitrogen, Ammonia(As N) (mg/L)	< 0.1	-	< 0.1	T2	0.10	T2	< 0.1	T2	< 0.1	-	0.076	J, T2	0.11	T2	< 0.1	T2	< 0.1	T2	0.049	J, T2, P1	0.16	T2	< 0.1	T2
Nitrogen, Nitrate(As N) (mg/L)	< 0.1	-	< 0.1	-	< 0.1	-	0.060	J	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-
Nitrogen, Nitrite(As N) (mg/L)	< 0.1	-	< 0.1	-	< 0.1	-	0.16	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	0.011	J	< 0.1	-	< 0.1	-	< 0.1	-
pH (field)	7.3	-	7.48	-	7.36	-	7.35	-	7.26	-	7.13	-	7.25	-	7.12	-	7.11	-	7.02	-	7.12	-	6.89	-
pH (lab)	7.7	T8	NA	-	NA	-	NA	-	7.7	T8	NA	-	NA	-	NA	-	7.5	T8	NA	-	NA	-	NA	-
Phosphorus, Total (As P)(mg/L)	0.045	J	0.046	J	< 0.1	-	0.022	J, T2	0.062	J	0.034	J, P1	< 0.1	-	0.020	J, T2, P1	0.11	T2	0.064	J	0.12	-	0.082	J, T2
Specific Conductance (field) (µmhos/cm)	1951	-	1867	-	1810	-	2010	-	2320	-	2300	-	2240	-	2330	-	4730	-	4300	-	4230	-	4430	-
Specific Conductance (µmhos/cm)	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Sulfate (mg/L)	**1100**	-	**1000**	-	**990**	-	**1000**	-	**1100**	-	**1100**	-	**1000**	-	**1200**	-	**2900**	-	**2600**	-	**2600**	-	**2600**	-
Total Dissolved Solids(residue, filterable) (mg/L	**1600**	-	**1700**	-	**1800**	-	**1600**	-	**1800**	-	**1900**	-	**1900**	-	**1900**	-	**4300**	-	**3800**	-	**4500**	-	**4000**	-
Metals (mg/L)																								
Aluminum, Dissolved	0.038	J	< 0.1	-	< 0.1	-	**0.054**	J	0.048	J	< 0.1	-	< 0.1	-	**0.061**	J	< 0.1	-	0.035	J	< 0.1	-	**0.058**	J
Antimony, Dissolved	< 0.02	-	< 0.02	-	**0.045**	-	< 0.02	-	< 0.02	-	< 0.02	-	**0.032**	-	**0.020**	-	**0.061**	-	< 0.02	-	**0.042**	-	**0.017**	J
Arsenic, Dissolved	**0.017**	J	< 0.02	-	< 0.02	-	**0.012**	J	**0.018**	J	< 0.02	-	< 0.02	-	**0.036**	-	**0.028**	-	< 0.02	-	< 0.02	-	**0.036**	-
Barium, Dissolved	0.014	-	0.015	-	0.015	-	0.014	-	0.022	-	0.024	-	0.016	-	0.018	-	0.028	-	0.038	-	0.036	-	0.046	-
Beryllium, Dissolved	< 0.002	-	< 0.002	-	0.00061	J	< 0.002	-	< 0.002	-	0.00083	J	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-
Boron, Dissolved	0.84	-	0.83	-	0.83	-	1.0	-	0.92	-	0.87	-	0.87	-	1.1	-	1.6	-	1.7	-	1.7	-	1.8	-
Cadmium, Dissolved	< 0.005	-	< 0.005	-	< 0.005	-	0.00070	J	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	0.0019	J	< 0.005	-	< 0.005	-	< 0.005	-
Calcium, Dissolved	210	-	200	-	200	-	240	-	200	-	190	-	200	-	240	-	420	-	420	-	410	-	440	-
Chromium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Chromium, hexavalent	< 0.01	-	< 0.01	-	**0.0030**	J	< 0.01	-	< 0.01	-	< 0.01	-	**0.0040**	J	< 0.01	-	< 0.01	-	< 0.01	-	**0.0060**	J	< 0.01	J6
Cobalt, Dissolved	< 0.01	-	< 0.01	-	0.0031	J	**0.011**	-	< 0.01	-	< 0.01	-	0.0033	J	**0.013**	-	< 0.01	-	< 0.01	-	0.0025	J	**0.014**	-
Copper, Dissolved	< 0.02	-	< 0.02	-	0.0042	J	< 0.02	-	< 0.02	-	< 0.02	-	0.0037	J	< 0.02	-	0.0035	J	< 0.02	-	0.0054	J	< 0.02	-
Fluoride, Dissolved	**2.8**	-	**2.7**	-	**2.8**	-	**2.4**	-	**2.4**	-	**2.3**	-	**2.5**	-	**2.0**	-	**4.1**	-	**3.4**	-	**3.9**	-	**3.5**	-
Iron, Dissolved	0.042	J	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	0.028	J	**1.0**	-	< 0.1	-	< 0.1	-	0.085	J	**0.48**	-
Lead, Dissolved	0.0036	J	< 0.005	-	< 0.005	-	< 0.005	-	0.0045	J	< 0.005	-	< 0.005	-	< 0.005	-	**0.034**	-	< 0.005	-	< 0.005	-	< 0.005	-
Magnesium, Dissolved	110	-	100	-	110	-	130	-	120	-	120	-	120	-	**160**	-	**270**	-	**270**	-	**280**	-	**290**	-
Manganese, Dissolved	**0.11**	-	**0.097**	-	**0.091**	-	**0.11**	-	**0.11**	-	**0.066**	-	**0.074**	-	**0.074**	-	**0.28**	-	**0.24**	-	**0.27**	-	**0.26**	-
Mercury, Dissolved	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-
Molybdenum, Dissolved	**0.25**	-	**0.23**	-	**0.23**	-	**0.29**	-	**0.086**	-	0.067	-	**0.13**	-	**0.098**	-	**0.37**	-	**0.37**	-	**0.39**	-	**0.41**	-
Nickel, Dissolved	< 0.02	-	0.0079	J	< 0.02	-	< 0.02	-	0.0073	J	0.0086	J	< 0.02	-	< 0.02	-	0.011	J	0.014	J	< 0.02	-	< 0.02	-
Potassium, Dissolved	26	-	25	-	25	-	30	-	44	-	40	-	36	-	51	-	84	-	84	-	86	-	86	-
Selenium, Dissolved	< 0.1	O	< 0.04	O	**0.18**	-	< 0.02	-	< 0.1	O	< 0.1	O	**0.18**	-	< 0.02	-	0.030	-	< 0.2	O	**0.24**	-	0.016	J
Silica, Dissolved	21	-	22	-	20	-	21	-	17	-	17	-	16	-	16	-	36	-	38	-	35	-	35	-
Silver, Dissolved	< 0.01	-	< 0.01	-	0.013	-	0.013	-	< 0.01	-	< 0.01	-	0.013	-	0.011	-	< 0.01	-	< 0.01	-	0.020	-	0.022	-
Sodium, Dissolved	100	-	100	-	100	-	120	-	160	-	170	-	140	-	200	-	420	-	400	-	400	-	400	-
Thallium, Dissolved	< 0.02	-	< 0.02	-	**0.050**	-	**0.073**	-	< 0.02	-	< 0.02	-	**0.054**	-	**0.077**	-	**0.0097**	J	< 0.02	-	**0.066**	-	**0.084**	-
Titanium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Vanadium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Zinc, Dissolved	0.014	J	< 0.03	-	0.015	J	0.068	-	0.015	J	0.011	J	0.014	J	0.066	-	< 0.03	-	< 0.03	-	0.024	J	0.081	-
PAH (µg/L)																								
Acenaphthene	0.012	J	< 0.05	-	< 0.05	-	< 0.05	-	0.010	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	-	< 0.05	-	0.019	J
Anthracene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(a)anthracene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(a)pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(b)fluoranthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(g,h,i)perylene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(k)fluoroanthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-
Chrysene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-
Fluoranthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-
Indeno(1,2,3-cd)pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-
Naphthalene	< 0.25	-	< 0.25	-	0.024	J	< 0.25	-	< 0.25	-	< 0.25	-	0.031	J	0.028	J	< 0.25	Q	0.091	J	0.021	J	0.042	J
Phenanthrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	-	< 0.05	-	0.012	J
Pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	-	< 0.05	-	0.054	-
SVOC (µg/L)																								
1,1-Biphenyl	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	T8	< 10	-	< 10	-	< 10	-
Bis(2-ethylhexyl)phthalate	< 1	-	0.90	J	0.58	J	1.0	J	< 1	-	< 1	-	0.55	J	0.86	J	< 1	T8	< 1	-	0.73	J	< 3	-

Table D-3 - Groundwater Chemical Analytical Results Summary

Monitoring Well	BG-3D		BG-3D		BG-3D		BG-3D		BG-3M		BG-3M		BG-3M		BG-3M		BG-3S		BG-3S		BG-3S		BG-3S	
Date	3/21/2012		5/23/2012		8/21/2012		11/27/2012		3/21/2012		5/24/2012		8/22/2012		11/27/2012		3/21/2012		5/23/2012		8/22/2012		11/27/2012	
Parameter Name	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier
Asbestos (MFL>10um)																								
Asbestos	< 0.7	-	< 0.2	-	< 0.2	-	< 0.2	-	< 0.2	-	< 0.7	-	< 5	-	< 1	-	< 9.9	-	< 1	-	< 0.5	-	< 5	-
General Chemistry (units listed below)																								
Alkalinity - Bicarbonate (mg/L)	190	-	220	-	220	-	190	-	190	-	200	-	220	-	190	-	130	-	160	-	150	-	140	-
Alkalinity - Carbonate (mg/L)	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-
Chloride (mg/L)	180	-	180	-	170	-	180	-	150	-	150	-	150	-	160	-	190	-	200	-	200	-	200	-
Nitrogen, Ammonia(As N) (mg/L)	< 0.1	-	0.073	J, T2	0.093	J	< 0.1	T2	< 0.1	-	0.073	J, T2	0.11	-	0.079	J, T2	< 0.1	-	0.047	J, T2	0.056	J	< 0.1	T2
Nitrogen, Nitrate(As N) (mg/L)	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	J6	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-
Nitrogen, Nitrite(As N) (mg/L)	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-
pH (field)	7.44	-	7.54	-	7.52	-	7.47	-	7.49	-	7.52	-	7.49	-	7.41	-	7.63	-	7.31	-	7.54	-	7.44	-
pH (lab)	8.1	T8	NA	-	NA	-	NA	-	8.0	T8	NA	-	NA	-	NA	-	7.9	T8	NA	-	NA	-	NA	-
Phosphorus, Total (As P)(mg/L)	0.15	-	0.13	T2	0.053	J	0.075	J	0.10	J	0.078	J	0.069	J, P1	0.035	J	0.15	-	0.19	-	0.081	J	0.090	J
Specific Conductance (field) (µmhos/cm)	1660	-	1637	-	1690	-	1770	-	1820	-	1731	-	1740	-	1830	-	1770	-	1770	-	1780	-	1770	-
Specific Conductance (µmhos/cm)	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Sulfate (mg/L)	430	-	400	-	390	-	480	-	**520**	-	**500**	-	470	-	**600**	-	**500**	-	**520**	-	**510**	-	**580**	-
Total Dissolved Solids(residue, filterable) (mg/L	**1100**	-	**1000**	-	**1100**	-	**1100**	-	**1200**	-	**1100**	-	**1200**	-	**1200**	-	**1100**	-	**1200**	-	**1200**	-	**1200**	-
Metals (mg/L)																								
Aluminum, Dissolved	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	0.036	J	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-
Antimony, Dissolved	< 0.02	-	< 0.02	-	< 0.02	-	**0.015**	J	< 0.02	-	< 0.02	-	**0.024**	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	**0.017**	J
Arsenic, Dissolved	**0.046**	-	**0.036**	-	**0.22**	-	**0.22**	-	**0.024**	-	**0.068**	-	< 0.02	-	**0.050**	-	**0.029**	-	**0.087**	-	**0.043**	-	**0.010**	J
Barium, Dissolved	0.066	-	0.067	-	0.026	-	0.023	-	0.038	-	0.020	-	0.036	-	0.016	-	0.064	-	0.041	-	0.035	-	0.036	-
Beryllium, Dissolved	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	0.00071	J	< 0.002	-	< 0.002	-
Boron, Dissolved	0.50	-	0.51	-	1.0	-	0.98	-	0.55	-	0.85	-	0.78	-	0.91	-	0.58	-	0.62	-	0.71	-	0.66	-
Cadmium, Dissolved	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	0.0016	J	< 0.005	-	< 0.005	-
Calcium, Dissolved	71	-	69	-	70	-	68	-	70	-	79	-	71	-	83	-	110	-	110	-	120	-	110	-
Chromium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Chromium, hexavalent	< 0.01	-	**0.0040**	J	**0.0040**	J	< 0.01	-	< 0.01	-	**0.0060**	J	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	**0.0050**	J	< 0.01	-
Cobalt, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Copper, Dissolved	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	0.0050	J	< 0.02	-	< 0.02	-	< 0.02	-	0.0033	J	< 0.02	-	< 0.02	-	< 0.02	-
Fluoride, Dissolved	**2.5**	-	**2.3**	-	**2.4**	-	**2.4**	-	**3.5**	-	**3.3**	-	**3.3**	-	**3.7**	-	**1.9**	-	**1.3**	-	**1.5**	-	**1.9**	-
Iron, Dissolved	< 0.1	-	< 0.1	-	< 0.1	-	0.068	J	< 0.1	-	< 0.1	-	< 0.1	-	0.037	J	< 0.1	-	< 0.1	-	< 0.1	-	0.016	J
Lead, Dissolved	0.0018	J	< 0.005	-	0.011	-	< 0.005	-	0.0048	J	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	0.0097	-	0.0021	J
Magnesium, Dissolved	28	-	28	-	39	-	38	-	27	-	34	-	32	-	35	-	46	-	56	-	62	-	60	-
Manganese, Dissolved	**0.19**	-	**0.18**	-	**0.022**	-	0.018	-	**0.030**	-	0.019	-	**0.028**	-	0.017	-	**0.054**	-	**0.098**	-	**0.051**	-	**0.022**	-
Mercury, Dissolved	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	0.000020	J	< 0.0002	-	< 0.0002	-
Molybdenum, Dissolved	0.045	-	0.026	-	**0.078**	-	**0.078**	-	0.030	-	0.020	-	0.026	-	0.036	-	0.029	-	0.0068	-	0.019	-	0.022	-
Nickel, Dissolved	0.0082	J	0.0058	J	0.012	J	< 0.02	-	< 0.02	-	0.0055	J	< 0.02	-	< 0.02	-	0.0061	J	0.0061	J	0.0091	J	< 0.02	-
Potassium, Dissolved	12	-	13	-	16	-	17	-	14	-	15	-	16	-	17	-	16	-	19	-	22	-	23	-
Selenium, Dissolved	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	**0.10**	-	0.012	J	< 0.02	-	< 0.04	O	< 0.02	-	< 0.02	-
Silica, Dissolved	17	-	21	-	17	-	16	-	18	-	17	-	18	-	17	-	18	-	19	-	18	-	17	-
Silver, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	0.0051	J	< 0.01	-	< 0.01	-	< 0.01	-	0.0041	J
Sodium, Dissolved	140	-	150	-	250	-	250	-	170	-	240	-	200	-	260	-	190	-	180	-	190	-	190	-
Thallium, Dissolved	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	**0.035**	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-
Titanium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Vanadium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Zinc, Dissolved	< 0.03	-	< 0.03	-	< 0.03	-	0.017	J	0.032	-	< 0.03	-	0.014	J	0.024	J	0.011	J	< 0.03	-	0.013	J	0.028	J
PAH (µg/L)																								
Acenaphthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.017	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Anthracene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.015	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(a)anthracene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(a)pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(b)fluoranthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(g,h,i)perylene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(k)fluoroanthene	< 0.05	-	< 0.05	-	< 0.05	J4	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	J4	< 0.05	-
Chrysene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Fluoranthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Indeno(1,2,3-cd)pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Naphthalene	0.025	J	< 0.25	-	< 0.25	-	< 0.25	-	**1.1**	-	< 0.25	-	0.022	J	0.021	J	0.026	J	< 0.25	-	< 0.25	-	0.022	J
Phenanthrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.013	J	< 0.05	-	0.044	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.032	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
SVOC (µg/L)																								
1,1-Biphenyl	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 8	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-
Bis(2-ethylhexyl)phthalate	< 1	-	0.87	J	1.4	J	0.65	J	< 1	-	0.58	J	1.3	J	0.65	J	0.84	J	0.91	J	0.83	J	0.69	J

Table D-3 - Groundwater Chemical Analytical Results Summary

Monitoring Well	BG-4D		BG-4D		BG-4D		BG-4D		BG-4M		BG-4M		BG-4M		BG-4M		BG-4S		BG-4S		BG-4S		BG-4S	
Date	3/20/2012		5/30/2012		8/30/2012		11/27/2012		3/20/2012		5/30/2012		8/30/2012		11/27/2012		3/20/2012		5/30/2012		8/30/2012		11/27/2012	
Parameter Name	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier
Asbestos (MFL>10um)																								
Asbestos	< 1	-	< 0.2	-	< 0.2	-	< 0.2	-	< 1	-	< 0.2	-	< 0.2	-	< 9.9	-	< 1	-	< 5	-	< 49.6	-	< 5	-
General Chemistry (units listed below)																								
Alkalinity - Bicarbonate (mg/L)	95	-	89	-	93	-	93	-	120	-	100	-	110	-	120	-	140	-	140	-	140	-	140	-
Alkalinity - Carbonate (mg/L)	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-
Chloride (mg/L)	290	-	270	-	250	-	270	-	290	-	280	-	260	-	280	-	300	-	280	-	270	-	290	-
Nitrogen, Ammonia(As N) (mg/L)	< 0.1	T2	0.10	T2, P1	0.11	T2	0.12	T2	< 0.1	T2	0.082	J, T2	0.091	J, T2	< 0.1	T2	< 0.1	T2	0.14	T2	0.067	J, T2	< 0.1	T2
Nitrogen, Nitrate(As N) (mg/L)	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	0.056	J	0.052	J	0.42	-	0.25	-
Nitrogen, Nitrite(As N) (mg/L)	0.014	J	< 0.1	-	< 0.1	-	< 0.1	-	0.045	J	0.029	J	0.091	J	0.057	J	0.016	J	< 0.1	-	< 0.1	-	< 0.1	-
pH (field)	7.56	-	7.64	-	7.77	-	7.58	-	7.46	-	7.53	-	7.62	-	7.37	-	7.42	-	7.5	-	7.53	-	7.29	-
pH (lab)	7.7	T8	NA	-	NA	-	NA	-	7.4	T8	NA	-	NA	-	NA	-	7.6	T8	NA	-	NA	-	NA	-
Phosphorus, Total (As P)(mg/L)	0.046	J	0.028	J	0.033	J	0.046	J	0.047	J	0.019	J	0.034	J	0.11	-	0.065	J	0.064	J	0.33	-	0.060	J
Specific Conductance (field) (µmhos/cm)	2270	-	2270	-	1930	-	2240	-	2490	-	2490	-	2330	-	2410	-	2610	-	2610	-	2460	-	2560	-
Specific Conductance (µmhos/cm)	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Sulfate (mg/L)	**720**	-	**670**	-	**670**	-	**720**	J6	**820**	-	**800**	-	**750**	-	**870**	-	**870**	-	**820**	-	**800**	-	**920**	-
Total Dissolved Solids(residue, filterable) (mg/L	**1500**	-	**1500**	-	**1500**	-	**1400**	-	**1700**	-	**1700**	-	**1600**	-	**1700**	-	**1800**	-	**1700**	-	**1700**	-	**1800**	-
Metals (mg/L)																								
Aluminum, Dissolved	< 0.1	-	0.049	J	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	**0.12**	-	< 0.1	-	< 0.1	-
Antimony, Dissolved	**0.0076**	J, P1	**0.021**	-	< 0.02	-	**0.028**	P1	**0.0066**	J	**0.022**	-	< 0.02	-	**0.017**	J	< 0.02	-	**0.026**	-	< 0.02	-	**0.0076**	J
Arsenic, Dissolved	**0.020**	P1	**0.032**	-	< 0.02	-	< 0.02	-	**0.019**	J	**0.033**	-	< 0.02	-	< 0.02	-	**0.019**	J	**0.035**	-	< 0.02	-	< 0.02	-
Barium, Dissolved	0.021	-	0.018	-	0.020	-	0.017	-	0.025	-	0.018	-	0.019	-	0.031	-	0.039	-	0.029	-	0.024	-	0.018	-
Beryllium, Dissolved	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	0.0013	J	< 0.002	-
Boron, Dissolved	0.72	-	0.76	-	0.77	-	0.78	-	0.72	-	0.73	-	0.76	-	0.75	-	0.64	-	0.68	-	0.71	-	0.70	-
Cadmium, Dissolved	< 0.005	-	0.0031	J	< 0.005	-	< 0.005	-	0.0021	J	0.0031	J	< 0.005	-	< 0.005	-	0.0030	J	0.0031	J	< 0.005	-	< 0.005	-
Calcium, Dissolved	130	V	140	-	130	-	130	V	160	-	150	-	140	-	150	-	170	-	170	-	160	-	160	-
Chromium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Chromium, hexavalent	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	**0.0050**	J	< 0.01	-	< 0.01	-
Cobalt, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Copper, Dissolved	< 0.02	-	0.0072	J	0.0023	J	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	0.0061	J	0.0066	J	< 0.02	-
Fluoride, Dissolved	**0.88**	-	**1.0**	-	**1.0**	-	**1.0**	-	**0.66**	-	0.58	-	**0.66**	-	**0.90**	-	0.54	-	0.52	-	0.56	-	**0.82**	-
Iron, Dissolved	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-
Lead, Dissolved	< 0.005	-	0.013	-	0.0036	J	< 0.005	-	0.0027	J	0.014	-	0.0031	J	< 0.005	-	< 0.005	-	**0.017**	-	0.0044	J	< 0.005	-
Magnesium, Dissolved	83	-	81	-	78	-	82	-	97	-	92	-	91	-	91	-	100	-	99	-	96	-	98	-
Manganese, Dissolved	**0.045**	-	**0.028**	-	0.0072	J	**0.025**	-	**0.052**	-	0.015	-	0.014	-	**0.031**	-	**0.039**	-	**0.021**	-	0.0046	J	0.0077	J
Mercury, Dissolved	< 0.0002	-	0.000020	J	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-
Molybdenum, Dissolved	0.011	-	< 0.005	-	0.0054	-	0.017	-	0.0069	-	< 0.005	-	0.0017	J	0.016	-	0.0045	J	< 0.005	-	0.0016	J	0.014	-
Nickel, Dissolved	0.0070	J, P1	< 0.02	-	< 0.02	-	< 0.02	-	0.0078	J	< 0.02	-	< 0.02	-	< 0.02	-	0.0089	J	< 0.02	-	< 0.02	-	< 0.02	-
Potassium, Dissolved	40	-	40	-	43	-	43	-	52	-	48	-	52	-	51	-	42	-	44	-	45	-	46	-
Selenium, Dissolved	< 0.1	O	0.0080	J	0.018	J	< 0.02	-	< 0.1	O	0.035	-	0.017	J	< 0.02	-	< 0.1	O	0.047	-	0.037	-	0.021	-
Silica, Dissolved	15	-	13	-	14	-	14	-	15	-	14	-	16	-	15	-	16	-	15	-	16	-	15	-
Silver, Dissolved	< 0.01	J6	0.0053	J	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	0.0038	J	0.0046	J	0.0055	J	< 0.01	-
Sodium, Dissolved	190	V	190	-	190	-	200	V	200	-	190	-	200	-	190	-	220	-	230	-	230	-	220	-
Thallium, Dissolved	< 0.02	-	**0.013**	J	**0.015**	J	< 0.02	-	< 0.02	-	**0.016**	J	**0.012**	J	< 0.02	-	< 0.02	-	**0.0091**	J	**0.014**	J	< 0.02	-
Titanium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Vanadium, Dissolved	< 0.01	-	< 0.01	-	0.0037	J	0.0025	J, P1	< 0.01	-	0.0030	J	0.0041	J	0.0028	J	< 0.01	-	< 0.01	-	0.0026	J	< 0.01	-
Zinc, Dissolved	< 0.03	-	< 0.03	-	< 0.03	-	0.028	J, P1	< 0.03	-	0.011	J	< 0.03	-	0.033	-	0.010	J	0.013	J	< 0.03	-	0.036	-
PAH (µg/L)																								
Acenaphthene	< 0.05	-	0.0086	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Anthracene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(a)anthracene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(a)pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(b)fluoranthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(g,h,i)perylene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.011	J	< 0.05	-
Benzo(k)fluoroanthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Chrysene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Fluoranthene	0.012	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Indeno(1,2,3-cd)pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.005	-	< 0.05	-	< 0.05	-	< 0.05	-
Naphthalene	**0.80**	-	< 0.25	-	< 0.25	-	0.025	J	**0.82**	-	< 0.25	-	< 0.25	-	0.025	J	0.020	J	< 0.25	-	0.023	J	0.021	J
Phenanthrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.015	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Pyrene	0.014	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
SVOC (µg/L)																								
1,1-Biphenyl	< 10	-	< 10	-	< 10	-	< 10	-	< 1	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-
Bis(2-ethylhexyl)phthalate	< 1	-	0.96	J	< 3	-	0.92	J	< 1	-	0.74	J	0.52	J	0.59	J	< 1	-	0.78	J	0.52	J	0.59	J

Table D-3 - Groundwater Chemical Analytical Results Summary

Monitoring Well	BG-6D		BG-6D		BG-6D		BG-6D		BG-6M		BG-6M		BG-6M		BG-6M		BG-6S		BG-6S		BG-6S		BG-6S	
Date	3/21/2012		5/25/2012		8/22/2012		11/27/2012		3/21/2012		5/25/2012		8/22/2012		11/27/2012		3/21/2012		5/25/2012		8/23/2012		11/27/2012	
Parameter Name	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier
Asbestos (MFL>10um)																								
Asbestos	< 5	-	< 0.2	-	< 0.5	-	< 0.2	-	< 0.7	-	< 0.2	-	< 0.5	-	< 0.2	-	< 0.7	-	< 1.7	-	< 0.5	-	< 9.9	-
General Chemistry (units listed below)																								
Alkalinity - Bicarbonate (mg/L)	130	-	130	-	150	-	130	-	120	-	130	-	140	-	120	-	130	-	160	-	140	-	130	-
Alkalinity - Carbonate (mg/L)	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-
Chloride (mg/L)	290	-	280	-	280	-	290	-	300	-	300	-	290	-	320	-	360	-	360	-	350	-	370	-
Nitrogen, Ammonia(As N) (mg/L)	< 0.1	-	0.060	J, T2	0.12	-	< 0.1	T2	< 0.1	-	0.095	J, T2	0.099	J	0.056	J, T2	< 0.1	T2	< 0.1	T2	0.12	T2	0.066	J, P1, T2
Nitrogen, Nitrate(As N) (mg/L)	< 0.1	-	0.13	-	0.24	-	0.31	-	0.053	J	0.099	J	0.26	-	0.25	-	< 0.1	-	< 0.1	-	0.17	-	0.11	-
Nitrogen, Nitrite(As N) (mg/L)	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-
pH (field)	7.31	-	7.45	-	7.4	-	7.31	-	7.45	-	7.47	-	7.45	-	7.49	-	7.52	-	7.35	-	7.58	-	7.46	-
pH (lab)	7.9	T8	NA	-	NA	-	NA	-	7.6	T8	NA	-	NA	-	NA	-	7.7	T8	NA	-	NA	-	NA	-
Phosphorus, Total (As P)(mg/L)	0.053	J	< 0.1	-	0.023	J	< 0.1	-	0.075	J	0.053	J	0.033	J	0.020	J	0.098	J	0.15	-	0.061	J	0.12	-
Specific Conductance (field) (µmhos/cm)	2600	-	2590	-	2530	-	2580	-	2530	-	2560	-	2480	-	2620	-	3370	-	3320	-	3370	-	3480	-
Specific Conductance (µmhos/cm)	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Sulfate (mg/L)	**890**	-	**860**	-	**830**	-	**940**	-	**820**	-	**810**	-	**750**	-	**920**	-	**1200**	-	**1200**	-	**1200**	-	**1300**	-
Total Dissolved Solids(residue, filterable) (mg/L	**1800**	-	**1800**	-	**1900**	-	**1900**	-	**1800**	-	**1800**	-	**1800**	-	**1900**	-	**2400**	-	**2400**	-	**2600**	-	**2500**	-
Metals (mg/L)																								
Aluminum, Dissolved	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	**0.052**	J	< 0.1	-	< 0.1	-	0.046	J	**0.10**	-	0.039	J	< 0.1	-	< 0.1	-
Antimony, Dissolved	< 0.02	-	**0.0072**	J	**0.034**	-	**0.022**	-	< 0.02	-	< 0.02	-	**0.041**	-	**0.025**	-	< 0.02	-	< 0.02	-	**0.038**	-	**0.025**	-
Arsenic, Dissolved	**0.016**	J	< 0.02	-	< 0.02	-	< 0.02	-	**0.018**	J	< 0.02	-	< 0.02	-	< 0.02	-	**0.015**	J	**0.016**	J	< 0.02	-	< 0.02	-
Barium, Dissolved	0.037	-	0.038	-	0.014	-	0.014	-	0.031	-	0.033	-	0.024	-	0.018	-	0.048	-	0.054	-	0.042	-	0.041	-
Beryllium, Dissolved	< 0.002	-	0.00082	J	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-
Boron, Dissolved	0.40	-	0.44	-	0.71	-	0.70	-	0.56	-	0.41	-	0.60	-	0.58	-	0.91	-	0.72	-	0.79	-	0.92	-
Cadmium, Dissolved	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-
Calcium, Dissolved	92	-	94	-	180	-	190	-	180	-	120	-	180	-	180	-	190	-	180	-	190	-	190	-
Chromium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Chromium, hexavalent	**0.0040**	J, P1	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	**0.0050**	J	< 0.01	-
Cobalt, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	0.0026	J	< 0.01	-	< 0.01	-	< 0.01	-	0.0035	J	< 0.01	-
Copper, Dissolved	0.0016	J	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	0.0041	J	< 0.02	-
Fluoride, Dissolved	**0.75**	-	**0.72**	-	**0.76**	-	**0.70**	-	**0.67**	-	**0.64**	-	**0.67**	-	**0.64**	-	**0.67**	-	**0.66**	-	**0.66**	-	**0.63**	-
Iron, Dissolved	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	0.098	J	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-
Lead, Dissolved	0.0048	J	< 0.005	-	< 0.005	-	< 0.005	-	0.0048	J	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-
Magnesium, Dissolved	46	-	48	-	110	-	110	-	110	-	67	-	110	-	110	-	97	-	86	-	99	-	98	-
Manganese, Dissolved	**0.089**	-	**0.095**	-	< 0.01	-	< 0.01	-	**0.096**	-	**0.20**	-	**0.026**	-	**0.026**	-	**0.11**	-	**0.20**	-	**0.11**	-	**0.058**	-
Mercury, Dissolved	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	0.000020	J	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-
Molybdenum, Dissolved	0.014	-	0.0051	-	< 0.005	-	0.016	-	0.012	-	0.0095	-	0.0053	-	0.017	-	0.018	-	0.0073	-	0.016	-	0.023	-
Nickel, Dissolved	< 0.02	-	0.011	J	< 0.02	-	< 0.02	-	< 0.02	-	0.0089	J	< 0.02	-	< 0.02	-	0.0052	J	0.0069	J	< 0.02	-	< 0.02	-
Potassium, Dissolved	15	-	16	-	29	-	30	-	27	-	18	-	27	-	28	-	20	-	17	-	20	-	23	-
Selenium, Dissolved	< 0.04	O	< 0.02	-	**0.18**	-	0.015	J	< 0.1	O	< 0.04	O	**0.19**	-	0.020	-	< 0.1	O	< 0.04	O	**0.18**	-	0.011	J
Silica, Dissolved	18	-	24	-	18	-	18	-	17	-	16	-	18	-	17	-	18	-	21	-	20	-	18	-
Silver, Dissolved	< 0.01	-	< 0.01	-	0.010	-	< 0.01	-	< 0.01	-	< 0.01	-	0.0077	J	< 0.01	-	< 0.01	-	< 0.01	-	0.0099	J	0.0029	J
Sodium, Dissolved	120	-	130	-	200	-	200	-	200	-	150	-	200	-	190	-	450	-	410	-	420	-	450	-
Thallium, Dissolved	< 0.02	-	< 0.02	-	**0.048**	-	< 0.02	-	< 0.02	-	< 0.02	-	**0.049**	-	< 0.02	-	< 0.02	-	< 0.02	-	**0.057**	-	< 0.02	-
Titanium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Vanadium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	0.0036	J	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	0.0029	J	< 0.01	-	0.0035	J	< 0.01	-
Zinc, Dissolved	0.028	J	0.016	J	0.018	J	0.045	-	0.014	J	< 0.03	-	0.018	J	0.039	-	0.014	J	< 0.03	-	0.015	J	0.047	-
PAH (µg/L)																								
Acenaphthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.0090	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Anthracene	0.017	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(a)anthracene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(a)pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(b)fluoranthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(g,h,i)perylene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(k)fluoroanthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Chrysene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Fluoranthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Indeno(1,2,3-cd)pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Naphthalene	0.015	J	0.020	J	< 0.25	-	< 0.25	-	**1.1**	-	0.021	J	0.035	J	0.025	J	0.023	J	0.020	J	0.027	J	0.031	J
Phenanthrene	< 0.05	-	< 0.05	-	0.015	J	< 0.05	-	0.012	J	< 0.05	-	0.015	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.034	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
SVOC (µg/L)																								
1,1-Biphenyl	0.22	J	< 10	-	< 8	-	< 10	-	< 10	-	< 10	-	< 8	-	< 10	-	< 10	-	< 10	-	< 8	-	< 10	-
Bis(2-ethylhexyl)phthalate	< 1	-	< 1	-	2.1	J	< 3	-	< 1	-	< 1	-	1.2	J	0.62	J	0.69	J	< 1	-	0.90	J	0.51	J

Table D-3 - Groundwater Chemical Analytical Results Summary

Monitoring Well	IMW-2.5D		IMW-2.5D		IMW-2.5D		IMW-2.5D		IMW-2.5S		IMW-2.5S		IMW-2.5S		IMW-2.5S		IMW-3D		IMW-3D		IMW-3S		IMW-3S	
Date	3/21/2012		5/21/2012		8/24/2012		11/26/2012		3/21/2012		5/21/2012		8/24/2012		11/26/2012		3/22/2012		5/25/2012		3/20/2012		5/21/2012	
Parameter Name	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier
Asbestos (MFL>10um)																								
Asbestos	< 1.7	-	< 1	-	< 1.7	-	< 1	-	< 9.9	-	< 5	-	< 1	-	< 5	-	< 5	-	< 1.7	-	< 1	-	< 0.2	-
General Chemistry (units listed below)																								
Alkalinity - Bicarbonate (mg/L)	450	-	460	-	480	-	440	-	440	-	500	-	470	-	440	-	240	-	240	-	330	-	360	-
Alkalinity - Carbonate (mg/L)	< 20	-	< 20	-	< 200	-	< 100	-	< 20	-	< 20	-	< 200	-	< 100	-	< 20	-	< 20	-	< 20	-	< 20	-
Chloride (mg/L)	310	-	330	-	310	-	320	-	350	-	370	-	340	-	360	-	230	-	230	-	250	-	230	-
Nitrogen, Ammonia(As N) (mg/L)	**0.30**	-	**0.54**	T2	**0.46**	T2	**0.35**	T2	0.16	T2	**0.39**	T2	**0.45**	T2	0.20	T2	0.082	J	0.080	J, T2	< 0.1	T2	< 0.1	T2
Nitrogen, Nitrate(As N) (mg/L)	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	0.027	J	0.22	-	0.074	J	0.71	-	0.38	-
Nitrogen, Nitrite(As N) (mg/L)	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	0.019	J	< 0.1	-	0.011	J	< 0.1	-	0.014	J	< 0.1	-
pH (field)	7.43	-	7.26	-	NA	-	7.36	-	7.67	-	7.46	-	NA	-	7.35	-	7.3	-	7.05	-	7.19	-	7.09	-
pH (lab)	7.6	T8	NA	-	NA	-	NA	-	7.6	T8	NA	-	NA	-	NA	-	8.1	T8	NA	-	7.4	T8	NA	-
Phosphorus, Total (As P)(mg/L)	0.12	-	0.099	J	0.13	T2	0.18	T2	0.28	-	0.18	-	0.27	T2	0.25	T2	0.066	J, T2	0.020	J	0.042	J	0.043	J, P1
Specific Conductance (field) (µmhos/cm)	3640	-	3620	-	NA	-	3670	-	3950	-	3940	-	NA	-	3880	-	2480	-	2330	-	2720	-	2710	-
Specific Conductance (µmhos/cm)	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Sulfate (mg/L)	**1000**	-	**1100**	-	**1000**	-	**1100**	-	**1200**	-	**1200**	-	**1200**	-	**1200**	-	**720**	-	**720**	-	**800**	-	**740**	-
Total Dissolved Solids(residue, filterable) (mg/L	**2400**	-	**2500**	-	**2600**	-	**2500**	-	**2700**	-	**2700**	-	**2700**	-	**2700**	-	**1700**	-	**1700**	-	**1600**	-	**1800**	-
Metals (mg/L)																								
Aluminum, Dissolved	**0.058**	J, P1	< 0.1	-	0.045	J	**0.078**	J	**0.056**	J	< 0.1	-	0.048	J	**0.090**	J	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-
Antimony, Dissolved	< 0.02	-	< 0.02	-	< 0.02	-	**0.016**	J	< 0.02	-	< 0.02	-	**0.014**	J, P1	**0.021**	-	**0.023**	-	< 0.02	-	**0.0079**	J	< 0.02	-
Arsenic, Dissolved	**0.16**	-	**0.14**	-	**0.13**	-	**0.19**	-	**0.17**	-	**0.16**	-	**0.14**	-	**0.24**	-	< 0.02	-	**0.0070**	J	**0.038**	-	**0.036**	-
Barium, Dissolved	0.015	-	0.019	-	0.015	-	0.018	-	0.025	-	0.025	-	0.025	-	0.029	-	0.013	-	0.017	-	0.017	-	0.018	-
Beryllium, Dissolved	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	0.00062	J
Boron, Dissolved	1.4	-	1.3	-	1.3	-	1.6	-	1.4	-	1.4	-	1.4	-	1.7	-	0.79	-	0.75	-	0.98	-	1.0	-
Cadmium, Dissolved	< 0.005	-	0.0017	J	< 0.005	-	< 0.005	-	< 0.005	-	0.0020	J	0.0015	J	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	0.0020	J
Calcium, Dissolved	110	-	110	-	110	-	130	-	87	-	90	-	93	-	110	-	130	-	130	-	110	-	110	-
Chromium, Dissolved	0.0046	J, P1	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Chromium, hexavalent	< 0.01	-	< 0.01	-	**0.0040**	J, T8	< 0.01	-	< 0.01	-	< 0.01	-	**0.0030**	J, T8, P1	< 0.01	-	< 0.01	T8	< 0.01	-	< 0.01	-	< 0.01	-
Cobalt, Dissolved	< 0.01	-	< 0.01	-	0.0041	J	**0.012**	-	< 0.01	-	< 0.01	-	0.0045	J	**0.012**	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Copper, Dissolved	0.0022	J, P1	< 0.02	-	0.0031	J	< 0.02	-	< 0.02	-	< 0.02	-	0.0045	J	< 0.02	-	0.0016	J	0.0061	J	< 0.02	-	< 0.02	-
Fluoride, Dissolved	**3.9**	-	**3.8**	-	**3.9**	-	**3.1**	-	**4.6**	-	**4.3**	-	**4.3**	-	**3.6**	-	**0.96**	-	**0.86**	-	**3.9**	-	**3.6**	-
Iron, Dissolved	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	0.019	J	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-
Lead, Dissolved	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	**0.016**	-	< 0.005	-	0.0040	J	< 0.005	-
Magnesium, Dissolved	140	-	140	-	140	-	**170**	-	130	-	140	-	140	-	**180**	-	83	-	84	-	98	-	98	-
Manganese, Dissolved	**0.23**	-	**0.22**	-	**0.24**	-	**0.28**	-	**0.22**	-	**0.30**	-	**0.28**	-	**0.36**	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Mercury, Dissolved	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-
Molybdenum, Dissolved	0.046	-	0.025	-	0.042	-	0.051	-	0.042	-	0.025	-	0.044	-	0.052	-	0.019	-	0.0029	J	0.033	-	0.018	-
Nickel, Dissolved	0.0053	J, P1	0.0067	J	< 0.02	-	< 0.02	-	0.0077	J	0.0099	J	< 0.02	-	< 0.02	-	< 0.02	-	0.0084	J	0.0077	J	0.0074	J
Potassium, Dissolved	30	-	27	-	32	-	34	-	35	-	32	-	36	-	38	-	23	-	23	-	23	-	23	-
Selenium, Dissolved	< 0.1	O	< 0.1	O	**0.19**	-	0.024	-	< 0.1	O	< 0.1	O	**0.18**	-	0.039	-	0.015	J	< 0.04	O	< 0.1	O	< 0.1	O
Silica, Dissolved	59	-	59	-	54	-	56	-	55	-	58	-	54	-	54	-	22	-	21	-	48	-	50	-
Silver, Dissolved	< 0.01	J6	< 0.01	-	0.0047	J	0.0078	J	< 0.01	-	< 0.01	-	0.0059	J	0.0065	J	< 0.01	-	< 0.01	-	0.0048	J	< 0.01	-
Sodium, Dissolved	510	V	470	-	470	-	540	-	660	-	570	-	540	-	640	-	250	-	260	-	330	-	330	-
Thallium, Dissolved	< 0.02	-	< 0.02	-	**0.038**	-	**0.061**	-	< 0.02	-	< 0.02	-	**0.031**	-	**0.049**	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-
Titanium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Vanadium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	0.0032	J	0.0032	J	0.0058	J	0.0066	J
Zinc, Dissolved	0.016	J, P1	< 0.03	-	0.018	J	0.060	-	0.011	J	< 0.03	-	0.020	J	0.054	-	< 0.03	-	< 0.03	-	< 0.03	-	< 0.03	-
PAH (µg/L)																								
Acenaphthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.020	-	< 0.05	-	< 0.05	-	< 0.05	-
Anthracene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.013	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(a)anthracene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(a)pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(b)fluoranthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(g,h,i)perylene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(k)fluoroanthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Chrysene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Fluoranthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Indeno(1,2,3-cd)pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Naphthalene	0.040	J	0.022	J	< 0.25	-	< 0.25	-	< 0.25	-	< 0.25	-	< 0.25	-	< 0.25	-	< 0.25	-	0.021	J	0.024	J	< 0.25	-
Phenanthrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.025	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
SVOC (µg/L)																								
1,1-Biphenyl	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-
Bis(2-ethylhexyl)phthalate	< 1	-	1.7	-	1.1	J	0.54	J	0.66	J	2.7	-	1.1	J	2.2	J	3.3	-	< 1	-	< 1	-	2.0	-

Table D-3 - Groundwater Chemical Analytical Results Summary

Monitoring Well	KMW-2D		KMW-2D		KMW-2D		KMW-2D		KMW-2M		KMW-2M		KMW-2M		KMW-2M		KMW-2S		KMW-2S		KMW-2S		KMW-2S	
Date	3/23/2012		5/21/2012		8/24/2012		11/26/2012		3/23/2012		5/21/2012		8/24/2012		11/26/2012		3/23/2012		5/21/2012		8/24/2012		11/26/2012	
Parameter Name	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**
Asbestos (MFL>10um)																								
Asbestos	< 0.7	-	< 1	-	< 5	-	< 5	-	< 2.5	-	< 9.9	-	< 5	-	< 5	-	< 16.5	-	< 9.9	-	< 1	-	< 124.1	-
General Chemistry (units listed below)																								
Alkalinity - Bicarbonate (mg/L)	440	-	460	-	470	-	440	-	410	-	430	-	440	-	410	-	400	-	420	-	440	-	1200	-
Alkalinity - Carbonate (mg/L)	< 20	-	< 20	-	< 200	-	< 100	-	< 20	-	< 20	-	< 200	-	< 100	-	< 20	-	< 20	-	< 200	-	< 100	-
Chloride (mg/L)	370	-	360	-	340	-	350	-	**420**	-	370	-	370	-	380	-	390	-	390	-	360	-	380	-
Nitrogen, Ammonia(As N) (mg/L)	< 0.1	-	**0.31**	T2	**0.44**	T2	**0.25**	T2	< 0.1	-	**0.37**	T2	**0.48**	T2	**0.33**	T2	< 0.1	-	**0.83**	J6, T2	**0.55**	T2	**0.40**	T2
Nitrogen, Nitrate(As N) (mg/L)	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-
Nitrogen, Nitrite(As N) (mg/L)	< 0.1	-	< 0.1	-	0.018	J, P1	< 0.1	-	< 0.1	-	< 0.1	-	0.018	J	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-
pH (field)	7.18	-	7.18	-	NA	-	7.33	-	7.14	-	7.18	-	NA	-	7.27	-	7.22	-	7.2	-	NA	-	7.26	-
pH (lab)	7.7	T8	NA	-	NA	-	NA	-	7.5	T8	NA	-	NA	-	NA	-	7.5	T8	NA	-	NA	-	NA	-
Phosphorus, Total (As P)(mg/L)	0.083	J, T2	0.086	J	0.12	T2	0.072	J, T2	0.12	T2	0.12	-	0.10	T2	0.12	T2	0.22	T2	0.48	-	0.091	J, T2	2.4	T2
Specific Conductance (field) (µmhos/cm)	3780	-	3810	-	NA	-	3830	-	3960	-	3990	-	NA	-	3990	-	3930	-	3940	-	NA	-	4000	-
Specific Conductance (µmhos/cm)	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Sulfate (mg/L)	**1200**	-	**1200**	-	**1200**	-	**1200**	-	**1400**	-	**1300**	-	**1200**	-	**1300**	-	**1300**	-	**1300**	-	**1200**	-	**1300**	-
Total Dissolved Solids(residue, filterable) (mg/L	**2600**	-	**2800**	-	**2800**	-	**2600**	-	**2800**	-	**3100**	-	**3000**	-	**2900**	-	**2800**	-	**3000**	-	**2900**	-	**3000**	-
Metals (mg/L)																								
Aluminum, Dissolved	< 0.1	-	< 0.1	-	**0.058**	J	**0.093**	J	< 0.1	-	< 0.1	-	**0.053**	J	**0.081**	J	0.038	J	< 0.1	-	0.035	J	**0.074**	J
Antimony, Dissolved	< 0.02	-	< 0.02	-	< 0.02	-	**0.022**	-	< 0.02	-	< 0.02	-	< 0.02	-	**0.022**	-	< 0.02	-	< 0.02	-	< 0.02	-	**0.024**	-
Arsenic, Dissolved	**0.093**	-	**0.098**	-	**0.070**	-	**0.16**	-	**0.094**	-	**0.10**	-	**0.077**	-	**0.18**	-	**0.21**	-	**0.19**	-	**0.16**	-	**0.29**	-
Barium, Dissolved	0.017	-	0.018	-	0.016	-	0.021	-	0.019	-	0.019	-	0.018	-	0.022	-	0.017	-	0.019	-	0.017	-	0.028	-
Beryllium, Dissolved	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-
Boron, Dissolved	1.3	-	1.3	-	1.3	-	1.7	-	1.2	-	1.2	-	1.2	-	1.5	-	1.1	-	1.1	-	1.1	-	1.5	-
Cadmium, Dissolved	< 0.005	-	0.0015	J	< 0.005	-	< 0.005	-	< 0.005	-	0.0020	J	< 0.005	-	< 0.005	-	< 0.005	-	0.0024	J	< 0.005	-	0.00080	J
Calcium, Dissolved	140	-	130	-	130	-	170	-	160	-	170	-	160	-	200	-	140	-	140	-	140	-	170	-
Chromium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Chromium, hexavalent	**0.0050**	J	< 0.01	-	**0.0040**	J, T8	< 0.01	-	**0.0040**	J	< 0.01	-	**0.0060**	J, T8	< 0.01	-	**0.0040**	J	< 0.01	-	**0.0030**	J, T8	< 0.01	-
Cobalt, Dissolved	< 0.01	-	< 0.01	-	0.0031	J	**0.011**	-	< 0.01	-	< 0.01	-	0.0033	J	**0.012**	-	< 0.01	-	< 0.01	-	0.0035	J	**0.014**	-
Copper, Dissolved	< 0.02	-	< 0.02	-	0.0036	J	< 0.02	-	< 0.02	-	< 0.02	-	0.0033	J	< 0.02	-	< 0.02	-	< 0.02	-	0.0026	J	< 0.02	-
Fluoride, Dissolved	**3.6**	-	**3.4**	-	**3.5**	-	**3.3**	-	**3.6**	-	**3.4**	-	**3.5**	-	**3.3**	-	**3.8**	-	**3.9**	-	**3.8**	-	**3.7**	-
Iron, Dissolved	< 0.1	-	< 0.1	-	0.033	J	0.27	-	0.036	J	< 0.1	-	0.16	-	**0.51**	-	< 0.1	-	< 0.1	-	0.10	J	0.055	J
Lead, Dissolved	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-
Magnesium, Dissolved	**150**	-	**150**	-	**150**	-	**190**	-	**160**	-	**170**	-	**160**	-	**200**	-	**170**	-	**170**	-	**170**	-	**210**	-
Manganese, Dissolved	**0.26**	-	**0.26**	-	**0.26**	-	**0.33**	-	**0.26**	-	**0.27**	-	**0.27**	-	**0.33**	-	**0.18**	-	**0.20**	-	**0.20**	-	**0.27**	-
Mercury, Dissolved	0.000010	J	< 0.0002	-	< 0.0002	-	< 0.0002	-	0.000010	J	< 0.0002	-	< 0.0002	-	< 0.0002	-	0.000010	J	< 0.0002	-	< 0.0002	-	< 0.0002	-
Molybdenum, Dissolved	0.037	-	0.022	-	0.039	-	0.052	-	0.034	-	0.021	-	0.034	-	0.044	-	0.036	-	0.023	-	0.028	-	0.041	-
Nickel, Dissolved	< 0.02	-	0.016	J	< 0.02	-	< 0.02	-	0.0058	J	0.012	J	< 0.02	-	< 0.02	-	< 0.02	-	0.010	J	< 0.02	-	< 0.02	-
Potassium, Dissolved	29	-	28	-	30	-	34	-	39	-	37	-	40	-	44	-	43	-	39	-	46	-	50	-
Selenium, Dissolved	< 0.1	O	< 0.1	O	**0.19**	-	**0.050**	-	< 0.2	O	< 0.1	O	**0.20**	-	0.009	J	< 0.1	O	< 0.1	O	**0.19**	-	0.028	-
Silica, Dissolved	58	-	60	-	54	-	56	-	60	-	61	-	55	-	58	-	63	-	64	-	57	-	60	-
Silver, Dissolved	< 0.01	-	< 0.01	-	0.0066	J	0.0076	J	< 0.01	-	< 0.01	-	0.0080	J	0.010	J	< 0.01	-	< 0.01	-	0.0054	J	0.010	J
Sodium, Dissolved	520	-	510	-	480	-	580	-	520	-	500	-	470	-	560	-	480	-	450	-	450	-	570	-
Thallium, Dissolved	< 0.02	-	< 0.02	-	**0.044**	-	**0.068**	-	< 0.02	-	< 0.02	-	**0.047**	-	**0.063**	-	< 0.02	-	< 0.02	-	**0.045**	-	**0.060**	-
Titanium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Vanadium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Zinc, Dissolved	< 0.03	-	0.016	J	0.019	J	0.061	-	< 0.03	-	< 0.03	-	0.019	J	0.063	-	< 0.03	-	< 0.03	-	0.022	J	0.062	-
PAH (µg/L)																								
Acenaphthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.013	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Anthracene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(a)anthracene	< 0.05	-	< 0.05	-	< 0.05	-	0.015	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(a)pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(b)fluoranthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(g,h,i)perylene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(k)fluoroanthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Chrysene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Fluoranthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Indeno(1,2,3-cd)pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Naphthalene	< 0.25	-	0.038	J	0.020	J	< 0.25	-	< 0.25	-	0.029	J	< 0.25	-	< 0.25	-	< 0.25	-	< 0.25	-	< 0.25	-	< 0.25	-
Phenanthrene	< 0.05	-	< 0.05	-	0.0094	J	0.0092	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Pyrene	< 0.05	-	< 0.05	-	0.039	J	0.019	J	< 0.05	-	< 0.05	-	< 0.05	-	0.013	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
SVOC (µg/L)																								
1,1-Biphenyl	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-
Bis(2-ethylhexyl)phthalate	< 1	-	0.90	J	0.81	J	0.67	J	< 1	-	2.0	-	0.96	J	0.71	J	< 1	-	1.1	-	0.65	J	0.73	J

Table D-3 - Groundwater Chemical Analytical Results Summary

Monitoring Well	LMW-10		LMW-10		LMW-10		LMW-10		LMW-11		LMW-11R		LMW-11R		LMW-11R		LMW-11R		LMW-12R		LMW-12R		LMW-12R	
Date	3/22/2012		5/30/2012		8/27/2012		11/28/2012		2/22/2012		3/23/2012		5/29/2012		8/21/2012		11/26/2012		5/30/2012		8/21/2012		10/22/2012	
Parameter Name	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier
Asbestos (MFL>10um)																								
Asbestos	< 198.6	-	< 9.9	-	< 49.6	-	< 49.6	-	NA	-	< 0.7	-	< 1	-	< 0.5	-	< 1	-	NA	-	NA	-	NA	-
General Chemistry (units listed below)																								
Alkalinity - Bicarbonate (mg/L)	93	-	89	-	94	-	110	-	NA	-	84	-	71	-	90	-	82	-	NA	-	NA	-	NA	-
Alkalinity - Carbonate (mg/L)	< 20	-	< 20	-	< 20	-	< 20	-	NA	-	< 20	-	< 20	-	< 20	-	< 20	-	NA	-	NA	-	NA	-
Chloride (mg/L)	**500**	-	**520**	-	**460**	-	**480**	-	**450**	-	**470**	-	**460**	-	**420**	-	**430**	-	380	-	380	-	350	-
Nitrogen, Ammonia(As N) (mg/L)	< 0.1	-	0.060	J, T2	0.062	J, T2	< 0.1	T2	NA	-	< 0.1	-	0.15	T2	0.053	J	< 0.1	T2	NA	-	NA	-	NA	-
Nitrogen, Nitrate(As N) (mg/L)	9.0	-	5.2	-	9.4	-	**10**	-	< 5	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	1.5	-	1.6	-	1.5	-
Nitrogen, Nitrite(As N) (mg/L)	0.010	J	< 0.1	-	0.083	J	< 0.1	-	NA	-	< 0.1	-	< 0.1	-	0.017	J	< 0.1	-	NA	-	NA	-	NA	-
pH (field)	7.49	-	NA	-	NA	-	NA	-	7.5	-	7.25	-	NA	-	NA	-	NA	-	7.44	-	7.39	-	7.56	-
pH (lab)	7.7	T8	NA	-	NA	-	NA	-	NA	-	7.6	T8	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Phosphorus, Total (As P)(mg/L)	0.80	T2	1.9	-	1.3	T2	0.88	-	NA	-	0.038	J, T2	0.038	J	0.036	J	< 0.1	T2	NA	-	NA	-	NA	-
Specific Conductance (field) (µmhos/cm)	5100	-	NA	-	NA	-	NA	-	NA	-	4980	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Specific Conductance (µmhos/cm)	NA	-	NA	-	NA	-	NA	-	5307	-	NA	-	NA	-	NA	-	NA	-	3490	-	3700	-	3640	-
Sulfate (mg/L)	**2200**	-	**2300**	-	**2200**	-	**2200**	-	**2500**	-	**2800**	-	**2800**	-	**2600**	-	**2600**	-	**1300**	-	**1400**	-	**1400**	-
Total Dissolved Solids(residue, filterable) (mg/L	**4200**	-	**4400**	-	**4200**	-	**4800**	-	**4336**	-	**4100**	-	**4300**	-	**4400**	-	**4500**	-	**2784**	-	**2786**	-	**2778**	-
Metals (mg/L)																								
Aluminum, Dissolved	< 0.1	-	< 0.1	-	**0.072**	J	< 0.1	-	NA	-	0.048	J	0.047	J	0.044	J	**0.054**	J, P1, J5	NA	-	NA	-	NA	-
Antimony, Dissolved	**0.037**	-	**0.034**	-	< 0.02	-	**0.017**	J	NA	-	< 0.02	-	**0.016**	-	**0.018**	J	**0.023**	P1	NA	-	NA	-	NA	-
Arsenic, Dissolved	**0.017**	J	< 0.02	-	**0.046**	-	< 0.02	-	**0.054**	-	< 0.02	-	**0.030**	-	**0.053**	-	< 0.02	P1	**0.13**	-	**0.084**	-	**0.081**	-
Barium, Dissolved	0.012	-	0.0023	J	0.015	-	0.011	-	NA	-	0.018	-	0.011	-	0.014	-	0.012	-	NA	-	NA	-	NA	-
Beryllium, Dissolved	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.003	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.003	-	< 0.003	-	< 0.003	-
Boron, Dissolved	**8.0**	-	5.4	-	**9.0**	-	**9.2**	-	3.6	-	3.6	-	3.7	-	3.8	-	4.5	-	2.5	-	2.5	-	2.7	-
Cadmium, Dissolved	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.003	-	< 0.005	-	**0.0051**	-	< 0.005	-	< 0.005	-	< 0.003	-	< 0.003	-	< 0.003	-
Calcium, Dissolved	300	-	190	-	330	-	340	-	490	-	440	-	450	-	460	-	530	V	260	-	250	-	270	-
Chromium, Dissolved	0.0051	J	< 0.01	-	0.0065	J	< 0.01	-	< 0.005	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.005	-	< 0.005	-	< 0.005	-
Chromium, hexavalent	**0.0090**	J	**0.0040**	J	**0.0080**	J	**0.0040**	J	NA	-	< 0.01	-	**0.0040**	J	**0.0030**	J, T8	< 0.01	-	NA	-	NA	-	NA	-
Cobalt, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	**0.010**	-	NA	-	< 0.01	-	< 0.01	-	< 0.01	-	**0.013**	-	NA	-	NA	-	NA	-
Copper, Dissolved	0.0027	J	0.0057	J	0.0047	J	< 0.02	-	NA	-	< 0.02	-	< 0.02	-	< 0.02	-	0.0067	J, P1	NA	-	NA	-	NA	-
Fluoride, Dissolved	**1.6**	-	**1.6**	-	**1.6**	-	**1.4**	-	NA	-	**2.1**	-	**1.9**	-	**2.1**	-	**1.7**	-	NA	-	NA	-	NA	-
Iron, Dissolved	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	NA	-	0.031	J	< 0.1	-	< 0.1	-	< 0.1	-	NA	-	NA	-	NA	-
Lead, Dissolved	**0.025**	-	**0.015**	-	0.0071	-	< 0.025	O	NA	-	< 0.005	-	**0.034**	-	**0.017**	-	< 0.005	-	NA	-	NA	-	NA	-
Magnesium, Dissolved	140	-	83	-	140	-	**150**	-	**200**	-	**220**	-	**220**	-	**230**	-	**260**	-	120	-	120	-	130	-
Manganese, Dissolved	< 0.01	-	< 0.01	-	0.0085	J	< 0.01	-	**0.28**	-	0.016	-	< 0.01	-	0.0032	J	< 0.01	-	< 0.005	-	< 0.005	-	< 0.005	-
Mercury, Dissolved	< 0.0002	-	0.000020	J	< 0.0002	-	< 0.0002	-	NA	-	0.000010	J	0.000020	J	< 0.0002	-	< 0.0002	-	NA	-	NA	-	NA	-
Molybdenum, Dissolved	**0.12**	-	0.046	-	**0.13**	-	**0.12**	-	0.057	-	**0.13**	-	**0.11**	-	**0.15**	-	**0.16**	-	**0.095**	-	**0.10**	-	**0.10**	-
Nickel, Dissolved	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.005	-	0.0076	J	< 0.02	-	0.024	-	< 0.02	-	< 0.005	-	< 0.005	-	< 0.005	-
Potassium, Dissolved	76	-	82	-	86	-	81	-	54	-	56	-	56	-	57	-	64	-	36	-	32	-	40	-
Selenium, Dissolved	**0.084**	-	**0.051**	-	**0.086**	-	**0.16**	-	< 0.02	-	< 0.1	O	0.022	-	< 0.02	-	< 0.02	-	0.041	-	**0.18**	-	**0.055**	-
Silica, Dissolved	13	-	14	-	14	-	13	-	NA	-	15	-	14	-	16	-	14	-	NA	-	NA	-	NA	-
Silver, Dissolved	< 0.01	-	< 0.01	-	0.0084	J	0.019	-	NA	-	< 0.01	-	< 0.01	-	0.0057	J	0.027	-	NA	-	NA	-	NA	-
Sodium, Dissolved	780	-	790	-	770	-	720	-	520	-	480	-	480	-	480	-	560	V	360	-	380	-	390	-
Thallium, Dissolved	< 0.02	-	< 0.02	-	**0.017**	J	**0.094**	-	NA	-	< 0.02	-	**0.022**	-	**0.015**	J	**0.10**	J3	NA	-	NA	-	NA	-
Titanium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.005	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.005	-	< 0.005	-	< 0.005	-
Vanadium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	0.0056	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	0.0041	-	< 0.003	-	0.013	-
Zinc, Dissolved	< 0.03	-	0.015	J	0.016	J	0.071	-	NA	-	0.041	-	0.015	J	0.019	J	0.088	-	NA	-	NA	-	NA	-
PAH (µg/L)																								
Acenaphthene	< 0.05	Q	< 0.05	-	< 0.05	-	0.034	J	NA	-	0.019	J	< 0.05	-	< 0.05	-	< 0.05	-	NA	-	NA	-	NA	-
Anthracene	< 0.05	Q	< 0.05	-	< 0.05	-	0.013	J	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	NA	-	NA	-	NA	-
Benzo(a)anthracene	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	NA	-	NA	-	NA	-
Benzo(a)pyrene	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	NA	-	NA	-	NA	-
Benzo(b)fluoranthene	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	NA	-	NA	-	NA	-
Benzo(g,h,i)perylene	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	NA	-	NA	-	NA	-
Benzo(k)fluoroanthene	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	J4	< 0.05	-	NA	-	NA	-	NA	-
Chrysene	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	NA	-	NA	-	NA	-
Fluoranthene	50	Q	< 0.05	-	< 0.05	-	< 0.05	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	NA	-	NA	-	NA	-
Indeno(1,2,3-cd)pyrene	**50**	Q	< 0.05	-	< 0.05	-	< 0.05	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	NA	-	NA	-	NA	-
Naphthalene	< 0.25	Q	< 0.25	-	0.030	J	**0.18**	J	NA	-	< 0.25	-	0.028	J	< 0.25	-	< 0.25	-	NA	-	NA	-	NA	-
Phenanthrene	< 0.05	Q	< 0.05	-	< 0.05	-	0.10	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	NA	-	NA	-	NA	-
Pyrene	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	NA	-	NA	-	NA	-
SVOC (µg/L)																								
1,1-Biphenyl	< 10	T8	< 10	-	< 10	-	< 10	-	NA	-	< 10	-	< 10	-	< 10	-	< 10	-	NA	-	NA	-	NA	-
Bis(2-ethylhexyl)phthalate	< 1	T8	0.66	J	0.96	J	0.92	J	NA	-	< 1	-	< 1	-	0.82	J	0.59	J	NA	-	NA	-	NA	-

Table D-3 - Groundwater Chemical Analytical Results Summary

Monitoring Well	LMW-12R		LMW-13R		LMW-13R		LMW-13R		LMW-13R		LMW-14R		LMW-14R		LMW-14R		LMW-14R		LMW-15		LMW-15		LMW-15	
Date	11/30/2012		5/29/2012		8/20/2012		10/22/2012		11/28/2012		5/29/2012		8/20/2012		10/22/2012		11/30/2012		5/29/2012		8/20/2012		10/22/2012	
Parameter Name	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier
Asbestos (MFL>10um)																								
Asbestos	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
General Chemistry (units listed below)																								
Alkalinity - Bicarbonate (mg/L)	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Alkalinity - Carbonate (mg/L)	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Chloride (mg/L)	**400**	-	250	-	250	-	250	-	270	-	260	-	260	-	250	-	270	-	270	-	250	-	250	-
Nitrogen, Ammonia(As N) (mg/L)	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Nitrogen, Nitrate(As N) (mg/L)	1.5	-	0.74	-	0.59	-	0.58	-	0.50	-	< 0.5	-	0.63	-	< 0.5	-	< 0.5	-	< 0.5	-	< 0.5	-	< 0.5	-
Nitrogen, Nitrite(As N) (mg/L)	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
pH (field)	7.36	-	7.28	-	7.2	-	7.31	-	7.36	-	7.19	-	7.13	-	7.28	-	7.07	-	7.28	-	7.23	-	7.34	-
pH (lab)	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Phosphorus, Total (As P)(mg/L)	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Specific Conductance (field) (µmhos/cm)	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Specific Conductance (µmhos/cm)	3680	-	3490	-	3500	-	3520	-	3520	-	3670	-	3730	-	3620	-	3720	-	3710	-	3690	-	3620	-
Sulfate (mg/L)	**1300**	-	**1700**	-	**1600**	-	**1700**	-	**1600**	-	**1700**	-	**1700**	-	**1800**	-	**1700**	-	**1900**	-	**1700**	-	**1700**	-
Total Dissolved Solids(residue, filterable) (mg/L	**2746**	-	**2862**	-	**2950**	-	**2930**	-	**2968**	-	**3052**	-	**3138**	-	**3082**	-	**3066**	-	**2946**	-	**3070**	-	**3070**	-
Metals (mg/L)																								
Aluminum, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Antimony, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Arsenic, Dissolved	**0.12**	-	**0.077**	-	**0.034**	-	**0.028**	-	**0.041**	-	**0.025**	-	< 0.02	-	< 0.02	-	< 0.02	-	**0.034**	-	< 0.02	-	< 0.02	-
Barium, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Beryllium, Dissolved	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-
Boron, Dissolved	2.7	-	1.2	-	1.0	-	1.2	-	1.1	-	1.1	-	1.0	-	1.1	-	1.1	-	1.3	-	1.2	-	1.3	-
Cadmium, Dissolved	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-
Calcium, Dissolved	270	-	350	-	340	-	380	-	380	-	390	-	380	-	420	-	420	-	360	-	350	-	400	-
Chromium, Dissolved	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-
Chromium, hexavalent	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Cobalt, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Copper, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Fluoride, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Iron, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Lead, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Magnesium, Dissolved	130	-	140	-	130	-	**150**	-	**160**	-	140	-	130	-	**150**	-	**150**	-	**150**	-	140	-	**160**	-
Manganese, Dissolved	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	**0.15**	-	**0.070**	-	**0.049**	-	**0.032**	-	**0.17**	-	0.0085	-	0.0058	-
Mercury, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Molybdenum, Dissolved	**0.11**	-	0.073	-	0.072	-	0.072	-	0.068	-	0.040	-	0.050	-	0.050	-	0.050	-	0.056	-	0.062	-	0.060	-
Nickel, Dissolved	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-
Potassium, Dissolved	35	-	31	-	30	-	37	-	33	-	34	-	34	-	41	-	35	-	32	-	31	-	39	-
Selenium, Dissolved	0.033	-	0.033	-	**0.20**	-	**0.057**	-	0.046	-	0.033	-	**0.21**	-	**0.062**	-	0.044	-	0.040	-	**0.20**	-	**0.062**	-
Silica, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Silver, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Sodium, Dissolved	410	-	230	-	230	-	260	-	270	-	240	-	240	-	260	-	260	-	250	-	250	-	270	-
Thallium, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Titanium, Dissolved	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-
Vanadium, Dissolved	0.025	-	< 0.003	-	< 0.003	-	0.0053	-	0.0037	-	< 0.003	-	< 0.003	-	0.0047	-	0.015	-	< 0.003	-	< 0.003	-	0.0031	-
Zinc, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
PAH (µg/L)																								
Acenaphthene	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Anthracene	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Benzo(a)anthracene	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Benzo(a)pyrene	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Benzo(b)fluoranthene	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Benzo(g,h,i)perylene	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Benzo(k)fluoroanthene	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Chrysene	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Fluoranthene	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Indeno(1,2,3-cd)pyrene	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Naphthalene	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Phenanthrene	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Pyrene	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
SVOC (µg/L)																								
1,1-Biphenyl	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Bis(2-ethylhexyl)phthalate	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-

Table D-3 - Groundwater Chemical Analytical Results Summary

Monitoring Well	LMW-15		LMW-16		LMW-16		LMW-16		LMW-16		LMW-7		LMW-7		LMW-7		LMW-7		LMW-9		LMW-9		LMW-9	
Date	11/28/2012		5/29/2012		8/20/2012		10/22/2012		11/28/2012		3/23/2012		5/31/2012		8/27/2012		11/28/2012		3/23/2012		5/31/2012		8/27/2012	
Parameter Name	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier	Result	Lab Qualifier
Asbestos (MFL>10um)																								
Asbestos	NA	-	NA	-	NA	-	NA	-	NA	-	< 992.8	-	< 99.3	-	< 49.6	-	< 49.6	-	< 16.5	-	< 19.9	-	< 49.6	-
General Chemistry (units listed below)																								
Alkalinity - Bicarbonate (mg/L)	NA	-	NA	-	NA	-	NA	-	NA	-	100	-	110	-	94	-	180	-	75	-	71	-	66	-
Alkalinity - Carbonate (mg/L)	NA	-	NA	-	NA	-	NA	-	NA	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-
Chloride (mg/L)	270	-	320	-	310	-	300	-	330	-	300	-	290	-	290	-	290	-	360	-	350	-	310	-
Nitrogen, Ammonia(As N) (mg/L)	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.1	-	< 0.1	T2	< 0.1	-	< 0.1	T2	< 0.1	-	< 0.1	T2	< 0.1	-
Nitrogen, Nitrate(As N) (mg/L)	< 0.5	-	2.6	-	2.5	-	2.6	-	7.8	-	3.8	-	1.3	-	5.4	-	5.7	-	2.5	-	0.78	-	4.8	-
Nitrogen, Nitrite(As N) (mg/L)	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-
pH (field)	7.1	-	7.52	-	7.49	-	7.61	-	7.56	-	7.27	-	NA	-	NA	-	NA	-	7.39	-	NA	-	NA	-
pH (lab)	NA	-	NA	-	NA	-	NA	-	NA	-	7.9	T8	NA	-	NA	-	NA	-	7.5	T8	NA	-	NA	-
Phosphorus, Total (As P)(mg/L)	NA	-	NA	-	NA	-	NA	-	NA	-	2.6	T2	2.2	T2	1.0	T2	0.96	-	0.12	T2	0.35	T2	0.090	J, T2
Specific Conductance (field) (µmhos/cm)	NA	-	NA	-	NA	-	NA	-	NA	-	3220	-	NA	-	NA	-	NA	-	4080	-	NA	-	NA	-
Specific Conductance (µmhos/cm)	3620	-	3470	-	3550	-	3400	-	3470	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Sulfate (mg/L)	**1700**	-	**1400**	-	**1300**	-	**1400**	-	**1300**	-	**1300**	-	**1300**	-	**1300**	-	**1300**	-	**1900**	-	**1900**	-	**1800**	-
Total Dissolved Solids(residue, filterable) (mg/L	**3070**	-	**2582**	-	**2610**	-	**2598**	-	**2562**	-	**2400**	-	**2500**	-	**2600**	-	**2100**	-	**3200**	-	**3300**	-	**3300**	-
Metals (mg/L)																								
Aluminum, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	0.034	J	0.033	J	0.041	J	< 0.1	-	**0.059**	J	**0.067**	J	0.048	J, P1
Antimony, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.02	-	< 0.02	-	< 0.02	-	**0.021**	-	< 0.02	-	< 0.02	-	**0.0097**	J, P1
Arsenic, Dissolved	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	**0.037**	-	< 0.02	-	**0.0075**	J	**0.014**	J	**0.063**	-
Barium, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	0.024	-	0.026	-	0.026	-	0.026	-	0.011	-	0.013	-	0.016	-
Beryllium, Dissolved	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-
Boron, Dissolved	1.2	-	3.3	-	3.3	-	3.5	-	3.4	-	2.1	-	2.2	-	2.6	-	2.5	-	2.2	-	2.2	-	2.4	-
Cadmium, Dissolved	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.003	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-
Calcium, Dissolved	400	-	220	-	220	-	230	-	240	-	230	-	250	-	240	-	280	-	340	-	330	-	340	V
Chromium, Dissolved	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	0.017	-	0.016	-	0.015	-	0.013	-	**0.11**	-	**0.11**	-	**0.11**	-
Chromium, hexavalent	NA	-	NA	-	NA	-	NA	-	NA	-	**0.020**	-	**0.018**	-	**0.018**	-	**0.015**	-	**0.11**	-	**0.11**	-	**0.11**	-
Cobalt, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.01	-	< 0.01	-	< 0.01	-	**0.011**	-	< 0.01	-	< 0.01	-	< 0.01	-
Copper, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.02	-	< 0.02	-	0.0029	J	< 0.02	-	< 0.02	-	< 0.02	-	0.0044	J, P1
Fluoride, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	**1.2**	-	**1.2**	-	**1.2**	-	< 0.1	-	**2.6**	-	**2.6**	-	**2.6**	-
Iron, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-
Lead, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.005	-	< 0.005	-	0.0098	-	< 0.01	O	< 0.005	-	< 0.005	-	0.014	P1
Magnesium, Dissolved	**160**	-	110	-	100	-	110	-	110	-	110	-	120	-	110	-	130	-	**150**	-	**160**	-	**160**	V
Manganese, Dissolved	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.01	-	< 0.01	-	0.0039	J	< 0.01	-	< 0.01	-	< 0.01	-	0.0092	J, P1
Mercury, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.0002	-	0.000040	J	< 0.0002	-	< 0.0002	-	0.000010	J	0.000040	J	< 0.0002	-
Molybdenum, Dissolved	0.055	-	0.060	-	0.075	-	0.073	-	0.069	-	0.021	-	0.0052	-	0.030	-	0.026	-	**0.20**	-	**0.18**	-	**0.22**	-
Nickel, Dissolved	< 0.005	-	< 0.005	-	0.0075	-	< 0.005	-	< 0.005	-	< 0.02	-	0.016	J	< 0.02	-	< 0.02	-	0.0052	J	0.0082	J	< 0.02	-
Potassium, Dissolved	35	-	47	-	49	-	58	-	50	-	61	-	60	-	63	-	64	-	44	-	43	-	46	-
Selenium, Dissolved	0.049	-	0.034	-	**0.18**	-	**0.064**	-	< 0.02	-	< 0.1	O	< 0.1	O	0.032	-	**0.12**	-	< 0.2	O	< 0.1	O	0.034	-
Silica, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	15	-	14	-	15	-	15	-	18	-	17	-	18	-
Silver, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.01	-	0.0038	J	0.0068	J	0.016	-	< 0.01	-	0.0042	J	0.0053	J, P1, J6
Sodium, Dissolved	280	-	410	-	340	-	370	-	390	-	330	-	330	-	340	-	340	-	390	-	370	-	400	V
Thallium, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.02	-	< 0.02	-	**0.0077**	J	**0.087**	-	< 0.02	-	< 0.02	-	**0.012**	J, P1
Titanium, Dissolved	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Vanadium, Dissolved	< 0.003	-	< 0.003	-	0.021	-	< 0.003	-	0.0031	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Zinc, Dissolved	NA	-	NA	-	NA	-	NA	-	NA	-	0.012	J	< 0.03	-	0.013	J	0.067	-	0.020	J	0.013	J	0.016	J, P1
PAH (µg/L)																								
Acenaphthene	NA	-	NA	-	NA	-	NA	-	NA	-	0.019	J	< 0.05	-	< 0.05	-	< 0.05	-	0.021	J	< 0.05	-	< 0.05	-
Anthracene	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(a)anthracene	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(a)pyrene	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(b)fluoranthene	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(g,h,i)perylene	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(k)fluoroanthene	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Chrysene	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Fluoranthene	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Indeno(1,2,3-cd)pyrene	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Naphthalene	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.25	-	0.026	J	< 0.25	-	0.038	J	< 0.25	-	0.028	J	< 0.25	-
Phenanthrene	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.0096	J
Pyrene	NA	-	NA	-	NA	-	NA	-	NA	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.026	J
SVOC (µg/L)																								
1,1-Biphenyl	NA	-	NA	-	NA	-	NA	-	NA	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-
Bis(2-ethylhexyl)phthalate	NA	-	NA	-	NA	-	NA	-	NA	-	< 1	-	0.52	J	0.85	J	0.82	J	< 1	-	**18**	-	0.79	J

Table D-3 - Groundwater Chemical Analytical Results Summary

Monitoring Well Date	LMW-9 11/28/2012		Current Screening Levels				
Parameter Name	**Result**	**Lab Qualifier**	**Federal/ Nevada Primary MCL[1]**	**Nevada Secondary MCL[2]**	**NDEP BCL - Residential Water - January 2013[3]**	**EPA RSL - Tap Water - November 2012[4]**	**Southeastern Nevada Alluvial Aquifer Ranges[5]**
Asbestos (MFL>10um)							
Asbestos	< 5	-	7	NA	NA	NA	NA
General Chemistry (units listed below)							
Alkalinity - Bicarbonate (mg/L)	72	-	NA	NA	NA	NA	160-361
Alkalinity - Carbonate (mg/L)	< 20	-	NA	NA	NA	NA	NA
Chloride (mg/L)	340	-	NA	400	NA	NA	26-219
Nitrogen, Ammonia(As N) (mg/L)	< 0.1	T2	NA	NA	0.209	NA	0.06-0.47
Nitrogen, Nitrate(As N) (mg/L)	5.0	-	10	NA	10	25	NA
Nitrogen, Nitrite(As N) (mg/L)	< 0.1	-	1	NA	1	1.6	NA
pH (field)	NA	-	6.5 - 8.5	6.5 - 8.5	NA	NA	7.0-8.4
pH (lab)	NA	-	NA	NA	NA	NA	NA
Phosphorus, Total (As P)(mg/L)	0.12	-	NA	NA	NA	NA	0.01-0.04
Specific Conductance (field) (µmhos/cm)	NA	-	NA	NA	NA	NA	460-820
Specific Conductance (µmhos/cm)	NA	-	NA	NA	NA	NA	NA
Sulfate (mg/L)	**1800**	-	NA	500	NA	NA	20-670
Total Dissolved Solids(residue, filterable) (mg/L	**3100**	-	NA	1000	NA	NA	499-1620
Metals (mg/L)							
Aluminum, Dissolved	< 0.1	J5	NA	0.2	0.05	16	NA
Antimony, Dissolved	**0.024**	P1	0.006	NA	0.006	0.006	NA
Arsenic, Dissolved	**0.010**	J, P1	0.01	NA	0.01	0.000045	NA
Barium, Dissolved	0.011	-	2	NA	2	2.9	0.049-0.34
Beryllium, Dissolved	< 0.002	-	0.004	NA	0.004	0.016	<0.0005
Boron, Dissolved	2.4	-	NA	NA	7.3	3.1	NA
Cadmium, Dissolved	< 0.005	-	0.005	NA	0.005	0.0069	<0.001
Calcium, Dissolved	350	V	NA	NA	NA	NA	33-137
Chromium, Dissolved	**0.12**	-	0.1	NA	NA	NA	NA
Chromium, hexavalent	**0.11**	-	NA	NA	0.1	0.000031	NA
Cobalt, Dissolved	**0.013**	-	NA	NA	0.011	0.0047	<0.003
Copper, Dissolved	< 0.02	-	1.3	1	1.3	0.62	<0.010
Fluoride, Dissolved	**2.1**	J6	4	2	4	0.62	0.5-1.2
Iron, Dissolved	< 0.1	-	NA	0.6	0.3	11	0.01-0.77
Lead, Dissolved	< 0.025	O	0.015	NA	0.015	NA	<0.010
Magnesium, Dissolved	**170**	V	NA	150	207	NA	7.5-70.4
Manganese, Dissolved	< 0.01	-	NA	0.1	0.02	0.32	0.08 – 0.3
Mercury, Dissolved	< 0.0002	-	0.002	NA	0.002	0.00063	NA
Molybdenum, Dissolved	**0.20**	-	NA	NA	0.183	0.078	<0.010- 0.02
Nickel, Dissolved	< 0.02	-	NA	NA	0.73	0.3	NA
Potassium, Dissolved	45	-	NA	NA	NA	NA	1.2-19.9
Selenium, Dissolved	**0.13**	-	0.05	NA	0.05	0.078	NA
Silica, Dissolved	17	-	NA	NA	NA	NA	14-65
Silver, Dissolved	0.019	-	NA	0.1	0.1	0.071	NA
Sodium, Dissolved	390	V	NA	NA	NA	NA	34-306
Thallium, Dissolved	**0.082**	-	0.002	NA	0.002	0.00016	NA
Titanium, Dissolved	< 0.01	-	NA	NA	146	NA	NA
Vanadium, Dissolved	< 0.01	-	NA	NA	0.183	0.078	<0.006
Zinc, Dissolved	0.072	-	NA	5	11	4.7	0.006-0.55
PAH (µg/L)							
Acenaphthene	0.18	*	NA	NA	6.24	400	NA
Anthracene	0.0080	*	NA	NA	6.25	1300	NA
Benzo(a)anthracene	< 0.05	*	NA	NA	0.0921	0.029	NA
Benzo(a)pyrene	< 0.05	*	0.2	NA	0.2	0.0029	NA
Benzo(b)fluoranthene	< 0.05	*	NA	NA	0.0921	0.029	NA
Benzo(g,h,i)perylene	< 0.05	*	NA	NA	1100	NA	NA
Benzo(k)fluoroanthene	< 0.05	*	NA	NA	0.921	0.29	NA
Chrysene	< 0.05	*	NA	NA	9.21	2.9	NA
Fluoranthene	< 0.05	*	NA	NA	1460	630	NA
Indeno(1,2,3-cd)pyrene	< 0.05	*	NA	NA	0.0921	0.029	NA
Naphthalene	0.058	*	NA	NA	0.143	0.14	NA
Phenanthrene	< 0.05	*	NA	NA	6.22	NA	NA
Pyrene	< 0.05	*	NA	NA	6.22	87	NA
SVOC (µg/L)							
1,1-Biphenyl	< 10	*	NA	NA	1830	0.83	NA
Bis(2-ethylhexyl)phthalate	0.75	*, J	6	NA	6	4.8	NA

Footnotes:

[1]**Federal/Nevada Primary MCL:** Primary Maximum Contaminant Level (MCL)-- Federal standards adopted by Nevada that apply to public water systems. Primary standards protect public health by limiting the levels of contaminants in drinking water (December 2009).

[2]**Nevada Secondary MCL:** Nevada Secondary MCL-- Secondary standards are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water as defined by NAC 445A.455.

[3]**NDEP BCL - Residential Water:** NDEP Basic Comparison Level (Residential Water)—Screening level determined by NDEP for the BMI Complex to be protective of exposure through residential water use. Residential water takes into account human exposure through ingestion of water and inhalation from exposure to vapors during showering or other activities. Source: *Updated User's Guide and Tables* (January 2013).

[4]**EPA Tap Water:** EPA Regional Screening Level (RSL) (Tap Water)-- Generic screening levels based on default exposure parameters and factors that represent Reasonable Maximum Exposure (RME) conditions for human long-term/chronic exposures and are based on the methods outlined in EPA's *Risk Assessment Guidance for Superfund, Part B Manual* (1991). The Tapwater RSL takes into account human exposure from direct ingestion of water and inhalation from exposure to vapors during showering or other activities (November 2012).

[5]**Southern Nevada Alluvial Aquifer Ranges:** Thomas, et. al, 1991, and Schroth, 1987.

Table D-4 **Groundwater Quality Control Sample Results - Blanks**

Analyte	EB-1	FB-1	EB-2	FB-2	EB-1	FB-1	EB-2	FB-2	EB-3	FB-3	EB-4	FB-4	EB-6	FB-6	EB-7	FB-7
	3/20/2012		3/21/2012		5/21/2012		5/23/2012		5/24/2012		5/25/2012		5/30/2012		5/31/2012	
General Chemistry (mg/L)																
Chloride	0.12 J,P1	0.096 J	ND	ND	0.22 J	0.098 J,P1	0.12 J	0.079 J	0.093 J,P1	0.098 J	0.1 J	0.27 J	0.2 J,P1	0.092 J	0.12 J,P1	0.11 J
Nitrogen, Ammonia(As N)	ND T2	ND T2	ND	ND	ND T2	0.067 JT2	ND T2	ND T2	ND T2	ND T2	ND T2	0.082 JT2	ND T2	ND T2	ND T2	ND T2
Nitrogen, Nitrate(As N)	0.023 J,P1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.084 J	ND	ND	ND	ND
Nitrogen, Nitrite(As N)	0.016 J,P1	0.015 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.006 J,P1	0.006 J
Phosphorus, Total (As P)	ND	0.048 J	0.075 J	0.024 J,P1	0.019 J	ND	ND T2 J6	0.019 JT2	0.034 J	ND	ND	ND	ND	0.027 J	ND T2	ND T2
Sulfate	ND	ND	ND	ND	2.0 J	0.7 J,P1	0.46 J	0.86 J	2.3 J,J3	1.4 J	ND	1.0 J	1.5 J,P1	ND	0.64 J,P1	ND
Total Dissolved Solids(residue, filterable)	ND	4.0 J	4.0 J	ND	7.0 J	11	ND	8.0 J	ND	ND	ND	ND	10 J	ND	ND	4.0 J
Metals (mg/L)																
Aluminum, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.14	0.11	ND	0.039 J
Antimony, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0068 J	ND	0.014 J	ND
Arsenic, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	0.0078 J	ND	ND	ND P1	ND	ND	ND	ND
Barium, Dissolved	0.0021 J	0.0022 J	ND	ND	0.0028 J	0.0024 J	0.0026 J	0.0024 J,P1	0.0027 J	0.0025 J	0.0025 J	ND	ND	ND	0.0032 J	ND
Beryllium, Dissolved	ND	ND	ND	ND	ND	ND	ND	0.00076 J,P1	ND	ND	ND	0.00061 J,P1	ND	ND	0.0011 J	ND
Boron, Dissolved	0.07 J	0.064 J	0.13 J	0.12 J	0.15 J	0.15 J	0.15 J	0.15 J,P1	0.17 J	0.16 J	0.13 J	0.12 J	0.12 J	0.17 J	0.15 J	0.14 J
Cadmium, Dissolved	0.0023 J	0.0025 J	ND	ND	0.0016 J	ND	ND	0.0017 J,P1	ND	ND	ND	ND	ND	ND	0.0021 J	ND
Calcium, Dissolved	ND	ND	ND	0.21 J	0.28 J	0.23 J	0.32 J	0.26 J,P1	0.42 J	0.74	0.1 J	ND	0.13 J	0.18 J	0.35 J	ND
Chromium, hexavalent	ND	ND	ND	ND	ND	ND	ND	ND	0.0050 J	0.0070 J,P1	ND	ND	0.0040 J	ND	0.004 J	ND
Cobalt, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper, Dissolved	ND	ND	0.0076 J	0.0071 J	ND	ND	ND	ND	ND	ND	ND	ND	0.0039 J	0.005 J	ND	ND
Fluoride, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron, Dissolved	0.026 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead, Dissolved	ND	ND	0.0023 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0023 J	0.0025 J
Magnesium, Dissolved	0.025 J	ND	0.027 J	ND	0.091 J	0.035 J	0.048 J	0.038 J,P1	0.062 J	0.038 J	0.044 J	ND	0.063 J	0.074 J	0.13	0.029 J
Manganese, Dissolved	ND	ND	ND	ND	ND	ND	ND	0.0015 J,P1	ND	0.0017 J	0.011	ND	ND	0.0015 J	0.0026 J	0.0027 J
Mercury, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00004 J	0.00004 J
Molybdenum, Dissolved	ND	ND	0.0024 J	0.0019 J	ND	ND	ND	0.0022 J,P1	ND	ND	ND	0.0028 J,P1	ND	0.0019 J	0.0026 J	ND
Nickel, Dissolved	ND	0.0066 J	ND	ND	0.0068 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0058 J	0.0052 J
Potassium, Dissolved	ND	ND	0.36 J	0.49 J	0.13 J	0.16 J	ND	ND	ND	ND	ND	ND	ND	0.32 J	ND	ND
Selenium, Dissolved	ND	ND	0.01 J	ND	ND	ND	0.0071 J	ND	ND	0.011 J	0.011 J	ND	ND	0.012 J	ND	ND
Silica, Dissolved	0.700	0.720	0.690	0.660	0.970	0.950	0.980	0.980	0.980	0.970	0.790	0.760	0.730	0.770	0.770	0.750
Silver, Dissolved	0.0059 J	0.006 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0099 J	ND	ND
Sodium, Dissolved	0.22 J	0.12 J	0.16 J	0.19 J	0.61	0.36 J	0.36 J	0.14 J,P1	0.67	0.3 J	0.36 J	0.26 J	0.36 J	1	0.82	0.24 J
Thallium, Dissolved	0.012 J	0.014 J	ND	ND	ND	ND	0.0085 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Titanium, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0037 J	ND
Zinc, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PAH (µg/L)																
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	0.000021 J	0.000017 J	0.000011 J	0.000011 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	0.000024 J	0.000021 J	0.000024 J	0.000018 J	0.000021 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SVOC (µg/L)																
Bis(2-ethylhexyl)phthalate	0.00054 J	ND	ND	ND	0.0015	0.0011	ND	0.00064 J	0.00055 J	0.00081 J	ND	ND	0.0013	0.0015	ND	ND

Notes:
ND-Non-detect.
Laboratory Qualifiers
J = Estimated value below the lowest calibration point.
J3 = The associated batch QC was outside the established quality control range for precision.
J4 = The associated batch QC was outside the established quality control range for accuracy.
P1 = RPD value not applicable for sample concentrations less than 5 times the reporting limit.

Table D-4 **Groundwater Quality Control Sample Results - Blanks (mg/L)**

Analyte	EB-2	FB-2	EB-3	FB-3	EB-4	FB-4	EB-5	FB-5	EB-6	FB-6	EB-9	FB-9	EB-2	FB-2	EB-3	FB-3
	8/21/2012		8/22/2012		8/23/2012		8/24/2012		8/27/2012		8/30/2012		11/27/2012		11/28/2012	
General Chemistry (mg/L)																
Chloride	0.17 J	0.19 J	0.33 J	0.28 J,P1	ND	ND	0.18 J	0.16 J	ND	ND	ND	ND	0.32 J	0.067 J	ND	ND
Nitrogen, Ammonia(As N)	0.084 J	0.084 J	ND	ND	0.26 T2	0.13 T2	0.14 T2	0.092 JT2	ND	0.11 T2	ND	0.13 T2	ND T2	ND T2	ND T2	0.066 JT2
Nitrogen, Nitrate(As N)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrogen, Nitrite(As N)	0.017 J	0.018 J	ND	ND	ND	ND	0.022 J	0.015 J	ND	ND	ND	ND	ND	ND	0.06 J	0.064 J
Phosphorus, Total (As P)	0.032 J	0.25	ND	ND	ND	ND	0.039 JT2	0.026 JT2	0.019 JT2	0.03 JT2	0.018 J	0.029 J	ND	ND	ND	ND
Sulfate	0.41 J	ND	0.64 J	1.6 J,P1	0.82 J	ND	ND	ND	2.1 J	0.6 J,P1	0.42 J	0.44 J	2.1 J	0.43 J	ND	2.6 J
Total Dissolved Solids(residue, filterable)	ND	5.0 J	6.0 J	21	ND	ND	ND	ND	ND	ND	ND	ND	ND	11	ND	ND
Metals (mg/L)																
Aluminum, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Antimony, Dissolved	ND	0.014 J,P1	0.0074 J,P1	ND	ND	ND	ND	ND	ND	0.014 J,P1	ND	ND	ND	ND	0.0097 J	ND
Arsenic, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium, Dissolved	ND	0.002 J,P1	ND	ND	ND	ND	ND	ND	ND	0.0035 J	ND	0.0028 J	ND	ND	ND	0.0017 J
Beryllium, Dissolved	ND	0.00069 J,P1	ND	ND	ND	ND	ND	ND	ND	0.00062 J,P1	ND	ND	ND	ND	ND	ND
Boron, Dissolved	0.071 J	0.059 J	0.037 J,P1	0.071 J	0.042 J	0.045 J	0.055 J	0.052 J	0.11 J	0.052 J	0.059 J	0.053 J	0.042 J	0.037 J	0.1 J	0.08 J
Cadmium, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Calcium, Dissolved	0.19 J	0.28 J	ND	0.14 J	ND	0.13 J	ND	0.17 J	0.29 J	ND	0.41 J	0.12 J	0.053 J	ND	0.055 J	ND
Chromium, hexavalent	0.011	0.009 J	0.007 J	0.003 J	0.008 J	0.008 J	0.005 JT8	0.007 JT8	0.011	0.009 J	ND	ND	ND	ND	ND	ND
Cobalt, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0016 J,P1	ND	ND	ND	ND	ND	ND
Fluoride, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01 J	ND	ND	ND
Iron, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead, Dissolved	ND	0.0025 J,P1	ND	ND	ND	ND	0.0029 J	ND	0.0019 J	ND	ND	ND	ND	ND	ND	ND
Magnesium, Dissolved	0.04 J	ND	ND	0.092 J	0.034 J	0.12	0.058 J	0.18	0.11	ND	0.16	0.045 J	0.012 J	ND	0.023 J	ND
Manganese, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Molybdenum, Dissolved	ND	0.0034 J,P1	0.0031 J,P1	ND	ND	ND	ND	ND	ND	0.0028 J,P1	ND	ND	ND	ND	ND	ND
Nickel, Dissolved	0.01 J	0.018 J,P1	ND	ND	ND	ND	0.012 J	0.018 J	ND	ND	ND	ND	ND	ND	ND	ND
Potassium, Dissolved	ND	ND	ND	0.56	0.16 J	0.26 J	0.33 J	0.6	0.3 J	ND	0.28 J	ND	0.2 J	0.19 J	0.65	0.4 J
Selenium, Dissolved	ND	ND	ND	ND	ND	ND	0.0066 J	ND	ND	0.011 J	ND	ND	ND	ND	ND	ND
Silica, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	0.01	ND	ND	ND	0.004 J	0.0038 J	0.0056 J	0.0031 J
Sodium, Dissolved	0.47 J	0.13 J,P1	ND	0.51	0.57	1.3	0.92	1.8	0.93	ND	0.99	0.37 J	0.61	0.22 J	2.6	1.4
Thallium, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Titanium, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc, Dissolved	0.01 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PAH (µg/L)																
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00002 J	0.000012 J
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	0.000019 J,J4	ND J4	ND	ND	ND	0.000026 J	0.000019 J	ND	0.000019 J	0.000019 J	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.000027 J	ND
Naphthalene	0.000034 J	0.000031 J	0.000032 J	0.000033 J	0.000029 J	0.000034 J	0.000026 J	0.000023 J	0.000026 J	0.000024 J	0.00002 J	ND	0.000033 J	0.000022 J	0.000047 J	0.000041 J
Phenanthrene	ND	ND	0.0000098 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.000021 J	ND
Pyrene	ND	ND	ND	ND	ND	ND	0.00003 J	ND	ND	0.000018 J	ND	ND	ND	ND	0.0001	ND
SVOC (µg/L)																
Bis(2-ethylhexyl)phthalate	0.0013 J	0.00067 J	0.00082 J	0.00091 J	0.00058 J	ND	0.00087 J	0.001 J	0.00063 J	0.00072 J	ND	ND	0.00059 J	ND	0.0011 J	0.00068 J

Notes:

ND-Non-detect.

Laboratory Qualifiers

J = Estimated value below the lowest calibration point.

J3 = The associated batch QC was outside the established quality control range for precision.

J4 = The associated batch QC was outside the established quality control range for accuracy.

P1 = RPD value not applicable for sample concentrations less than 5 times the reporting limit.

Table D-5 **Groundwater Quality Control Sample Results - Duplicates**

	BG-2M (DUP-2) 5/24/2012		BG-2M 5/24/2012		BG-2M (DUP-1) 11/26/2012		BG-2M 11/26/2012		BG-2S (DUP-3) 3/21/2012		BG-2S 3/21/2012		BG-3D (DUP-2) 11/27/2012		BG-3D 11/27/2012		BG-3S (Dup #1) 8/22/2012		BG-3S 8/22/2012		BG-4M (DUP-1) 3/20/2012		BG-4M 3/20/2012	
Parameter Name	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**
Asbestos (MFL>10um)																								
Asbestos	< 1.7	-	< 1.7	-	< 1	-	< 1	-	< 5	-	< 5	-	< 0.2	-	< 0.2	-	< 0.5	-	< 0.5	-	< 1	-	< 1	-
General Chemistry (mg/L)																								
Alkalinity - Bicarbonate	200	-	210	-	200	-	210	-	260	-	260	-	190	-	190	-	150	-	150	-	110	-	120	-
Alkalinity - Carbonate	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-
Chloride	34	-	35	-	35	-	38	-	75	-	72	-	180	-	180	-	190	-	200	-	280	-	290	-
Nitrogen, Ammonia(As N)	0.076	J, T2	0.076	J, T2	< 0.1	T2	< 0.1	T2	< 0.1	-	< 0.1	T2	0.069	J, T2	< 0.1	T2	0.043	J	0.056	J	< 0.1	-	< 0.1	T2
Nitrogen, Nitrate(As N)	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-
Nitrogen, Nitrite(As N)	< 0.1	-	< 0.1	-	0.19	-	< 0.1	-	0.010	J	0.011	J	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	0.036	J	0.045	J
Phosphorus, Total (As P)	0.039	J	0.034	J, P1	0.017	J, T2	0.020	J, T2, P1	0.079	J, T2	0.11	T2	0.074	J	0.075	J	0.080	J	0.081	J	0.059	J	0.047	J
Sulfate	**1100**	-	**1100**	-	**1100**	-	**1200**	-	**3000**	-	**2900**	-	470	-	480	-	**500**	-	**510**	-	**790**	-	**820**	-
Total Dissolved Solids(residue, filterable)	**1900**	-	**1900**	-	**1800**	-	**1900**	-	**4400**	-	**4300**	-	**1000**	-	**1100**	-	**1200**	-	**1200**	-	**1700**	-	**1700**	-
General Chemistry (pH Units)																								
pH (lab)	NA	-	NA	-	NA	-	NA	-	7.4	T8	7.5	T8	NA	-	NA	-	NA	-	NA	-	7.6	T8	7.4	T8
Metals (mg/L)																								
Aluminum, Dissolved	< 0.1	-	< 0.1	-	**0.064**	J	**0.061**	J	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-
Antimony, Dissolved	< 0.02	-	< 0.02	-	**0.022**	-	**0.020**	-	**0.058**	-	**0.061**	-	< 0.02	-	**0.015**	J	< 0.02	-	< 0.02	-	< 0.02	-	**0.0066**	J
Arsenic, Dissolved	< 0.02	-	< 0.02	-	**0.012**	J	**0.036**	-	**0.037**	-	**0.028**	-	**0.21**	-	**0.22**	-	**0.045**	-	**0.043**	-	**0.024**	-	**0.019**	J
Barium, Dissolved	0.017	-	0.024	-	0.018	-	0.018	-	0.031	-	0.028	-	0.021	-	0.023	-	0.033	-	0.035	-	0.026	-	0.025	-
Beryllium, Dissolved	< 0.002	-	0.00083	J	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-
Boron, Dissolved	0.84	-	0.87	-	1.1	-	1.1	-	1.7	-	1.6	-	0.98	-	0.98	-	0.68	-	0.71	-	0.73	-	0.72	-
Cadmium, Dissolved	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	0.0019	J	0.0019	J	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	0.0015	J	0.0021	J
Calcium, Dissolved	180	-	190	-	240	-	240	-	460	-	420	-	68	-	68	-	110	-	120	-	160	-	160	-
Chromium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Chromium, hexavalent	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	**0.0050**	J	**0.015**	J	< 0.01	-
Cobalt, Dissolved	< 0.01	-	< 0.01	-	**0.012**	-	**0.013**	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Copper, Dissolved	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	0.0075	J	0.0035	J	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-
Fluoride, Dissolved	**2.3**	-	**2.3**	-	**2.0**	-	**2.0**	-	**4.1**	-	**4.1**	-	**2.4**	-	**2.4**	-	**1.5**	-	**1.5**	-	**0.66**	-	**0.66**	-
Iron, Dissolved	< 0.1	-	< 0.1	-	**1.3**	-	**1.0**	-	< 0.1	-	< 0.1	-	0.096	J	0.068	J	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-
Lead, Dissolved	< 0.005	-	< 0.005	-	< 0.01	O	< 0.005	-	**0.036**	-	**0.034**	-	< 0.005	-	< 0.005	-	0.0067	-	0.0097	-	< 0.005	-	0.0027	J
Magnesium, Dissolved	120	-	120	-	**150**	-	**160**	-	**290**	-	**270**	-	38	-	38	-	61	-	62	-	97	-	97	-
Manganese, Dissolved	**0.062**	-	**0.066**	-	**0.073**	-	**0.074**	-	**0.28**	-	**0.28**	-	0.018	-	0.018	-	**0.048**	-	**0.051**	-	**0.055**	-	**0.052**	-
Mercury, Dissolved	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-
Molybdenum, Dissolved	0.062	-	0.067	-	**0.098**	-	**0.098**	-	**0.42**	-	**0.37**	-	0.076	-	**0.078**	-	0.017	-	0.019	-	0.0063	-	0.0069	-
Nickel, Dissolved	0.0090	J	0.0086	J	< 0.02	-	< 0.02	-	0.0069	J	0.011	J	< 0.02	-	< 0.02	-	0.011	J	0.0091	J	0.0071	J	0.0078	J
Potassium, Dissolved	41	-	40	-	49	-	51	-	88	-	84	-	17	-	17	-	21	-	22	-	49	-	52	-
Selenium, Dissolved	< 0.1	O	< 0.1	O	0.022	-	< 0.02	-	0.019	J	0.030	-	0.0094	J	< 0.02	-	< 0.02	-	< 0.02	-	< 0.1	O	< 0.1	O
Silica, Dissolved	17	-	17	-	16	-	16	-	38	-	36	-	16	-	16	-	17	-	18	-	15	-	15	-
Silver, Dissolved	< 0.01	-	< 0.01	-	0.012	-	0.011	-	< 0.01	-	< 0.01	-	0.0030	J	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Sodium, Dissolved	160	-	170	-	200	-	200	-	460	-	420	-	250	-	250	-	190	-	190	-	190	-	200	-
Thallium, Dissolved	< 0.02	-	< 0.02	-	**0.082**	-	**0.077**	-	< 0.02	-	**0.0097**	J	< 0.02	-	< 0.02	-	**0.0099**	J	< 0.02	-	< 0.02	-	< 0.02	-
Titanium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Vanadium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Zinc, Dissolved	< 0.03	-	0.011	J	0.067	-	0.066	-	< 0.03	-	< 0.03	-	0.017	J	0.017	J	0.011	J	0.013	J	0.011	J	< 0.03	-
PAH (µg/L)																								
Acenaphthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Anthracene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(a)anthracene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(a)pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(b)fluoranthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(g,h,i)perylene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(k)fluoroanthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	J4	< 0.05	J4	< 0.05	-	< 0.05	-
Chrysene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Fluoranthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Indeno(1,2,3-cd)pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Naphthalene (PAH)	< 0.25	-	< 0.25	-	< 0.25	-	0.028	J	< 0.25	Q	< 0.25	Q	< 0.25	-	< 0.25	-	< 0.25	-	< 0.25	-	**0.83**	-	**0.82**	-
Phenanthrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.011	J	0.015	J
Pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	Q	< 0.05	Q	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
SVOC (µg/L)																								
1,1-Biphenyl	< 10	-	< 10	-	< 10	-	< 10	-	< 10	T8	< 10	T8	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 1	-
Bis(2-ethylhexyl)phthalate	< 1	-	< 1	-	< 3	-	0.86	J	0.71	J, T8	< 1	T8	0.52	J	0.65	J	0.88	J	0.83	J	< 1	-	< 1	-

NA - Not Applicable; Results that exceed a screening level are in bold.

Laboratory Qualifiers

J = Estimated value below the lowest calibration point.

J4 = The associated batch QC was outside the established quality control range for accuracy.

J5 = The sample matrix interfered with the ability to make an accurate determination; spike value is high.

J6 = The sample matrix interfered with the ability to make an accurate getermination; spike value is low.

O = Sample diluted due to matrix interferences that impaired the ability to make an accurate analytical determination. The detection limit is elevated in order to reflect the necessary dilution.

P1 = RPD value not applicable for sample concentrations less than 5 times the reporting limit.

T2 = Additional method/sample information - laboratory analysis was from an unpreserved or improperly preserved sample.

T8 = Additional method/sample information - samples received past/ too close to holding time.

V= The sample concentration is too high to evaluate accurate spike recoveries.

Table D-5 **Groundwater Quality Control Sample Results - Duplicates**

	BG-4M (DUP-4) 5/30/2012		BG-4M 5/30/2012		BG-4M (Dup #5) 8/30/2012		BG-4M 8/30/2012		BG-6S (DUP-2) 3/21/2012		BG-6S 3/21/2012		BG-6S (Dup #2) 8/23/2012		BG-6S 8/23/2012		KMW-2M (Dup #3) 8/24/2012		KMW-2M 8/24/2012		KMW-2S (DUP-1) 5/21/2012		KMW-2S 5/21/2012	
Parameter Name	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**
Asbestos (MFL>10um)																								
Asbestos	< 0.2	-	< 0.2	-	< 0.2	-	< 0.2	-	< 0.7	-	< 0.7	-	< 0.5	-	< 0.5	-	< 5	-	< 5	-	< 49.6	-	< 9.9	-
General Chemistry (mg/L)																								
Alkalinity - Bicarbonate	110	-	100	-	110	-	110	-	130	-	130	-	140	-	140	-	430	-	440	-	410	-	420	-
Alkalinity - Carbonate	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 200	-	< 20	-	< 20	-
Chloride	280	-	280	-	260	-	260	-	350	-	360	-	350	-	350	-	370	-	370	-	380	-	390	-
Nitrogen, Ammonia(As N)	0.056	J, T2	0.082	J, T2	0.082	J, T2	0.091	J, T2	< 0.1	-	< 0.1	T2	**0.26**	P1, T2	0.12	T2	**0.47**	T2	**0.48**	T2	**0.43**	T2	**0.83**	J6, T2
Nitrogen, Nitrate(As N)	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	0.16	-	0.17	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-
Nitrogen, Nitrite(As N)	0.039	J	0.029	J	0.091	J	0.091	J	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	0.018	J	0.018	J	< 0.1	-	< 0.1	-
Phosphorus, Total (As P)	< 0.1	-	0.019	J	11	-	0.034	J	0.096	J	0.098	J	0.060	J, P1	0.061	J	0.10	T2	0.10	T2	0.82	T2	0.48	-
Sulfate	**820**	-	**800**	-	**770**	-	**750**	-	**1200**	-	**1200**	-	**1200**	-	**1200**	-	**1300**	-	**1200**	-	**1300**	-	**1300**	-
Total Dissolved Solids(residue, filterable)	**1700**	-	**1700**	-	**1700**	-	**1600**	-	**2400**	-	**2400**	-	**2600**	-	**2600**	-	**3000**	-	**3000**	-	**3000**	-	**3000**	-
General Chemistry (pH Units)																								
pH (lab)	NA	-	NA	-	NA	-	NA	-	7.7	T8	7.7	T8	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Metals (mg/L)																								
Aluminum, Dissolved	**0.063**	J, P1	< 0.1	-	< 0.1	-	< 0.1	-	**0.058**	J	**0.10**	-	< 0.1	-	< 0.1	-	0.047	J	**0.053**	J	< 0.1	-	< 0.1	-
Antimony, Dissolved	**0.015**	J, P1	**0.022**	-	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	**0.042**	-	**0.038**	-	**0.014**	J	< 0.02	-	< 0.02	-	< 0.02	-
Arsenic, Dissolved	**0.027**	-	**0.033**	-	< 0.02	-	< 0.02	-	**0.016**	J	**0.015**	J	< 0.02	-	< 0.02	-	**0.080**	-	**0.077**	-	**0.20**	-	**0.19**	-
Barium, Dissolved	0.019	-	0.018	-	0.021	-	0.019	-	0.049	-	0.048	-	0.042	-	0.042	-	0.018	-	0.018	-	0.018	-	0.019	-
Beryllium, Dissolved	< 0.002	-	< 0.002	-	0.00091	J, P1	< 0.002	-	< 0.002	-	< 0.002	-	0.00064	J, P1	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-
Boron, Dissolved	0.73	-	0.73	-	0.77	-	0.76	-	0.91	-	0.91	-	0.79	-	0.79	-	1.2	-	1.2	-	1.1	-	1.1	-
Cadmium, Dissolved	0.0031	J, P1	0.0031	J	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	0.0025	J	0.0024	J
Calcium, Dissolved	150	V	150	-	140	J5	140	-	190	-	190	-	200	V	190	-	160	J6	160	-	140	-	140	-
Chromium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Chromium, hexavalent	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	**0.0030**	J, P1	**0.0050**	J	**0.0060**	J, T8	**0.0060**	J, T8	< 0.01	-	< 0.01	-
Cobalt, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	0.0045	J, P1	0.0035	J	0.0034	J	0.0033	J	< 0.01	-	< 0.01	-
Copper, Dissolved	0.0039	J, P1	< 0.02	-	0.0026	J, P1	< 0.02	-	< 0.02	-	< 0.02	-	0.0050	J, P1	0.0041	J	0.0039	J	0.0033	J	< 0.02	-	< 0.02	-
Fluoride, Dissolved	**0.62**	-	0.58	-	**0.65**	-	**0.66**	-	**0.68**	-	**0.67**	-	**0.66**	-	**0.66**	-	**3.4**	-	**3.5**	-	**4.0**	-	**3.9**	-
Iron, Dissolved	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	0.16	-	< 0.1	-	< 0.1	-
Lead, Dissolved	0.013	-	0.014	-	0.0034	J, P1	0.0031	J	0.0054	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-
Magnesium, Dissolved	92	V	92	-	92	-	91	-	97	-	97	-	99	-	99	-	**160**	J6	**160**	-	**170**	-	**170**	-
Manganese, Dissolved	0.015	-	0.015	-	0.015	-	0.014	-	**0.10**	-	**0.11**	-	**0.11**	-	**0.11**	-	**0.27**	-	**0.27**	-	**0.16**	-	**0.20**	-
Mercury, Dissolved	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-
Molybdenum, Dissolved	< 0.005	-	< 0.005	-	0.0031	J, P1	0.0017	J	0.017	-	0.018	-	0.018	-	0.016	-	0.034	-	0.034	-	0.027	-	0.023	-
Nickel, Dissolved	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	0.0060	J	0.0052	J	< 0.02	-	< 0.02	-	< 0.02	-	< 0.02	-	0.0093	J	0.010	J
Potassium, Dissolved	50	V	48	-	52	-	52	-	20	-	20	-	20	-	20	-	39	-	40	-	40	-	39	-
Selenium, Dissolved	0.021	-	0.035	-	0.020	P1	0.017	J	< 0.1	O	< 0.1	O	**0.18**	-	**0.18**	-	**0.20**	-	**0.20**	-	< 0.1	O	< 0.1	O
Silica, Dissolved	14	-	14	-	16	-	16	-	18	-	18	-	18	-	20	-	64	-	55	-	62	-	64	-
Silver, Dissolved	< 0.01	J6	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	0.0094	J, P1	0.0099	J	0.0086	J	0.0080	J	< 0.01	-	< 0.01	-
Sodium, Dissolved	200	V	190	-	200	J5	200	-	450	-	450	-	430	V	420	-	460	-	470	-	470	-	450	-
Thallium, Dissolved	**0.012**	J, P1	**0.016**	J	**0.019**	J, P1	**0.012**	J	< 0.02	-	< 0.02	-	**0.056**	-	**0.057**	-	**0.044**	-	**0.047**	-	< 0.02	-	< 0.02	-
Titanium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Vanadium, Dissolved	0.0040	J, P1	0.0030	J	0.0047	J, P1	0.0041	J	0.0030	J	0.0029	J	0.0054	J, P1	0.0035	J	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Zinc, Dissolved	0.011	J, P1	0.011	J	< 0.03	-	< 0.03	-	0.015	J	0.014	J	0.017	J, P1	0.015	J	0.017	J, P1	0.019	J	< 0.03	-	< 0.03	-
PAH (µg/L)																								
Acenaphthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.013	J	0.013	J	< 0.05	-	< 0.05	-
Anthracene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(a)anthracene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(a)pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(b)fluoranthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(g,h,i)perylene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Benzo(k)fluoroanthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Chrysene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Fluoranthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Indeno(1,2,3-cd)pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Naphthalene (PAH)	< 0.25	-	< 0.25	-	< 0.25	-	< 0.25	-	0.022	J	0.023	J	< 0.25	-	0.027	J	< 0.25	-	< 0.25	-	< 0.25	-	< 0.25	-
Phenanthrene	< 0.05	-	< 0.05	-	0.010	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
Pyrene	< 0.05	-	< 0.05	-	0.028	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-
SVOC (µg/L)																								
1,1-Biphenyl	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 8	-	< 10	-	< 10	-	< 10	-	< 10	-
Bis(2-ethylhexyl)phthalate	1.5	-	0.74	J	< 3	-	0.52	J	0.76	J	0.69	J	0.79	J	0.90	J	0.75	J	0.96	J	0.70	J	1.1	-

NA - Not Applicable; Results that exceed a screening level are in bold.

Laboratory Qualifiers

J = Estimated value below the lowest calibration point.

J4 = The associated batch QC was outside the established quality control range for accuracy.

J5 = The sample matrix interfered with the ability to make an accurate determination; spike value is high.

J6 = The sample matrix interfered with the ability to make an accurate getermination; spike value is low.

O = Sample diluted due to matrix interferences that impaired the ability to make an accurate analytical determination. The detection limit is elevated in order to reflect the necessary dilution.

P1 = RPD value not applicable for sample concentrations less than 5 times the reporting limit.

T2 = Additional method/sample information - laboratory analysis was from an unpreserved or improperly preserved sample.

T8 = Additional method/sample information - samples received past/ too close to holding time.

V= The sample concentration is too high to evaluate accurate spike recoveries.

Table D-5 **Groundwater Quality Control Sample Results - Duplicates**

	LMW-11R (DUP-4) 3/23/2012		LMW-11R 3/23/2012		LMW-11R (DUP-3) 5/29/2012		LMW-11R 5/29/2012		LMW-9 (DUP-5) 5/31/2012		LMW-9 5/31/2012		LMW-9 (Dup #4) 8/27/2012		LMW-9 8/27/2012		LMW-9 (DUP-3) 11/28/2012		LMW-9 11/28/2012	
Parameter Name	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**	**Result**	**Lab Qualifier**
Asbestos (MFL>10um)																				
Asbestos	< 0.7	-	< 0.7	-	< 0.2	-	< 1	-	< 9.9	-	< 19.9	-	< 24.8	-	< 49.6	-	< 9.9	-	< 5	-
General Chemistry (mg/L)																				
Alkalinity - Bicarbonate	81	-	84	-	70	-	71	-	67	-	71	-	66	-	66	-	72	-	72	-
Alkalinity - Carbonate	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-	< 20	-
Chloride	**480**	-	**470**	-	**450**	-	**460**	-	350	-	350	-	310	-	310	-	340	-	340	-
Nitrogen, Ammonia(As N)	< 0.1	-	< 0.1	-	< 0.1	T2	0.15	T2	< 0.1	T2	< 0.1	T2	0.085	J, T2	< 0.1	-	0.052	J, T2	< 0.1	T2
Nitrogen, Nitrate(As N)	< 0.1	-	< 0.1	-	0.64	-	< 0.1	-	< 0.1	-	0.78	-	4.8	-	4.8	-	4.9	-	5.0	-
Nitrogen, Nitrite(As N)	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-
Phosphorus, Total (As P)	0.028	J, T2	0.038	J, T2	0.031	J	0.038	J	0.17	T2	0.35	T2	0.19	T2	0.090	J, T2	0.10	-	0.12	-
Sulfate	**2800**	-	**2800**	-	**2600**	-	**2800**	-	**1900**	-	**1900**	-	**1900**	-	**1800**	-	**1800**	-	**1800**	-
Total Dissolved Solids(residue, filterable)	**4300**	-	**4100**	-	**4100**	-	**4300**	-	**3300**	-	**3300**	-	**3300**	-	**3300**	-	**3200**	-	**3100**	-
General Chemistry (pH Units)																				
pH (lab)	7.5	T8	7.6	T8	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-	NA	-
Metals (mg/L)																				
Aluminum, Dissolved	< 0.1	-	0.048	J	0.033	J, J5	0.047	J	**0.055**	J, P1	**0.067**	J	**0.063**	J	0.048	J, P1	< 0.1	-	< 0.1	J5
Antimony, Dissolved	< 0.02	-	< 0.02	-	**0.010**	J	**0.016**	-	**0.035**	P1	< 0.02	-	**0.011**	J	**0.0097**	J, P1	**0.011**	J	**0.024**	P1
Arsenic, Dissolved	< 0.02	-	< 0.02	-	**0.026**	-	**0.030**	-	**0.015**	J, P1	**0.014**	J	**0.057**	-	**0.063**	-	**0.016**	J	**0.010**	J, P1
Barium, Dissolved	0.020	-	0.018	-	0.010	J6	0.011	-	0.013	-	0.013	-	0.014	-	0.016	-	0.012	-	0.011	-
Beryllium, Dissolved	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-	< 0.002	-
Boron, Dissolved	3.5	-	3.6	-	3.6	-	3.7	-	2.1	-	2.2	-	2.4	-	2.4	-	2.5	-	2.4	-
Cadmium, Dissolved	< 0.005	-	< 0.005	-	0.0049	J	**0.0051**	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-	< 0.005	-
Calcium, Dissolved	440	-	440	-	450	V	450	-	310	V	330	-	350	-	340	V	360	-	350	V
Chromium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	**0.11**	-	**0.11**	-	**0.11**	-	**0.11**	-	**0.12**	-	**0.12**	-
Chromium, hexavalent	< 0.01	-	< 0.01	-	**0.0060**	J	**0.0040**	J	**0.12**	-	**0.11**	-	**0.11**	-	**0.11**	-	**0.11**	-	**0.11**	-
Cobalt, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	**0.013**	-	**0.013**	-
Copper, Dissolved	< 0.02	-	< 0.02	-	0.0039	J	< 0.02	-	< 0.02	-	< 0.02	-	0.0047	J	0.0044	J, P1	< 0.02	-	< 0.02	-
Fluoride, Dissolved	**2.1**	-	**2.1**	-	**2.2**	-	**1.9**	-	**2.6**	-	**2.6**	-	**2.6**	-	**2.6**	-	**2.1**	-	**2.1**	J6
Iron, Dissolved	< 0.1	-	0.031	J	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-	< 0.1	-
Lead, Dissolved	< 0.005	-	< 0.005	-	**0.036**	-	**0.034**	-	< 0.005	-	< 0.005	-	0.010	-	0.014	P1	< 0.025	O	< 0.025	O
Magnesium, Dissolved	**210**	-	**220**	-	**220**	V	**220**	-	**150**	V	**160**	-	**160**	-	**160**	V	**170**	-	**170**	V
Manganese, Dissolved	**0.020**	-	0.016	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	0.0081	J	0.0092	J, P1	< 0.01	-	< 0.01	-
Mercury, Dissolved	0.000010	J	0.000010	J	0.000020	J	0.000020	J	0.000040	J	0.000040	J	< 0.0002	-	< 0.0002	-	< 0.0002	-	< 0.0002	-
Molybdenum, Dissolved	**0.13**	-	**0.13**	-	**0.10**	-	**0.11**	-	**0.17**	-	**0.18**	-	**0.22**	-	**0.22**	-	**0.21**	-	**0.20**	-
Nickel, Dissolved	0.0059	J	0.0076	J	< 0.02	-	< 0.02	-	0.010	J, P1	0.0082	J	0.0072	J	< 0.02	-	< 0.02	-	< 0.02	-
Potassium, Dissolved	56	-	56	-	55	V	56	-	40	-	43	-	47	-	46	-	44	-	45	-
Selenium, Dissolved	< 0.1	O	< 0.1	O	0.024	-	0.022	-	< 0.1	O	< 0.1	O	0.037	-	0.034	-	**0.12**	-	**0.13**	-
Silica, Dissolved	15	-	15	-	14	-	14	-	17	-	17	-	18	-	18	-	18	-	17	-
Silver, Dissolved	< 0.01	-	< 0.01	-	0.0057	J, J6	< 0.01	-	< 0.01	J6	0.0042	J	0.010	-	0.0053	J, P1, J6	0.022	-	0.019	-
Sodium, Dissolved	480	-	480	-	460	V	480	-	340	V	370	-	410	-	400	V	390	-	390	V
Thallium, Dissolved	< 0.02	-	< 0.02	-	**0.026**	-	**0.022**	-	< 0.02	-	< 0.02	-	**0.014**	J	**0.012**	J, P1	**0.10**	-	**0.082**	-
Titanium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Vanadium, Dissolved	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-	< 0.01	-
Zinc, Dissolved	0.036	-	0.041	-	0.014	J	0.015	J	0.010	J, P1	0.013	J	0.016	J	0.016	J, P1	0.073	-	0.072	-
PAH (µg/L)																				
Acenaphthene	0.021	J	0.019	J	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.18	-	5.3	-
Anthracene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.0080	J	**7.0**	-
Benzo(a)anthracene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	**7.9**	-
Benzo(a)pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	**5.1**	-
Benzo(b)fluoranthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	**5.3**	-
Benzo(g,h,i)perylene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	2.4	-
Benzo(k)fluoroanthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	**2.1**	-
Chrysene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	**5.3**	-
Fluoranthene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	22	-
Indeno(1,2,3-cd)pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	**2.0**	-
Naphthalene (PAH)	< 0.25	-	< 0.25	-	0.026	J	0.028	J	0.029	J	0.028	J	< 0.25	-	< 0.25	-	0.058	J	**1100**	-
Phenanthrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.0096	J	< 0.05	-	**26**	-
Pyrene	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	< 0.05	-	0.026	J	< 0.05	-	**18**	-
SVOC (µg/L)																				
1,1-Biphenyl	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-	< 10	-
Bis(2-ethylhexyl)phthalate	< 1	-	< 1	-	1.4	-	< 1	-	< 1	-	**18**	-	0.78	J	0.79	J	0.89	J	0.75	J

NA - Not Applicable; Results that exceed a screening level are in bold.

Laboratory Qualifiers

J = Estimated value below the lowest calibration point.

J4 = The associated batch QC was outside the established quality control range for accuracy.

J5 = The sample matrix interfered with the ability to make an accurate determination; spike value is high.

J6 = The sample matrix interfered with the ability to make an accurate getermination; spike value is low.

O = Sample diluted due to matrix interferences that impaired the ability to make an accurate analytical determination. The detection limit is elevated in order to reflect the necessary dilution.

P1 = RPD value not applicable for sample concentrations less than 5 times the reporting limit.

T2 = Additional method/sample information - laboratory analysis was from an unpreserved or improperly preserved sample.

T8 = Additional method/sample information - samples received past/ too close to holding time.

V= The sample concentration is too high to evaluate accurate spike recoveries.

Appendix E

Soil Physical Analysis Reports

Total Organic Content Results (ASTM-D2974)

Location	Depth (feet)	Total Organic Content (%)
BG-1D	19-22	0.5
BG-1D	40-42	0.3
BG-1D	45-48	0.9
BG-1D	62-65	2.4
BG-1D	99-102	0.7

Converse Consultants
731 Pilot Rd. Suite H
Las Vegas, NV 89119

Project: Reid Gardner Replacement Wells
Project No.: 11-35120-01

Assigned By: MDJ / ACD
Date Assigned: 11/10/12

Checked By:
Date Needed: 1/23/12

Page No: 2 of

Boring No.	Bulk	Brass Rings	Amount of Sample (inches)	Depth (feet)	Unit Class. Symbol	Moisture Content	MC & Unit Weight	Atterberg Limits (LL & PI)	Consolidation	Swell	Solubility	Sieve	%>No. 4 & < No. 200	R-Value	D1557	Single-Point Check	~~CBR~~ Permeability	Miller Box Resistivity	Direct Shear (Single Point)	Direct Shear (3 Point)	Unconfined Compressive Strength	NDOT Resistivity	Water Soluble Sodium Sulfate & Solubility	Resistivity Analysis	Corrosivity Analysis	Corrosivity, Resistivity & Sodium Sulfate	Other Tests pH Carbon	Instructions / Remarks
BG-1D																												Permeability tests to be sent to AP Engineers
	/		19	19-22	SW-GW			/				/															/	Other Tests include pH & Total Organic Carbon D 2974
		/	6	20-20.5	SW-SC																							
		/	6	20.5-21	SW-SC												/											
	/		19	40-42	SP-SP			/				/															/	
	/		19	45-48	CL			/				/															/	
		/	6	46-46.5	CL																							
		/	6	46.5-47	CL												/											
	/		19	62-65	CL			/				/															/	
		/	6	63-63.5	CL/ML												/											
		/	6	63.5-64	CL																							
	/		19	99-102	CL			/				/															/	
		/	6	100.5-100	SP/SM																							
		/	6	101-101.5	SP/SM												/											

* No sample collected for 80' interval

SilverState
Analytical Laboratories

LABORATORY REPORT

DATE: February 17, 2012

REPORT NUMBER: 12-0275

CLIENT: Converse Consultants
731 Pilot Road, Suite H
Las Vegas, NV 89119

PAGE: 1 of 1

CLIENT PROJECT: 11-35120-01

CLIENT PO #: 25453

Sampled By: Client
Date Sampled: 01/20/12
Time Sampled: --

Submitted by: Client
Date Received: 01/20/12
Time Received: 1620

Report Attention:

Sample ID	Parameter	Result	Unit	Method	Date Analyzed	Analyst
BG1D @ 19-22'	pH	8.79	S.U.	SM4500H+B	01/23/12	SW
BG1D @ 40-42'	pH	9.04	S.U.	SM4500H+B	01/23/12	SW
BG1D @ 45-48'	pH	8.39	S.U.	SM4500H+B	01/23/12	SW
BG1D @ 62-65'	pH	8.35	S.U.	SM4500H+B	01/23/12	SW
BG1D @ 99-102'	pH	8.37	S.U.	SM4500H+B	01/23/12	SW

NOTES: The results for each constituent denote the percentage (%) for that particular element which is soluble in a 1:5 (soil to water) extraction ratio and corrected for dilution.

REVIEWED BY:

John Sloan
Laboratory Director

3638 East Sunset Road, Suite 100 Las Vegas, NV 89120
Tel: 702-873-4478 Fax: 702-873-7967 www.ssalabs.com

AP Engineering & Testing, Inc.

CONSTANT HEAD PERMEABILITY TEST

ASTM D2434

Project	Reid Gardner Wells	Tested by	KM	Date	01/28/12
Project No.	11-35120-01	Calculated by	KM	Date	01/28/12
Boring No.	BG-10	Checked by	AP	Date	01/30/12
Sample No.	-	Depth (ft):	20.5-21.0		
Soil Description	Sand w/clay, fine-coarse grained	Max. Size:	3/4"		

CONDITION OF SPECIMEN

				Before	After
Diameter	6.13	cm	Container No.		
Sample Area	29.55	cm^2	Wt. Wet Soil+Container(gms)	360.11	496.91
Length	7.81	cm	Wt. Dry Soil+Container(gms)	352.00	439.21
Weight Before	422.40	g	Wt. Container (gms)	50.00	50.11
Wet Density	114.23	pcf	Moisture, (%)	2.69	14.83
Dry Density	111.24	pcf			

Sample Type	Rings	Max. Dry Density (pcf)	N/A
	Mod. Cal.	Optimum Moisture (%)	N/A
		Relative Compaction (%)	N/A

PERMEABILITY DATA

Trial No.	Manometers		Head, h	Outflow	Time	Q/At	h/L	Temp.	k
	H1	H2	cm	Q, ml	sec			°c	cm/sec
1	25.3	19.7	5.6	100	80.3	0.0421	0.7170	20.6	5.88E-02
2	25.3	19.7	5.6	100	79.9	0.0424	0.7170	20.6	5.91E-02
3	25.3	17.9	7.4	100	66.7	0.0507	0.9474	20.6	5.35E-02
4	25.3	17.9	7.4	100	67.6	0.0501	0.9474	20.6	5.28E-02
5	25.3	15.9	9.4	100	56.1	0.0603	1.2035	20.6	5.01E-02
6	25.3	15.9	9.4	100	57.8	0.0585	1.2035	20.6	4.86E-02
7	25.3	13.1	12.2	100	47.3	0.0715	1.5620	20.6	4.58E-02
8	25.3	13.1	12.2	100	47.8	0.0708	1.5620	20.6	4.53E-02
9	25.3	12.0	13.3	100	44.5	0.0760	1.7028	20.6	4.47E-02
10	25.3	12.0	13.3	100	44.0	0.0769	1.7028	20.6	4.52E-02
Corrected k_{20} (cm/sec) :									4.97E-02

AP Engineering & Testing, Inc.

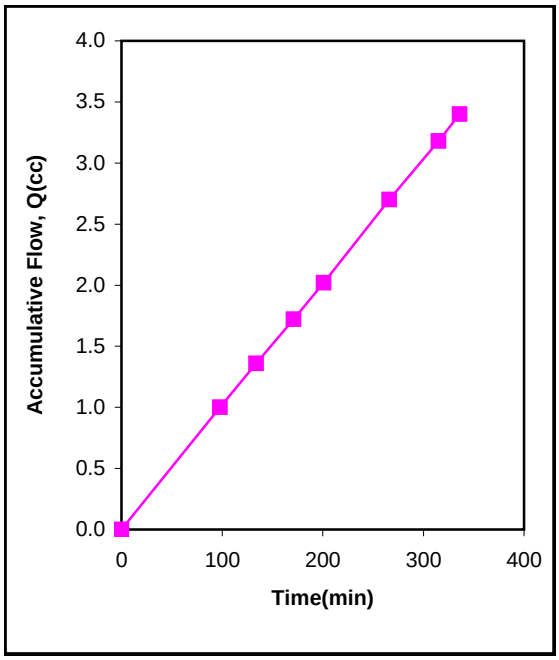
FLEXIBLE WALL HYDRAULIC CONDUCTIVITY TEST
ASTM D 5084

Project Name:	Reid Gardner Wells	Tested by	ST	Date	01/25/12
Project No.:	11-35120-01	Calculated by	KM	Date	01/27/12
Boring No.:	BG-10	Checked by	AP	Date	01/28/12
Sample No.:	- Depth (ft.): 46.5-47.0				
Soil Description:	Sandy Clay				
Test Condition:	Mod Cal				
	Confining Pressure = 39 PSI				
Remarks:					

INITIAL CONDITION OF SPECIMEN

				Before	After
Diameter (d)	2.42	in			
Sample Area (A)	4.61	in²			
Length (L)	3.02	in	Container No.		
Weight Before	489.10	g	Wt. Wet Soil+Container(gms)	206.81	637.08
			Wt. Dry Soil+Container(gms)	183.77	565.49
Wet Density	133.96	pcf	Wt. Container (gms)	51.7	148.8
Dry Density	114.06	pcf	Moisture, (%)	17.45	17.18

TEST RESULTS



Time (min)	Flow Rdg (cm)	Burette Factor	Q (cc)	Head, h (psi)	h/L	Q/t (cc/s)
0	48.0	1	0.0	3.0	27.5	0
98	47.0	1	1.0	3.0	27.5	1.70E-04
134	46.6	1	1.4	3.0	27.5	1.67E-04
171	46.3	1	1.7	3.0	27.5	1.62E-04
201	46.0	1	2.0	3.0	27.5	1.67E-04
266	45.3	1	2.7	3.0	27.5	1.74E-04
315	44.8	1	3.2	3.0	27.5	1.63E-04
336	44.6	1	3.4	3.0	27.5	1.75E-04

Hydraulic Conductivity (cm/sec): 2.08E-07

AP Engineering & Testing, Inc.

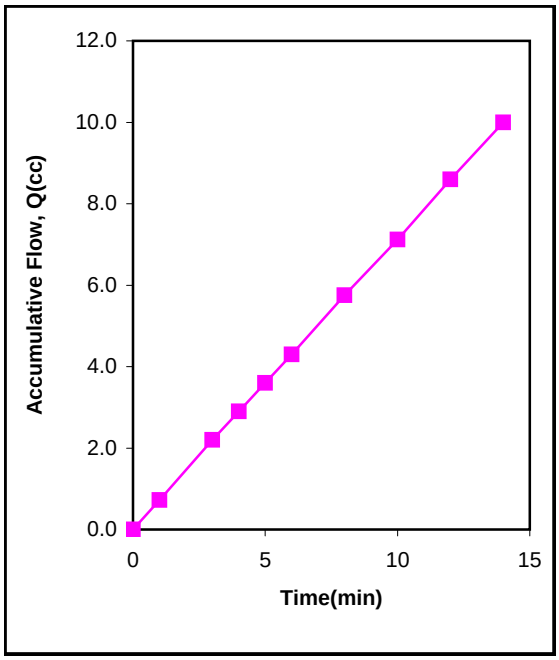
FLEXIBLE WALL HYDRAULIC CONDUCTIVITY TEST
ASTM D 5084

Project Name:	Reid Gardner Wells	Tested by	ST	Date	01/25/12
Project No.:	11-35120-01	Calculated by	KM	Date	01/27/12
Boring No.:	BG-10	Checked by	AP	Date	01/28/12
Sample No.:	- Depth (ft.): 63.0-63.5				
Soil Description:	Silty Sand				
Test Condition:	Mod Cal				
	Confining Pressure = 53 PSI				
Remarks:					

INITIAL CONDITION OF SPECIMEN

				Before	After
Diameter (d)	2.40	in			
Sample Area (A)	4.51	in²			
Length (L)	3.00	in	Container No.		
Weight Before	446.97	g	Wt. Wet Soil+Container(gms)	293.81	592.13
			Wt. Dry Soil+Container(gms)	239.01	492.85
Wet Density	125.76	pcf	Wt. Container (gms)	49.75	150.36
Dry Density	97.52	pcf	Moisture, (%)	28.95	28.99

TEST RESULTS



Time (min)	Flow Rdg (cm)	Burette Factor	Q (cc)	Head, h (psi)	h/L	Q/t (cc/s)
0	44.3	1	0.0	1.0	9.23	0
1	43.6	1	0.7	1.0	9.23	1.20E-02
3	42.1	1	2.2	1.0	9.23	1.23E-02
4	41.4	1	2.9	1.0	9.23	1.17E-02
5	40.7	1	3.6	1.0	9.23	1.17E-02
6	40.0	1	4.3	1.0	9.23	1.17E-02
8	38.6	1	5.8	1.0	9.23	1.21E-02
10	37.2	1	7.1	1.0	9.23	1.14E-02
12	35.7	1	8.6	1.0	9.23	1.23E-02
14	34.3	1	10.0	1.0	9.23	1.17E-02

Hydraulic Conductivity (cm/sec): 4.40E-05

AP Engineering & Testing, Inc.

CONSTANT HEAD PERMEABILITY TEST

ASTM D2434

Project	Reid Gardner Wells		Tested by	KM	Date 01/28/12
Project No.	11-35120-01		Calculated by	KM	Date 01/28/12
Boring No.	BG-10		Checked by	AP	Date 01/30/12
Sample No.	-	Depth (ft): 101-101.5			
Soil Description	Fine Sand w/silt		Max. Size:	N/A	

CONDITION OF SPECIMEN

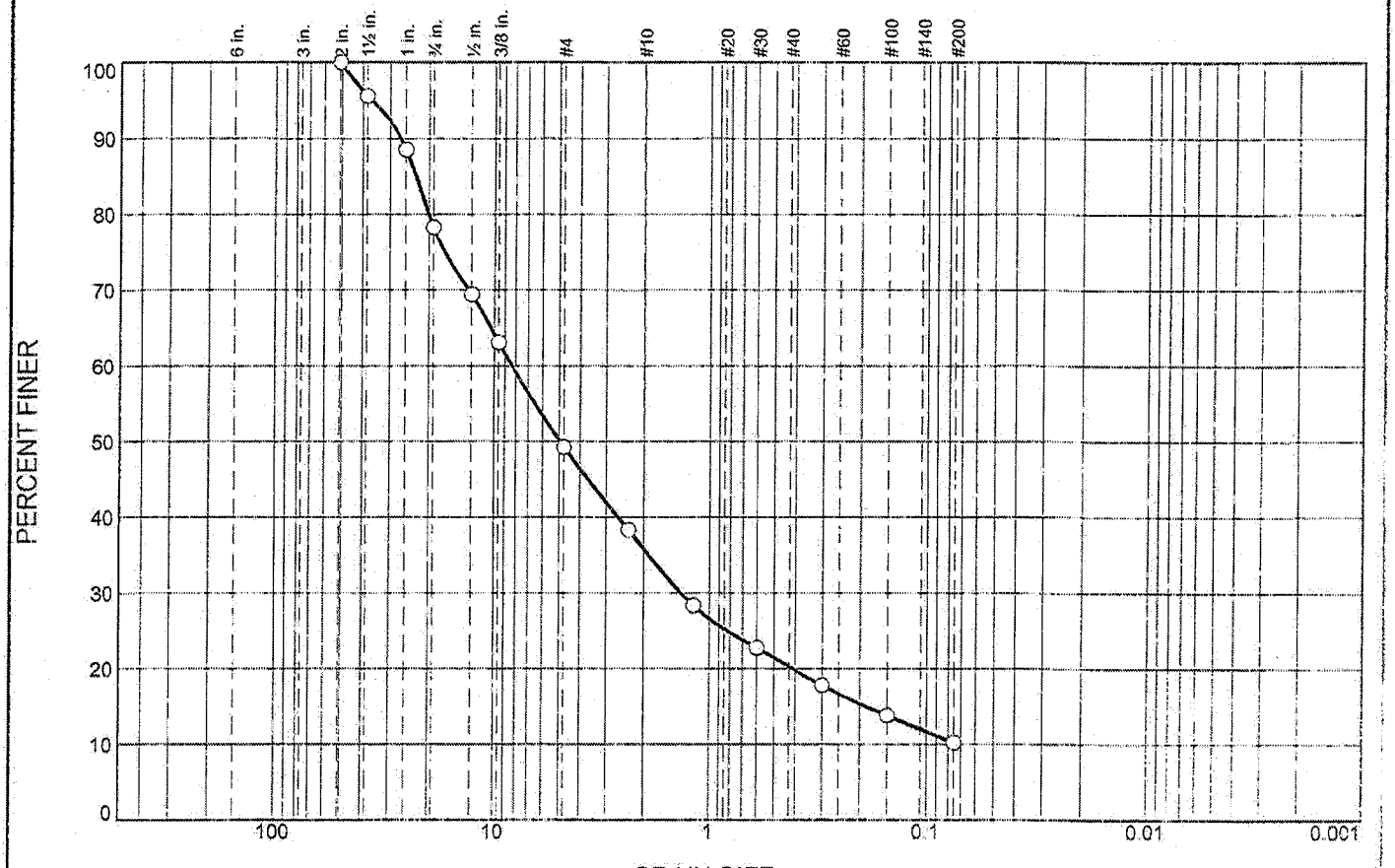
				Before	After
Diameter	6.13	cm	Container No.		
Sample Area	29.55	cm^2	Wt. Wet Soil+Container(gms)	190.82	536.66
Length	7.81	cm	Wt. Dry Soil+Container(gms)	169.51	455.72
Weight Before	494.14	g	Wt. Container (gms)	50.11	50.09
Wet Density	133.63	pcf	Moisture, (%)	17.85	19.95
Dry Density	113.39	pcf			

Sample Type	Rings	Max. Dry Density (pcf)	N/A
	Mod. Cal.	Optimum Moisture (%)	N/A
		Relative Compaction (%)	N/A

PERMEABILITY DATA

Trial No.	Manometers		Head, h	Outflow	Time	Q/At	h/L	Temp.	k
	H1	H2	cm	Q, ml	sec			°c	cm/sec
1	94.1	16.5	77.6	100	170.8	0.0198	9.9353	20.6	1.99E-03
2	94.1	16.5	77.6	100	170.1	0.0199	9.9353	20.6	2.00E-03
3	94.1	14.4	79.7	100	165.5	0.0204	10.2042	20.6	2.00E-03
4	94.1	14.4	79.7	100	160.5	0.0211	10.2042	20.6	2.07E-03
5	94.1	12.6	81.5	100	155.2	0.0218	10.4347	20.6	2.09E-03
6	94.1	12.6	81.5	100	154.9	0.0218	10.4347	20.6	2.09E-03
7	94.1	10.7	83.4	100	154.1	0.0220	10.6779	20.6	2.06E-03
8	94.1	10.7	83.4	100	154.1	0.0220	10.6779	20.6	2.06E-03
9	94.1	8.5	85.6	100	139.0	0.0243	10.9596	20.6	2.22E-03
10	94.1	8.5	85.6	100	139.6	0.0242	10.9596	20.6	2.21E-03
Corrected k_{20} (cm/sec) :									2.08E-03

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	50.7	39.1	10.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1-1/2"	95.6		
1"	88.5		
3/4"	78.3		
1/2"	69.4		
3/8"	63.0		
#4	49.3		
#8	38.3		
#16	28.3		
#30	22.7		
#50	17.8		
#100	13.8		
#200	10.2		

* (no specification provided)

Material Description

Poorly Graded Gravel with Silt and Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 26.8167 D_{85}= 22.9134 D_{60}= 8.3012
D_{50}= 4.9616 D_{30}= 1.3521 D_{15}= 0.1876
D_{10}= C_u= C_c=

Classification

USCS= GP-GM AASHTO= A-1-a

Remarks

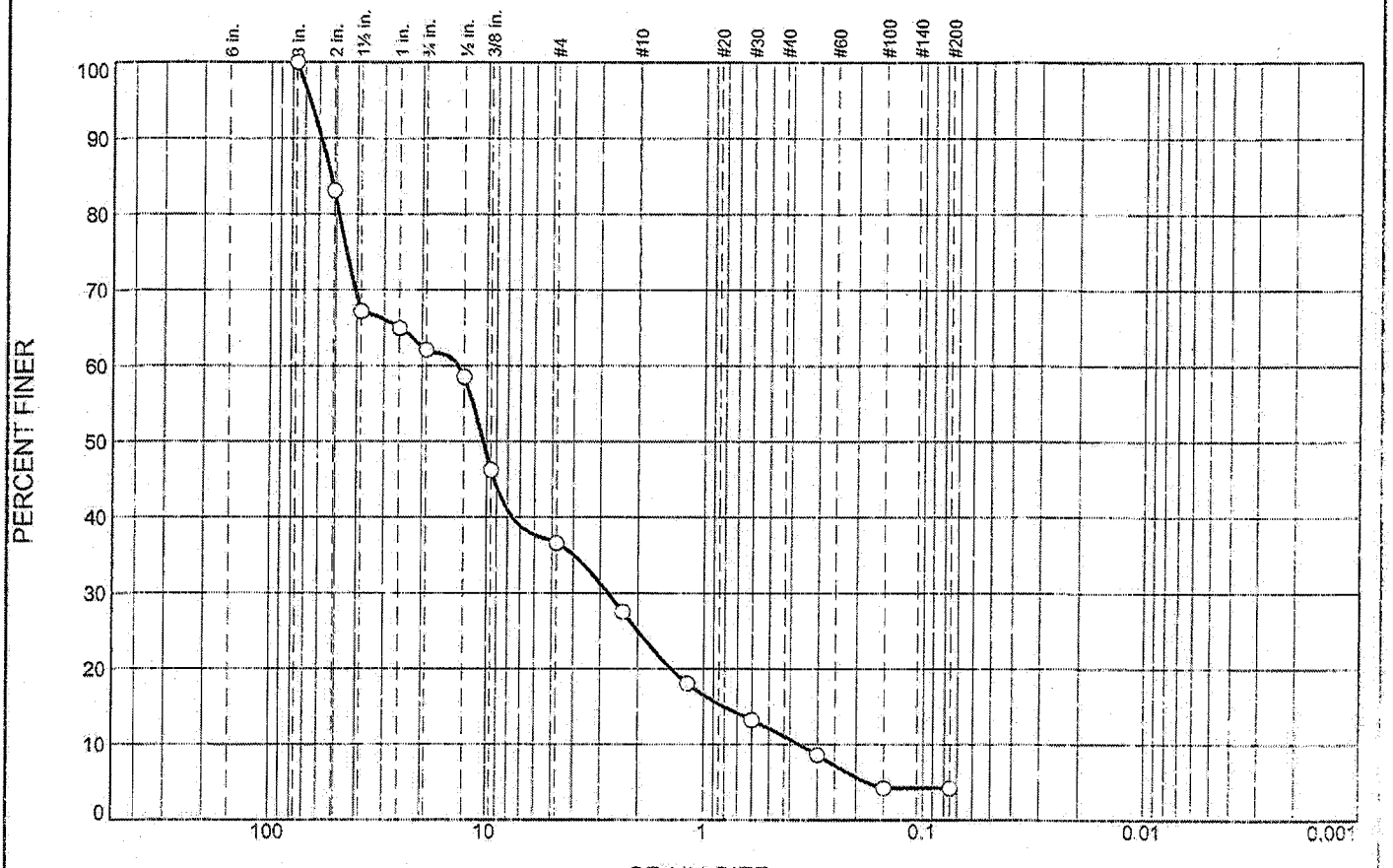
Source of Sample: BG-1D **Depth:** 19-22

Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS
Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	63.4	32.4	4.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	83.1		
1-1/2"	67.2		
1"	64.9		
3/4"	62.1		
1/2"	58.5		
3/8"	46.2		
#4	36.6		
#8	27.5		
#16	18.0		
#30	13.2		
#50	8.6		
#100	4.2		
#200	4.2		

* (no specification provided)

Material Description

Well Graded Gravel with Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 58.2793 D_{85}= 52.5775 D_{60}= 13.5117
D_{50}= 10.3821 D_{30}= 2.7587 D_{15}= 0.8078
D_{10}= 0.3641 C_u= 37.11 C_c= 1.55

Classification

USCS= GW AASHTO= A-1-a

Remarks

Source of Sample: BG-1D **Depth:** 40-42

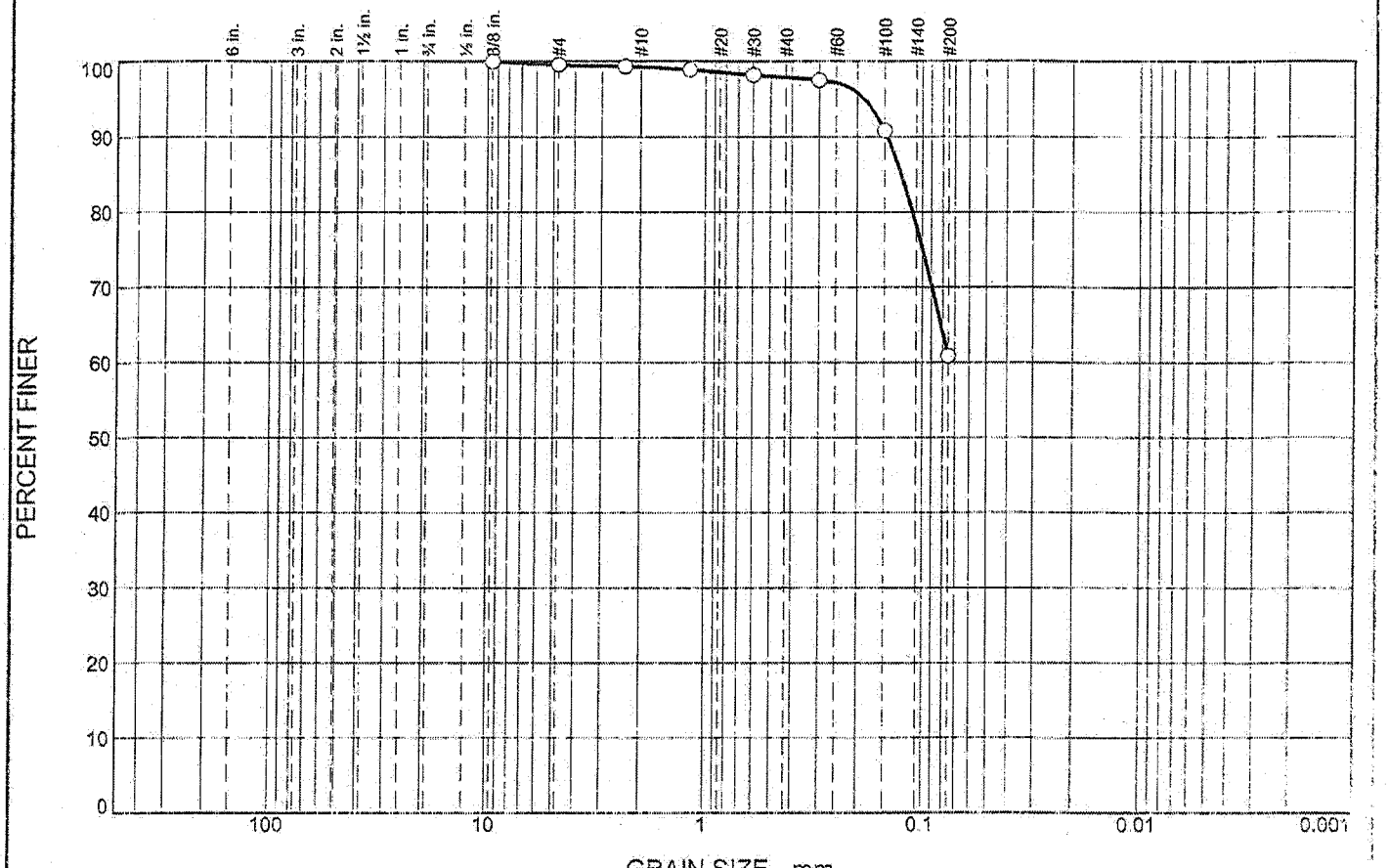
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.4	38.8	60.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	99.6		
#8	99.3		
#16	98.9		
#30	98.2		
#50	97.5		
#100	90.8		
#200	60.8		

* (no specification provided)

Material Description

Sandy Lean Clay

Atterberg Limits

PL= 13 LL= 26 PI= 13

Coefficients

D_{90}= 0.1458 D_{85}= 0.1255 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(5)

Remarks

Source of Sample: BG-1D **Depth:** 45-48

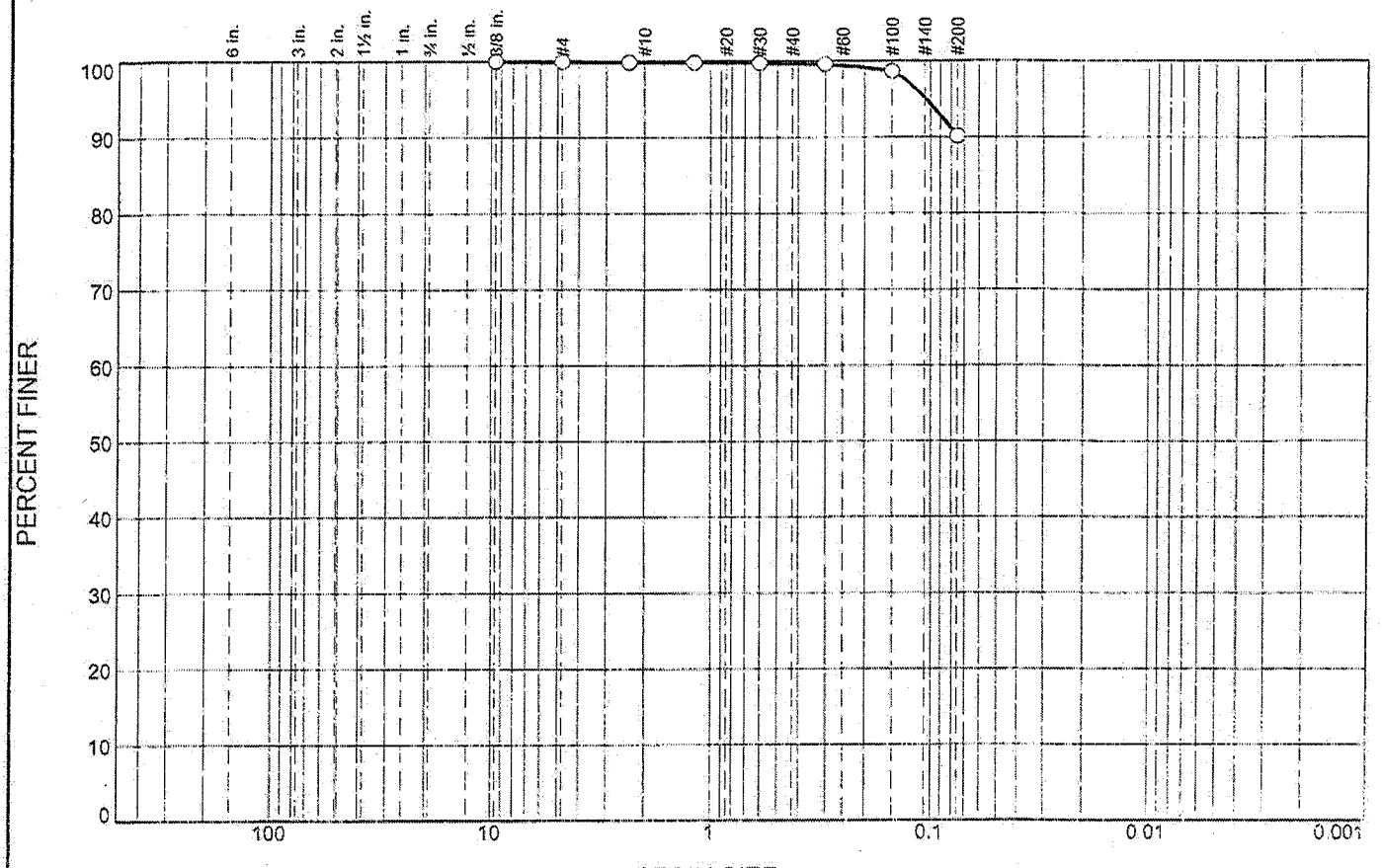
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.1	9.7	90.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	99.9		
#8	99.9		
#16	99.8		
#30	99.7		
#50	99.6		
#100	98.7		
#200	90.2		

* (no specification provided)

Material Description

Lean Clay

Atterberg Limits

PL= 18 LL= 34 PI= 16

Coefficients

D_{90}= D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(14)

Remarks

Source of Sample: BG-1D **Depth:** 62-65

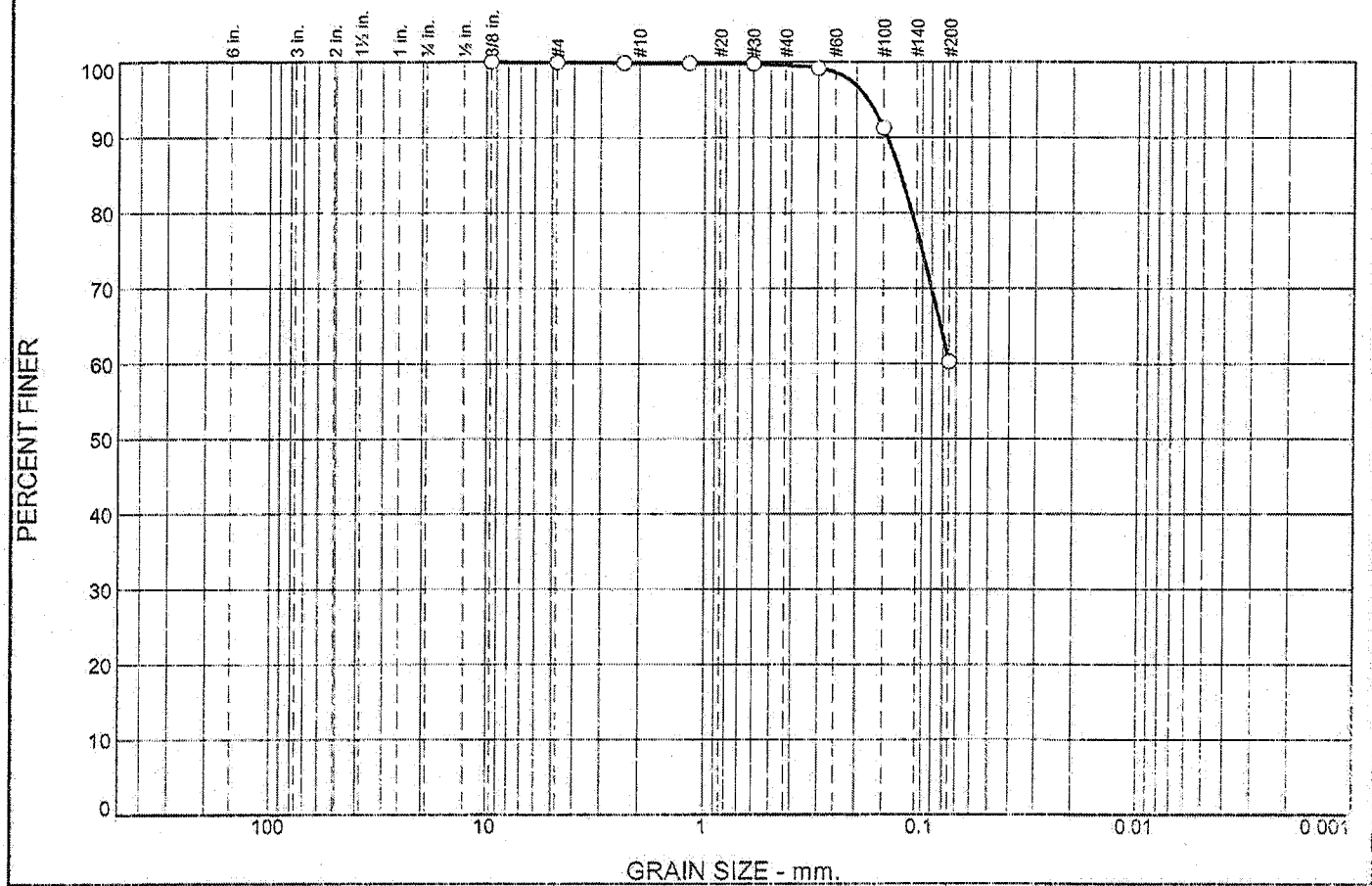
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.0	39.8	60.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	100.0		
#8	99.9		
#16	99.8		
#30	99.8		
#50	99.2		
#100	91.3		
#200	60.2		

* (no specification provided)

Material Description

Sandy Silty Clay

Atterberg Limits

PL= 15 LL= 20 PI= 5

Coefficients

D_{90}= 0.1437 D_{85}= 0.1249 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL-ML AASHTO= A-4(0)

Remarks

Source of Sample: BG-1D **Depth:** 99

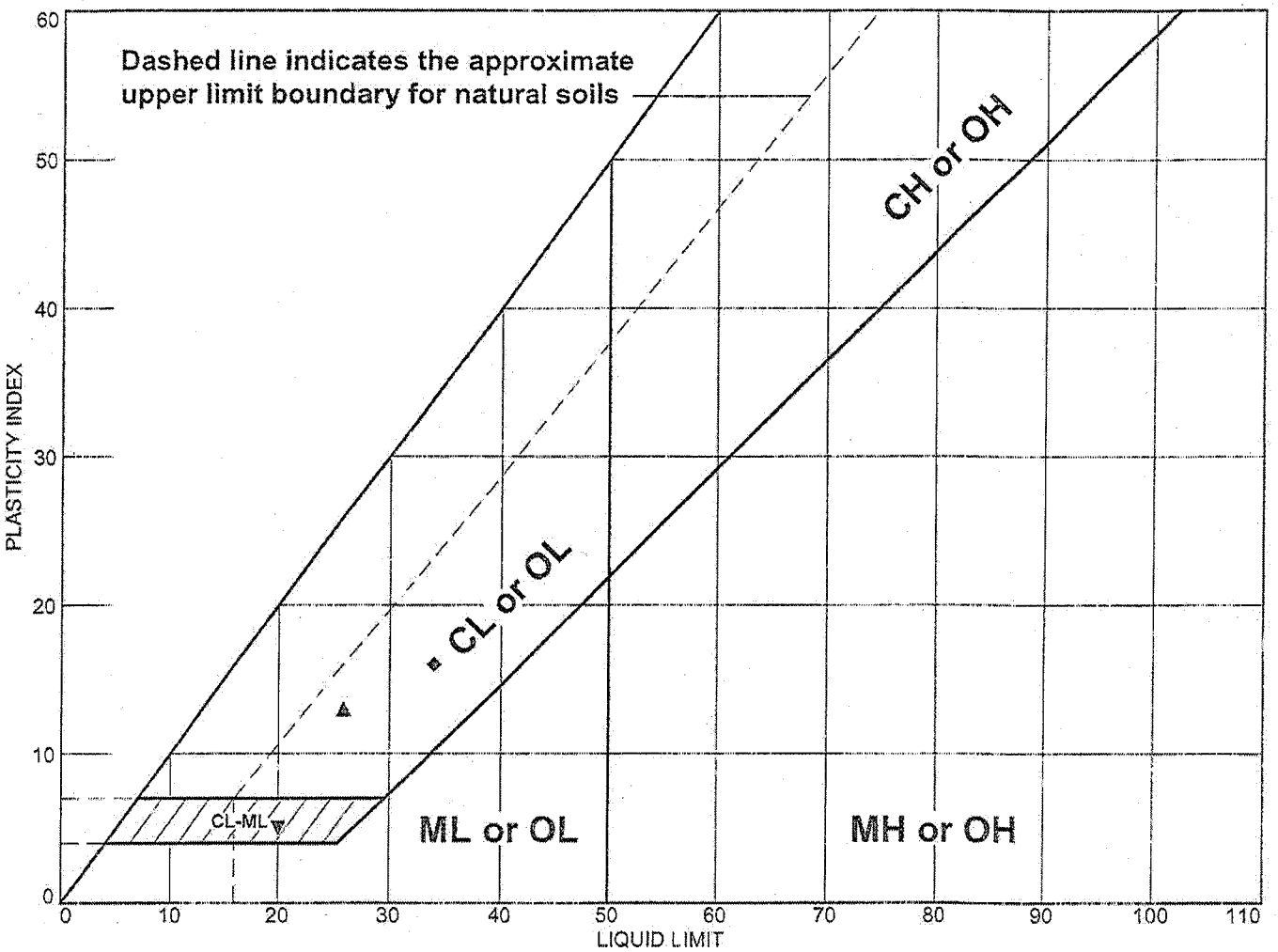
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Poorly Graded Gravel with Silt and Sand	NV	NP	NP	20.2	10.2	GP-GM
■	Well Graded Gravel with Sand	NV	NP	NP	11.1	4.2	GW
▲	Sandy Lean Clay	26	13	13	97.9	60.8	CL
◆	Lean Clay	34	18	16	99.7	90.2	CL
▼	Sandy Silty Clay	20	15	5	99.6	60.2	CL-ML

Project No. 11-35120-01 **Client:** NV Energy

Project: REPLACEMENT WELLS

● **Source of Sample:** BG-1D **Depth:** 19-22
■ **Source of Sample:** BG-1D **Depth:** 40-42
▲ **Source of Sample:** BG-1D **Depth:** 45-48
◆ **Source of Sample:** BG-1D **Depth:** 62-65
▼ **Source of Sample:** BG-1D **Depth:** 99

Remarks:

Converse Consultants

Figure

Total Organic Content Results (ASTM-D2974)

Location	Depth (feet)	Total Organic Content (%)
BG-2D	19-21	1.24
BG-2D	42-44	0.18
BG-2D	59-62	0.28
BG-2D	SM 75	0.07
BG-2D	82-84	0.03

Converse Consultants
731 Pilot Rd. Suite H
Las Vegas, NV 89119

Project: Reid Gardner Replacement Wells
Project No.: 11-35120-01
Assigned By: MDJ / ACD
Date Assigned: 12/30/11

Checked By:
Date Needed: 1/16/12

Page No: 1 of

? USCS symbol not provided on samples

Permeability Tests to be Sent out to AP Engineers

Boring No.	Bulk	Brass Rings	Amount of Sample (inches)	Depth (feet)	Unit Class Symbol	Moisture Content	MC & Unit Weight	Atterberg Limits (L.L. & PI)	Consolidation	Swell	Solubility	Sieve	%>No. 4 & < No. 200	R-Value	D1557	Single-Point Check	~~CBR~~ Permeability	Miller Box Resistivity	Direct Shear (Single Point)	Direct Shear (3 Point)	Unconfined Compressive Strength	NDOT Resistivity	Water Soluble Sodium Sulfate & Solubility	Resistivity Analysis	Corrosivity Analysis	Corrosivity, Resistivity & Sodium Sulfate	Other Tests (pH) Carbon	Instructions / Remarks
B6-20																												Other tests include pH and Total Organic Carbon D2974
	/		19	19-21	?			/				/															/	
		/	6	20.5-21	?																							
		/	6	21-21.5	?												/											
	/		19	42-44	?			/				/															/	
		/	6	43-43.5	?																							
		/	6	43.5-44	?												/											
	/		sm	58	SM							/																extra sample, stanley requested sieve only
	/		19	59-62	CL			/				/															/	
		/	6	61-61.5	CL																							
		/	6	61.5-62	CL												/											
	/		sm	75	SM																							
	/		sm	75	SM			/				/															/	
		/	6	76-76.5	SP												/											
		/	6	76.5-77	SP																							
	/		19	82-84	SM-CL			/				/															/	
		/	6	82.5-83	SM												/											
		/	6	83-83.5	SM																							

SilverState
Analytical Laboratories

LABORATORY REPORT

DATE: January 26, 2012

REPORT NUMBER: 12-0066

CLIENT: Converse Consultants
731 Pilot Road, Suite H
Las Vegas, NV 89119

PAGE: 1 of 1

CLIENT PROJECT: 11-35120-01

CLIENT PO #: 25440

Sampled By: Client
Date Sampled: 01/06/12
Time Sampled: Refer to COC

Submitted by: Client
Date Received: 01/06/12
Time Received: 1135

Report Attention: R. Clark

Sample ID	Parameter	Result	Unit	Method	Date Analyzed	Analyst
BG2 @ 19'-21'	pH	7.81	S.U.	SM4500H+B	01/09/12	SW
BG2 @ 42'-44'	pH	8.48	S.U.	SM4500H+B	01/09/12	SW
BG2 @ 59'-62'	pH	8.63	S.U.	SM4500H+B	01/09/12	SW
BG2 @ SM 75	pH	8.08	S.U.	SM4500H+B	01/09/12	SW
BG2 @ 82'-84'	pH	8.32	S.U.	SM4500H+B	01/09/12	SW

ND: non-detect
EPA Flags: none
Note: TOC subcontracted to Anatek Labs, Inc., Moscow, ID (see attached laboratory report)

REVIEWED BY:

John Sloan
Laboratory Director

3638 East Sunset Road, Suite 100 • Las Vegas, NV 89120 • Tel: 702-873-4478 Fax: 702-873-7967
4587 Longley Lane, No. 2 • Reno, NV 89502 • Tel: 775-825-1127 Fax: 775-825-1167
www.ssalabs.com • www.envirotechonline.com

AP Engineering & Testing, Inc.

CONSTANT HEAD PERMEABILITY TEST

ASTM D2434

Project	Reid Gardner Wells		Tested by	KM	Date 01/11/12
Project No.	11-35120-01		Calculated by	KM	Date 01/12/12
Boring No.	BG-20		Checked by	AP	Date 01/14/12
Sample No.	-	Depth (ft): 21-21.5			
Soil Description	Sand with plastic fines		Max. Size:	N/A	

CONDITION OF SPECIMEN

				Before	After
Diameter	6.13	cm	Container No.		
Sample Area	29.55	cm^2	Wt. Wet Soil+Container(gms)	372.43	533.48
Length	7.62	cm	Wt. Dry Soil+Container(gms)	353.00	474.53
Weight Before	473.57	g	Wt. Container (gms)	50.38	50.18
Wet Density	131.27	pcf	Moisture, (%)	6.42	13.89
Dry Density	123.35	pcf			

Sample Type	Rings	Max. Dry Density (pcf)	N/A
	Mod. Cal.	Optimum Moisture (%)	N/A
		Relative Compaction (%)	N/A

PERMEABILITY DATA

Trial No.	Manometers		Head, h	Outflow	Time	Q/At	h/L	Temp.	k
	H1	H2	cm	Q, ml	sec			°c	cm/sec
1	94.6	15.2	79.4	10	33.8	0.0100	10.4199	20.6	9.61E-04
2	94.6	15.2	79.4	10	34.0	0.0100	10.4199	20.6	9.55E-04
3	94.6	12.1	82.5	10	33.0	0.0103	10.8268	20.6	9.47E-04
4	94.6	12.1	82.5	10	33.2	0.0102	10.8268	20.6	9.41E-04
5	94.6	10.2	84.4	10	32.8	0.0103	11.0761	20.6	9.31E-04
6	94.6	10.2	84.4	10	32.7	0.0103	11.0761	20.6	9.34E-04
7	94.6	8.4	86.2	10	32.5	0.0104	11.3123	20.6	9.20E-04
8	94.6	8.4	86.2	10	32.4	0.0104	11.3123	20.6	9.23E-04
9	94.6	5.5	89.1	10	32.1	0.0105	11.6929	20.6	9.02E-04
10	94.6	5.5	89.1	10	31.9	0.0106	11.6929	20.6	9.07E-04
						Corrected k_{20} (cm/sec) :			9.19E-04

AP Engineering & Testing, Inc.

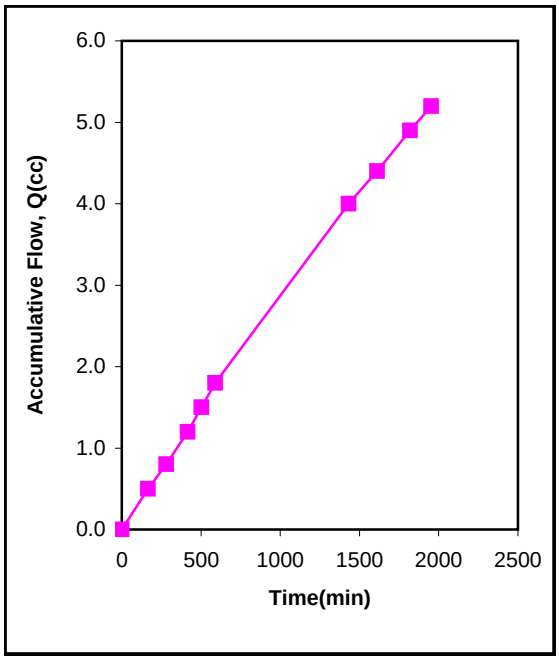
FLEXIBLE WALL HYDRAULIC CONDUCTIVITY TEST
ASTM D 5084

Project Name:	Reid Gardner Wells	Tested by	ST	Date	01/09/12
Project No.:	11-35120-01	Calculated by	KM	Date	01/14/12
Sample Location:	BG-20	Checked by	AP	Date	01/15/12
Sample No.:	- Depth: 43.5-44 feet				
Soil Description:	Silty Clay				
Test Condition:	Mod Cal				
	Confining Pressure = 15 PSI				
Remarks:					

INITIAL CONDITION OF SPECIMEN

				Before	After
Diameter (d)	2.42	in			
Sample Area (A)	4.58	in²			
Length (L)	3.00	in	Container No.		
Weight Before	439.98	g	Wt. Wet Soil+Container(gms)	214.27	593.07
			Wt. Dry Soil+Container(gms)	182.69	497.06
Wet Density	121.96	pcf	Wt. Container (gms)	50.08	148.04
Dry Density	98.50	pcf	Moisture, (%)	23.81	27.51

TEST RESULTS



Time (min)	Flow Rdg (cm)	Burette Factor	Q (cc)	Head, h (psi)	h/L	Q/t (cc/s)
0	44.0	1	0.0	3.0	27.7	0
166	43.5	1	0.5	3.0	27.7	5.02E-05
280	43.2	1	0.8	3.0	27.7	4.39E-05
416	42.8	1	1.2	3.0	27.7	4.90E-05
503	42.5	1	1.5	3.0	27.7	5.75E-05
590	42.2	1	1.8	3.0	27.7	5.75E-05
1431	40.0	1	4.0	3.0	27.7	4.36E-05
1611	39.6	1	4.4	3.0	27.7	3.70E-05
1820	39.1	1	4.9	3.0	27.7	3.99E-05
1952	38.8	1	5.2	3.0	27.7	3.79E-05

Hydraulic Conductivity (cm/sec): 5.28E-08

AP Engineering & Testing, Inc.

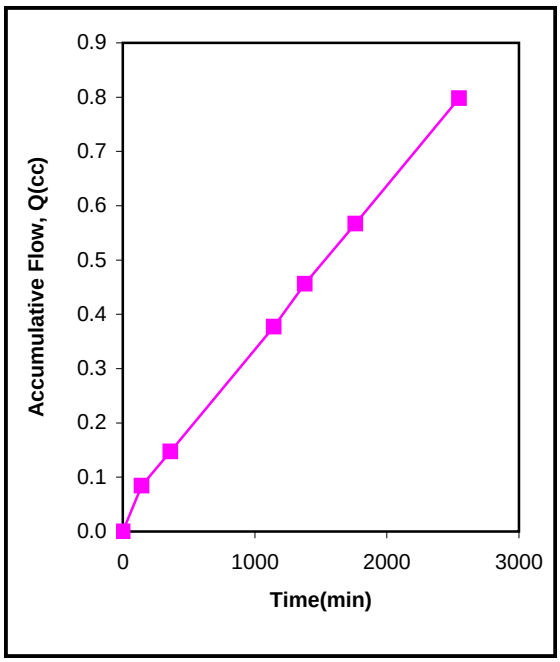
FLEXIBLE WALL HYDRAULIC CONDUCTIVITY TEST
ASTM D 5084

Project Name:	Reid Gardner Wells	Tested by	ST	Date	01/13/12
Project No.:	11-35120-01	Calculated by	KM	Date	01/16/12
Sample Location:	BG-20	Checked by	AP	Date	01/17/12
Sample No.:	- Depth: 61.5-62 feet				
Soil Description:	Clay				
Test Condition:	Mod Cal				
	Confining Pressure = 25 PSI				
Remarks:					

INITIAL CONDITION OF SPECIMEN

				Before	After
Diameter (d)	2.420	in			
Sample Area (A)	4.60	in²			
Length (L)	3.079	in	Container No.		
Weight Before	423.63	g	Wt. Wet Soil+Container(gms)	145.21	585.45
			Wt. Dry Soil+Container(gms)	121.05	458.19
Wet Density	113.94	pcf	Wt. Container (gms)	50.05	149.02
Dry Density	85.01	pcf	Moisture, (%)	34.03	41.16

TEST RESULTS



Time (min)	Flow Rdg (cm)	Burette Factor	Q (cc)	Head, h (psi)	h/L	Q/t (cc/s)
0	46.3	0.082	0.0	3.0	27	0
144	45.3	0.082	0.1	3.0	27	9.72E-06
360	44.5	0.082	0.1	3.0	27	4.91E-06
1143	41.7	0.082	0.4	3.0	27	4.89E-06
1378	40.7	0.082	0.5	3.0	27	5.59E-06
1761	39.4	0.082	0.6	3.0	27	4.83E-06
2546	36.6	0.082	0.8	3.0	27	4.90E-06

Hydraulic Conductivity (cm/sec): 7.25E-09

AP Engineering & Testing, Inc.

CONSTANT HEAD PERMEABILITY TEST

ASTM D2434

Project	Reid Gardner Wells		Tested by	KM	Date 01/11/12
Project No.	11-35120-01		Calculated by	KM	Date 01/12/12
Boring No.	BG-20		Checked by	AP	Date 01/14/12
Sample No.	-	Depth (ft): 76-76.5			
Soil Description	Fine Sand		Max. Size:	N/A	

CONDITION OF SPECIMEN

				Before	After
Diameter	6.13	cm	Container No.		
Sample Area	29.55	cm^2	Wt. Wet Soil+Container(gms)	205.97	496.54
Length	7.62	cm	Wt. Dry Soil+Container(gms)	181.57	414.10
Weight Before	476.38	g	Wt. Container (gms)	50.25	50.22
Wet Density	132.04	pcf	Moisture, (%)	18.58	22.66
Dry Density	111.35	pcf			

		Max. Dry Density (pcf)	N/A
Sample Type	Rings	Optimum Moisture (%)	N/A
	Mod. Cal.	Relative Compaction (%)	N/A

PERMEABILITY DATA

Trial No.	Manometers		Head, h	Outflow	Time	Q/At	h/L	Temp.	k
	H1	H2	cm	Q, ml	sec			°c	cm/sec
1	25.9	15.1	10.8	10	33.8	0.0100	1.4173	20.6	7.06E-03
2	25.9	15.1	10.8	10	34.0	0.0100	1.4173	20.6	7.02E-03
3	25.9	13.9	12.0	10	33.0	0.0103	1.5748	20.6	6.51E-03
4	25.9	13.9	12.0	10	33.2	0.0102	1.5748	20.6	6.47E-03
5	25.9	11.5	14.4	10	32.8	0.0103	1.8898	20.6	5.46E-03
6	25.9	11.5	14.4	10	32.7	0.0103	1.8898	20.6	5.48E-03
7	25.9	10.3	15.6	10	32.5	0.0104	2.0472	20.6	5.09E-03
8	25.9	10.3	15.6	10	32.4	0.0104	2.0472	20.6	5.10E-03
Corrected k_{20} (cm/sec) :									5.94E-03

AP Engineering & Testing, Inc.

CONSTANT HEAD PERMEABILITY TEST

ASTM D2434

Project	Reid Gardner Wells		Tested by	KM	Date 01/11/12
Project No.	11-35120-01		Calculated by	KM	Date 01/12/12
Boring No.	BG-20		Checked by	AP	Date 01/14/12
Sample No.	-	Depth (ft): 82.5-83			
Soil Description	Fine Sand		Max. Size:	N/A	

CONDITION OF SPECIMEN

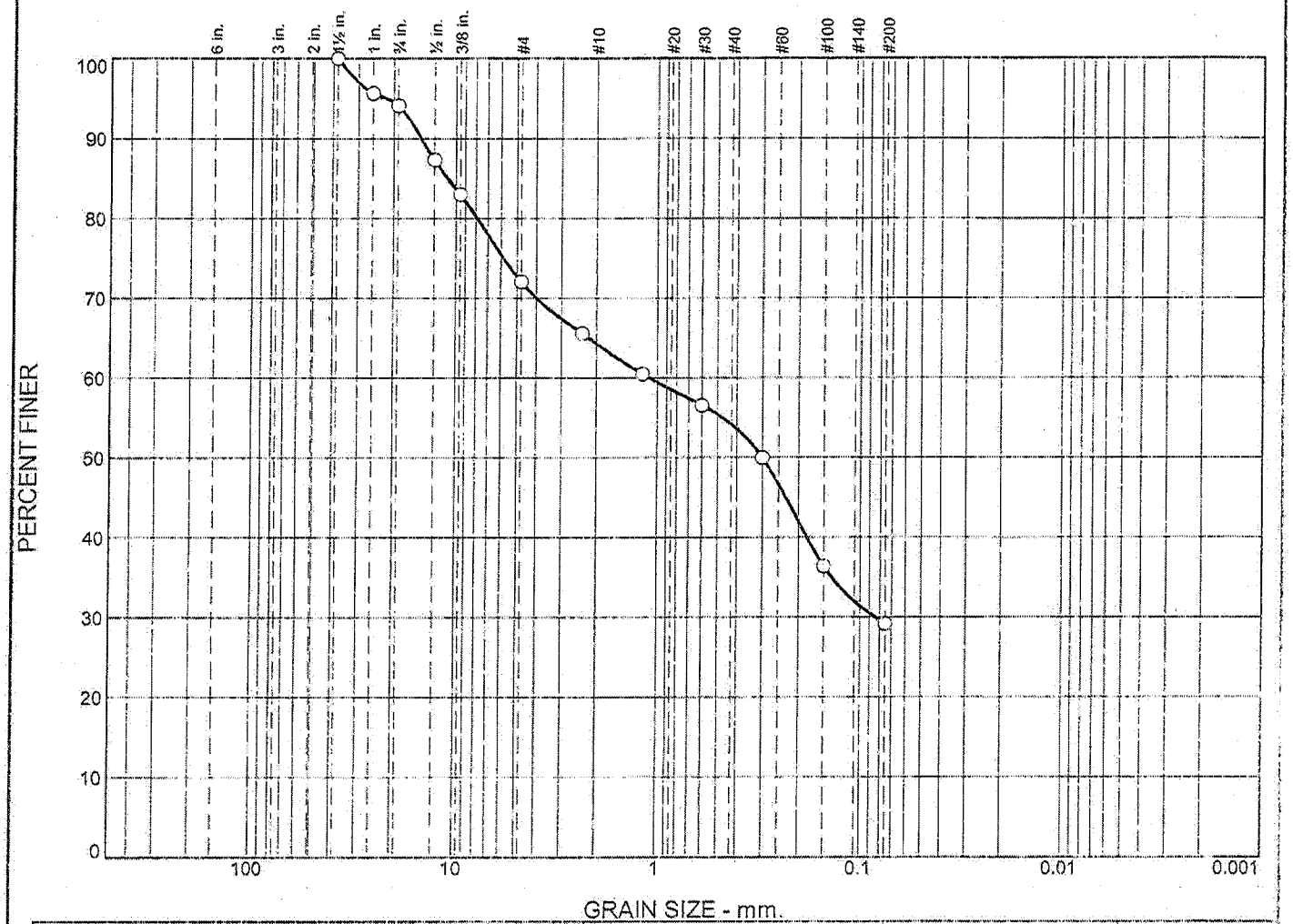
				Before	After
Diameter	6.13	cm	Container No.		
Sample Area	29.55	cm^2	Wt. Wet Soil+Container(gms)	322.06	399.94
Length	7.62	cm	Wt. Dry Soil+Container(gms)	274.45	324.09
Weight Before	476.00	g	Wt. Container (gms)	50.08	49.92
Wet Density	131.94	pcf	Moisture, (%)	21.22	27.67
Dry Density	108.84	pcf			

		Max. Dry Density (pcf)	N/A
Sample Type	Rings	Optimum Moisture (%)	N/A
	Mod. Cal.	Relative Compaction (%)	N/A

PERMEABILITY DATA

Trial No.	Manometers		Head, h	Outflow	Time	Q/At	h/L	Temp.	k
	H1	H2	cm	Q, ml	sec			°c	cm/sec
1	22.0	15.8	6.2	100	59.7	0.0567	0.8136	20.6	6.97E-02
2	22.0	15.8	6.2	100	59.3	0.0571	0.8136	20.6	7.01E-02
3	22.0	14.8	7.2	100	44.3	0.0764	0.9449	20.6	8.08E-02
4	22.0	14.8	7.2	100	44.4	0.0762	0.9449	20.6	8.07E-02
5	22.0	13.8	8.2	100	36.3	0.0932	1.0761	20.6	8.66E-02
6	22.0	13.8	8.2	100	36.5	0.0927	1.0761	20.6	8.62E-02
7	22.0	12.8	9.2	100	28.7	0.1179	1.2073	20.6	9.77E-02
8	22.0	12.8	9.2	100	28.7	0.1179	1.2073	20.6	9.77E-02
9	22.0	11.0	11.0	100	24.6	0.1376	1.4436	20.6	9.53E-02
10	22.0	11.0	11.0	100	25.0	0.1354	1.4436	20.6	9.38E-02
						Corrected k_{20} (cm/sec) :			8.46E-02

Particle Size Distribution Report



	% +3"	% Gravel	% Sand	% Silt	% Clay
○	0.0	28.0	42.9	29.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	10.9699	1.1006	0.3008	0.0845				

Material Description	USCS	AASHTO
○ Silty Sand with Gravel	SM	A-2-4(0)

Project No. 11-35120-01 **Client:** NV Energy
Project: REPLACEMENT WELLS

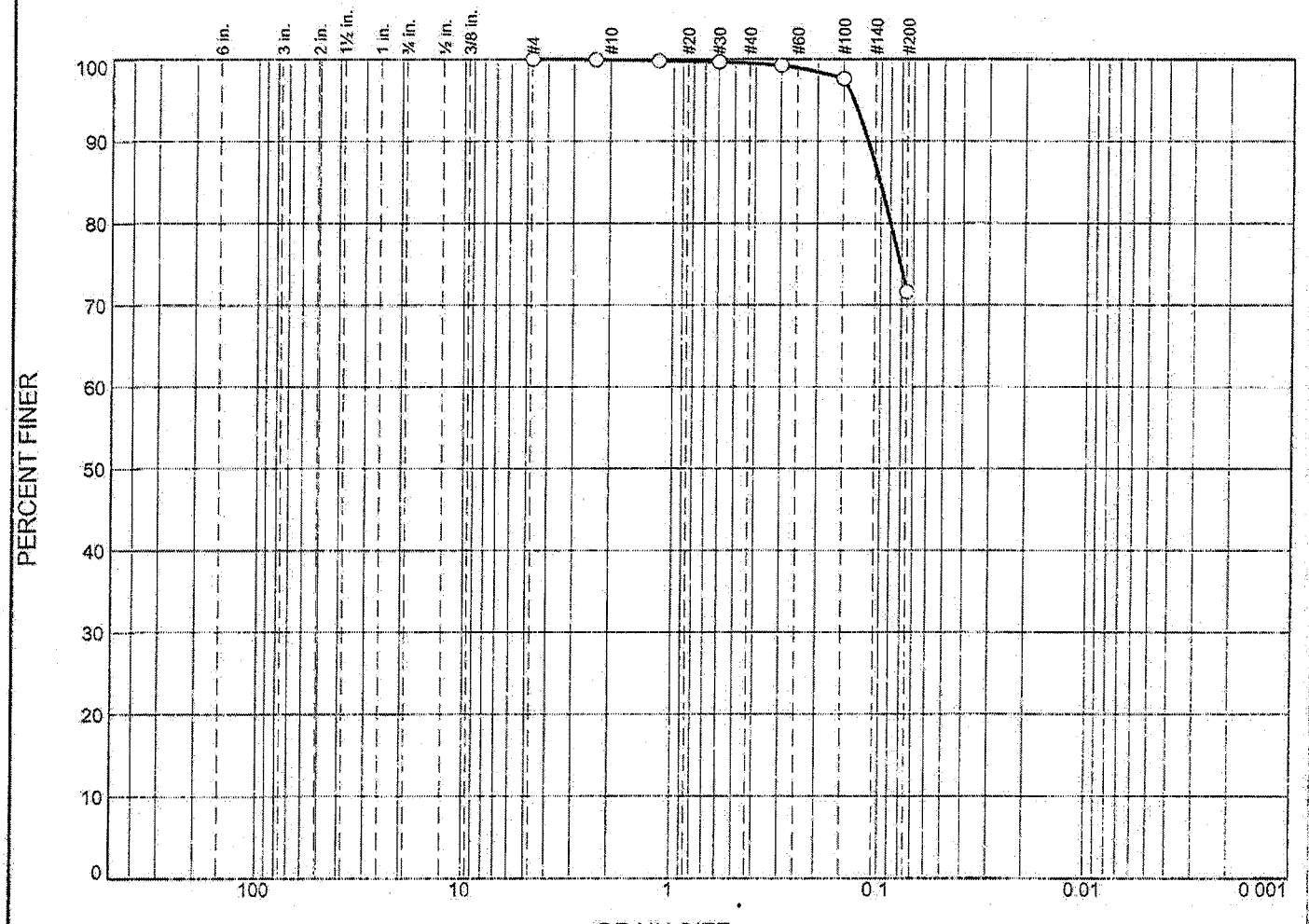
○ **Source of Sample:** BG-20 **Depth:** 19-21

Remarks:

Converse Consultants

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand	% Silt	% Clay
○	0.0	0.0	28.4	71.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	33	20	0.1010							

Material Description	USCS	AASHTO
○ Lean Clay with Sand	CL	A-6(8)

Project No. 11-35120-01 **Client:** NV Energy
Project: REPLACEMENT WELLS

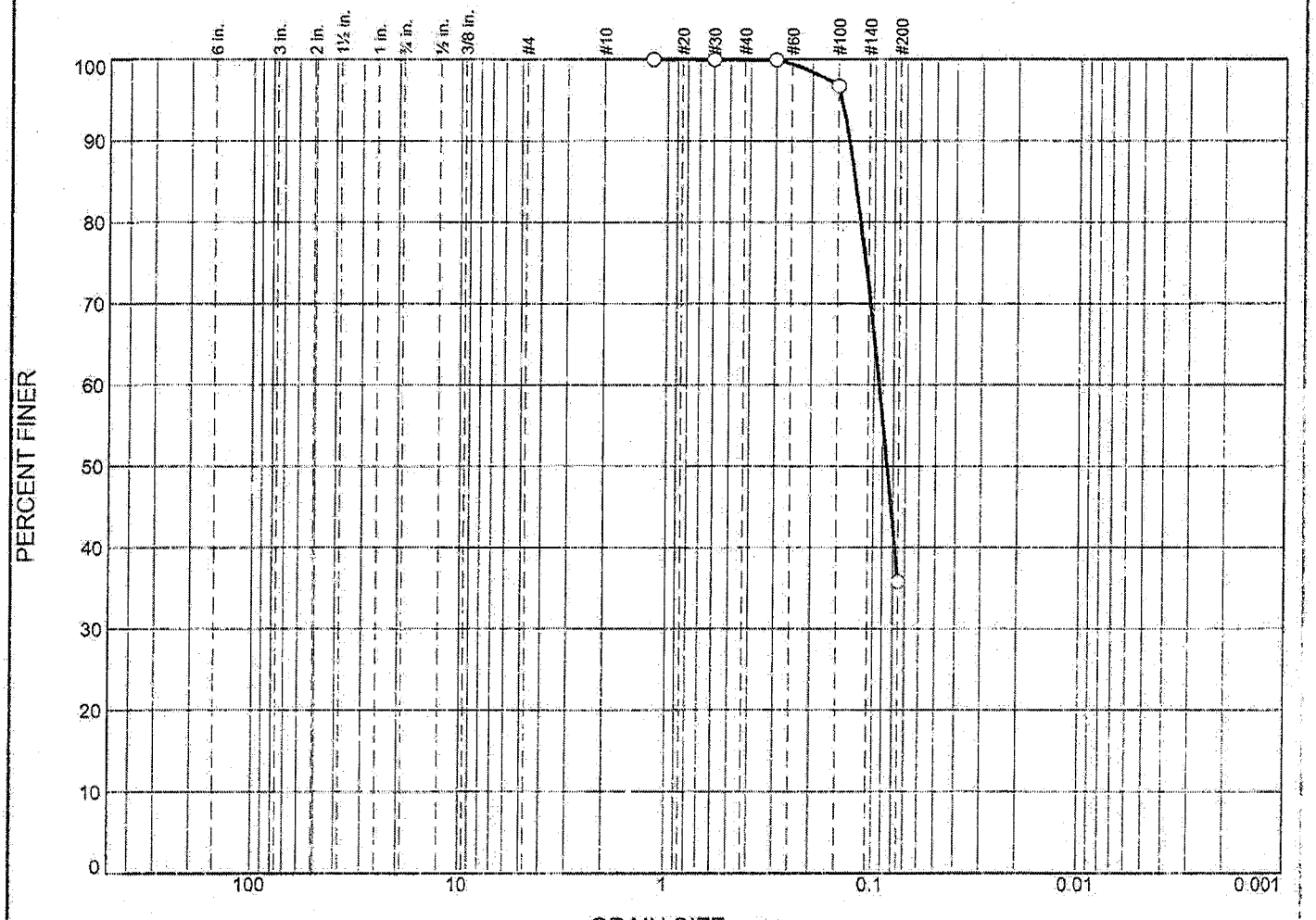
○ **Source of Sample:** BG-20 **Depth:** 42-44

Remarks:

Converse Consultants

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand	% Silt	% Clay
○	0.0	0.0	64.2	35.8	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○		NV	NP	0.1237	0.0939	0.0855					

Material Description	USCS	AASHTO
○ Silty Sand	SM	A-4(0)

Project No. 11-35120-01 **Client:** NV Energy

Project: REPLACEMENT WELLS

○ **Source of Sample:** BG-20 **Depth:** 58

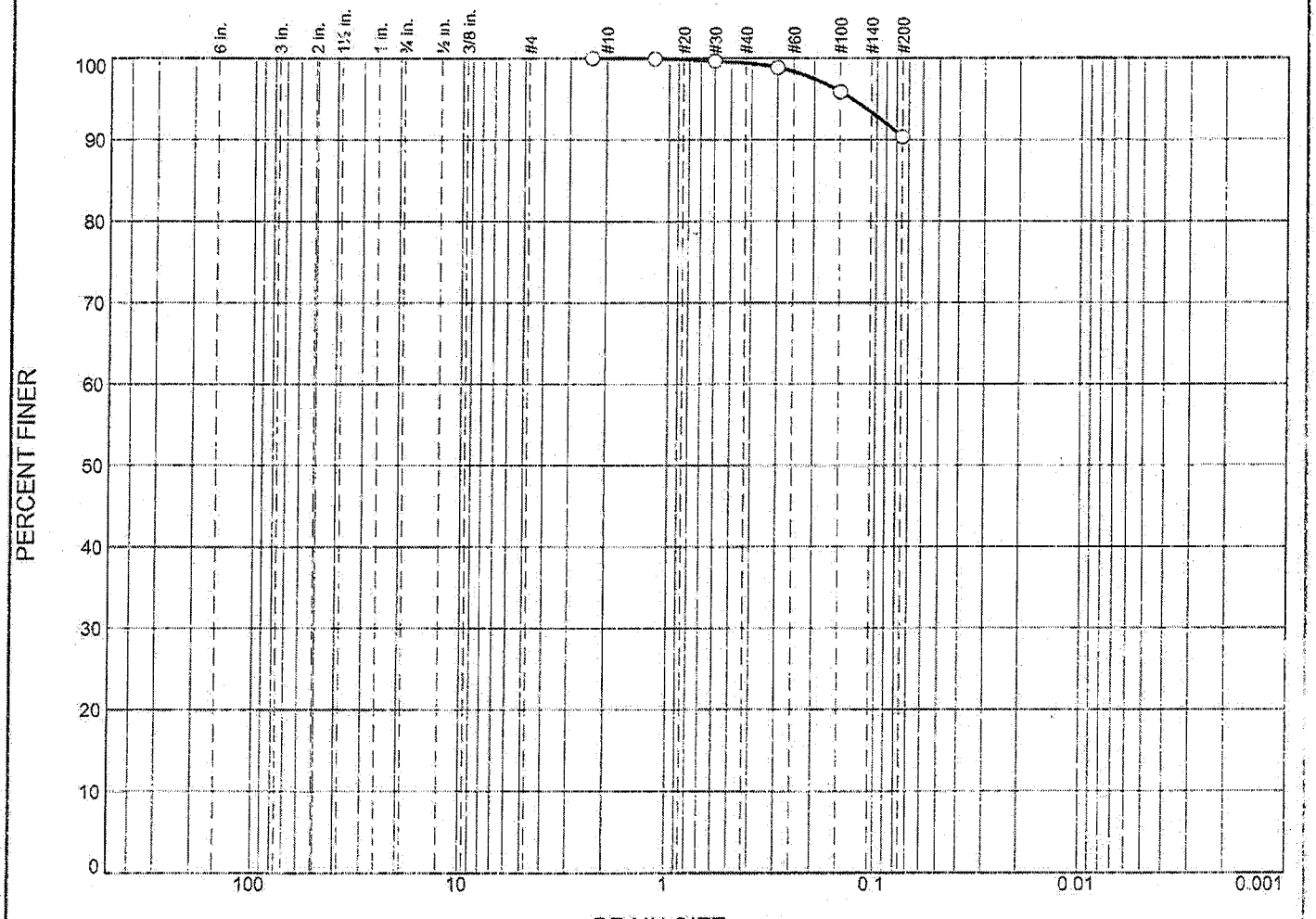
Date: ○

Remarks:

Converse Consultants

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand	% Silt	% Clay
○	0.0	0.0	9.6	90.4	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○		100	29								

Material Description	USCS	AASHTO
○ Fat Clay	CH	A-7-6(73)

Project No. 11-35120-01 **Client:** NV Energy

Project: REPLACEMENT WELLS

○ **Source of Sample:** BG-20 **Depth:** 59-62

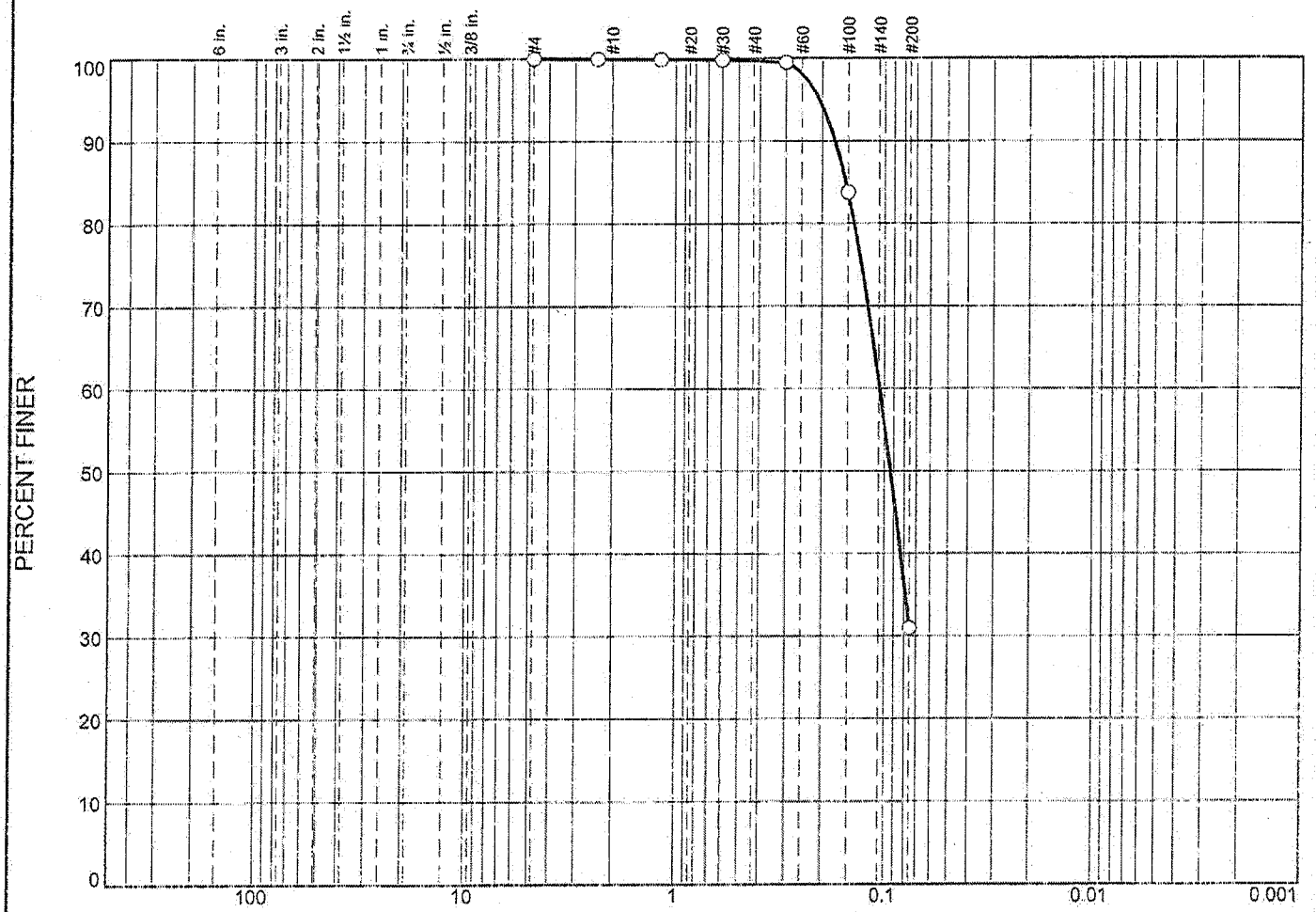
Date: ○

Remarks:

Converse Consultants

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand	% Silt	% Clay
○	0.0	0.0	69.1	30.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.1538	0.1052	0.0932					

Material Description	USCS	AASHTO
○ Silty Sand	SM	A-2-4(0)

Project No. 11-35120-01 **Client:** NV Energy

Project: REPLACEMENT WELLS

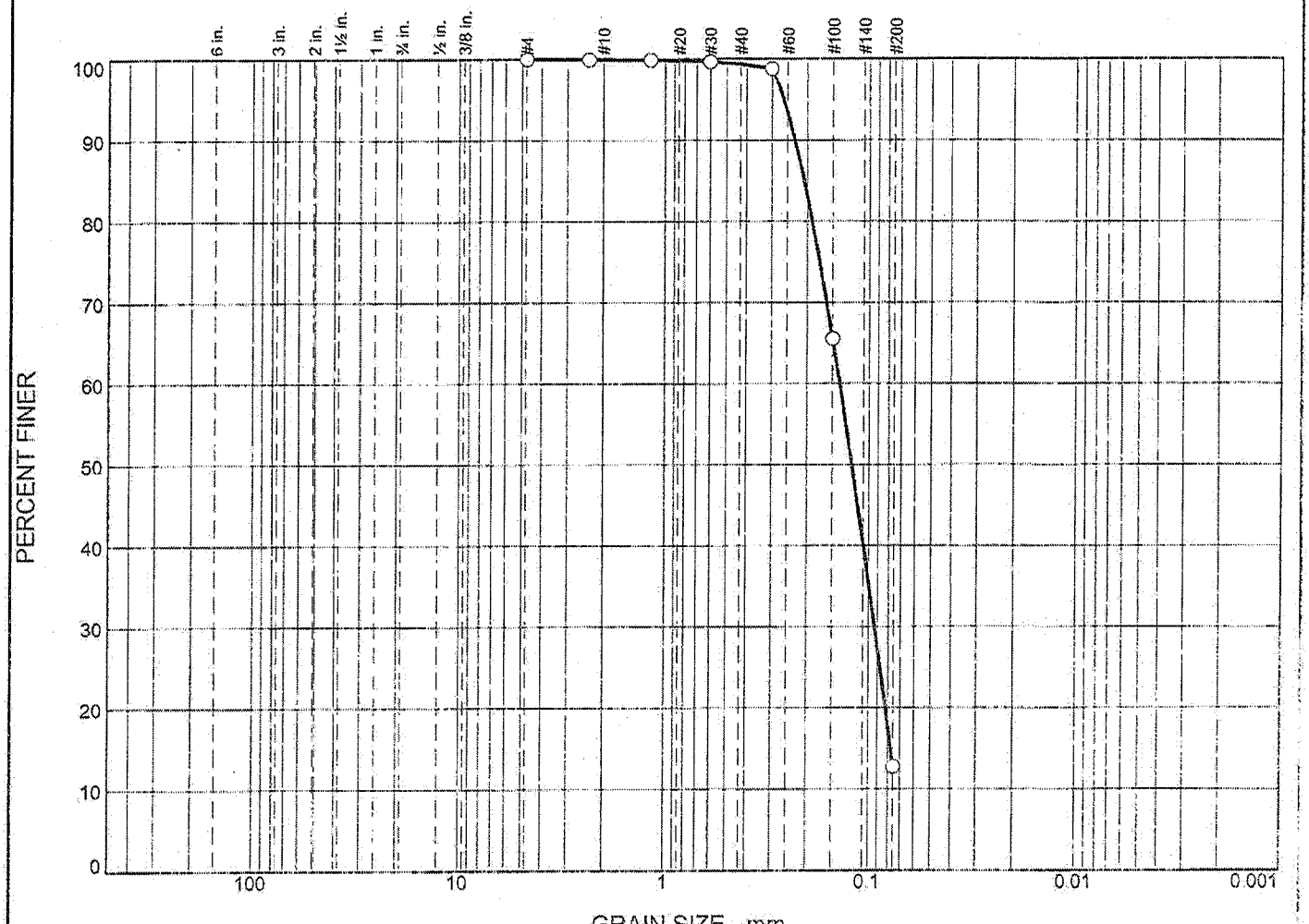
○ **Source of Sample:** BG-20 **Depth:** 75

Remarks:

Converse Consultants

Figure

Particle Size Distribution Report



	% +3"	% Gravel	% Sand	% Silt	% Clay
○	0.0	0.0	87.3	12.7	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○		NV	NP	0.2073	0.1386	0.1207	0.0931	0.0772			

Material Description	USCS	AASHTO
○ Silty Sand	SM	A-2-4(0)

Project No. 11-35120-01 **Client:** NV Energy

Project: REPLACEMENT WELLS

○ **Source of Sample:** BG-20 **Depth:** 82-84

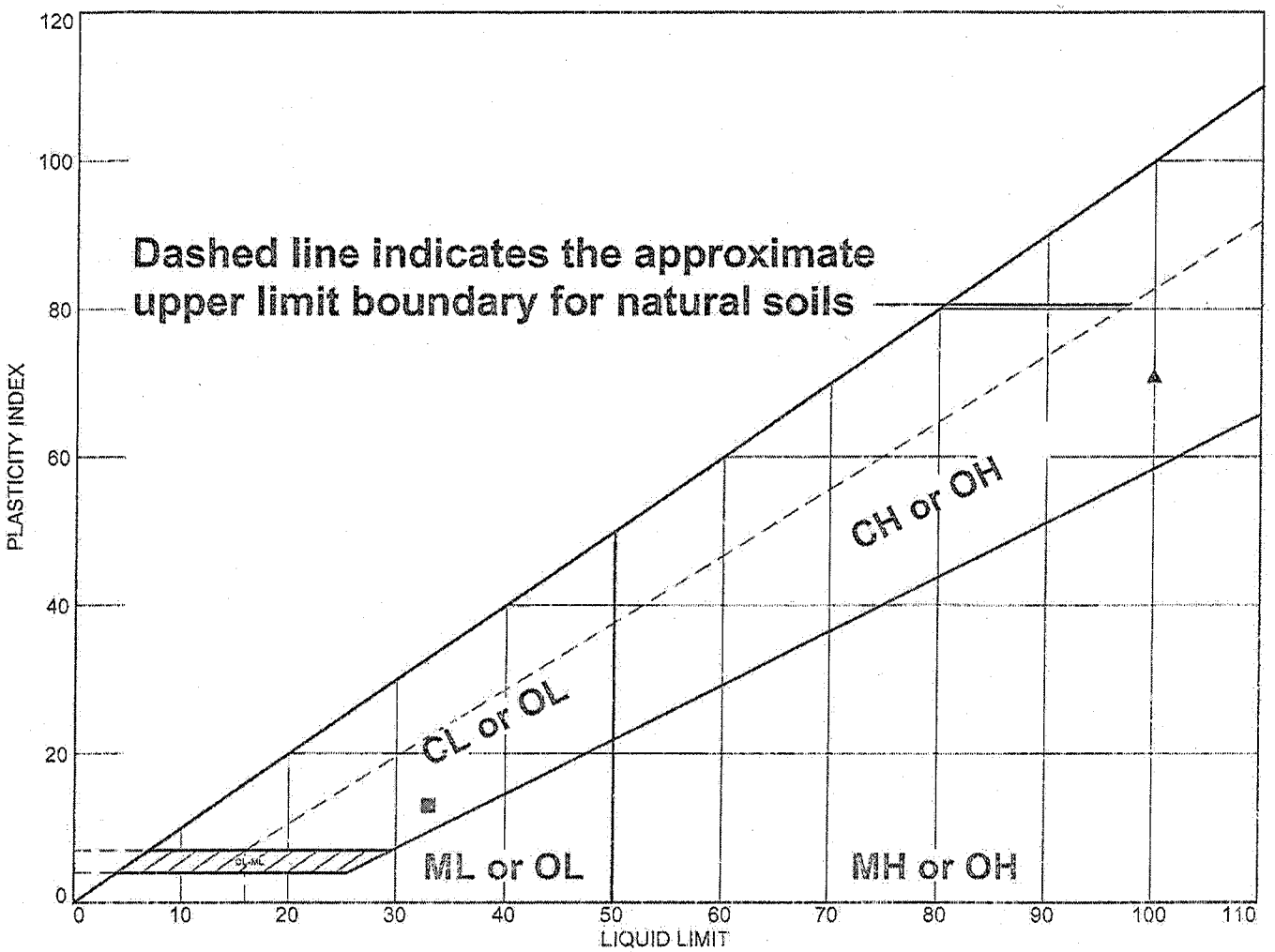
Date: ○

Remarks:

Converse Consultants

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Silty Sand with Gravel	NV	NP	NP	54.1	29.1	SM
■	Lean Clay with Sand	33	20	13	99	72	CL
▲	Fat Clay	100	29	71	99	90	CH
◆	Silty Sand	NV	NP	NP	100	31	SM
▼	Silty Sand	NV	NP	NP	99	13	SM

Project No. 11-35120-01 **Client:** NV Energy

Project: REPLACEMENT WELLS

● **Source of Sample:** BG-20 **Depth:** 19-21
■ **Source of Sample:** BG-20 **Depth:** 42-44
▲ **Source of Sample:** BG-20 **Depth:** 59-62
◆ **Source of Sample:** BG-20 **Depth:** 75
▼ **Source of Sample:** BG-20 **Depth:** 82-84

Remarks:

Converse Consultants

Figure

Location	Depth (feet)	Total Organic Content (%)
BG-3D	40-42	0.4
BG-3D	58-60	0.3
BG-3D	80-82	0.3
BG-3D	100-102	0.5
BG-3D	120-122	0.9
BG-3D	142.5-144.5	0.1

Converse Consultants
731 Pilot Rd. Suite H
Las Vegas, NV 89119

Project: Reid Gardner Replacement Wells
Project No.: 11-35120-01
Assigned By: MDJ/ACD
Date Assigned: 2/27/12
Checked By:
Date Needed: 3/15/12

Permeability Tests to be sent to AP Engineers
Other Tests include: pH + Total Organic Carbon D2974

Boring No.	Bulk	Brass Rings	Amount of Sample (inches)	Depth (feet)	Unit Class. Symbol	Moisture Content	MC & Unit Weight	Atterberg Limits (LL & PI)	Consolidation	Swell	Solubility	Sieve	%>No. 4 & < No. 200	R-Value	D1557	Single-Point Check	~~CBR~~ Permeability	Miller Box Resistivity	Direct Shear (Single Point)	Direct Shear (3 Point)	Unconfined Compressive Strength	NDOT Resistivity	Water Soluble Sodium Sulfate & Solubility	Resistivity Analysis	Corrosivity Analysis	Corrosivity, Resistivity & Sodium Sulfate	Other Tests pH, Carbon	Instructions / Remarks
B6-3D																												
	/		1g	40-42	CL SM			/				/															/	
		/	6	40.5-41	CL-SM												/											
		/	6	41-41.5	CL-SM																							
	/		1g	58-60	SM			/				/															/	
		/	6	60-60.5	SM												/											
	/		1g	80-82	SM			/				/															/	
		/	6	80-80.5	SM												/											
		/	6	80.5-81	SM																							
	/		1g	100-102	SM			/				/															/	
		/	6	100.5-101	SM												/											
		/	6	101-101.5	SM																							
	/		1g	120-122	SM			/				/															/	
		/	6	120.5-121	SP												/											
		/	6	121-121.5	SM																							
	/		1g	142.5-144	SM			/				/															/	- sample arrived 2-28-12
		/	6	143-143.5	SM												/											

SilverState
Analytical Laboratories

LABORATORY REPORT

DATE: March 06, 2012

REPORT NUMBER: 12-0908

CLIENT: Converse Consultants
731 Pilot Road, Suite H
Las Vegas, NV 89119

PAGE: 1 of 1

CLIENT PROJECT: 11-35120-01
Reid Gardner Replacement Wells

CLIENT PO #: 25489

Sampled By: Client
Date Sampled: --
Time Sampled: --

Submitted by: Client
Date Received: 03/05/12
Time Received: 1545

Report Attention:

Sample ID	Parameter	Result	Unit	Method	Date Analyzed	Analyst
BG3D @ 40-42'	pH	8.31	S.U.	SM4500H+B	03/06/12	SW
BG3D @ 58-60'	pH	8.95	S.U.	SM4500H+B	03/06/12	SW
BG3D @ 80-82'	pH	8.46	S.U.	SM4500H+B	03/06/12	SW
BG3D @ 100-102'	pH	8.68	S.U.	SM4500H+B	03/06/12	SW
BG3D @ 120-122'	pH	8.68	S.U.	SM4500H+B	03/06/12	SW
BG3D @ 142.5-144.5'	pH	8.85	S.U.	SM4500H+B	03/06/12	SW

NOTES: The results for each constituent denote the percentage (%) for that particular element which is soluble in a 1:5 (soil to water) extraction ratio and corrected for dilution.

REVIEWED BY:

John Sloan
Laboratory Director

3638 East Sunset Road, Suite 100 Las Vegas, NV 89120
Tel: 702-873-4478 Fax: 702-873-7967 www.ssalabs.com

AP Engineering & Testing, Inc.

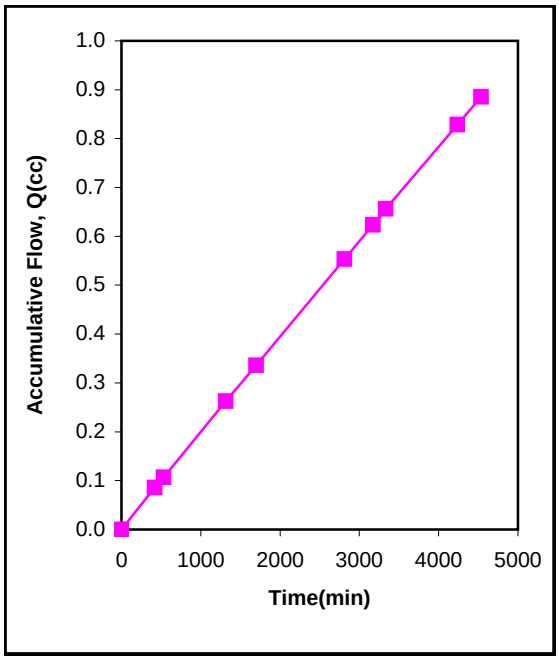
FLEXIBLE WALL HYDRAULIC CONDUCTIVITY TEST
ASTM D 5084

Project Name:	Reid Gardner Wells	Tested by	ST	Date	03/09/12
Project No.:	11-35120-01	Calculated by	KM	Date	03/22/12
Boring No.:	BG-3D	Checked by	AP	Date	03/23/12
Sample No.:	- Depth (ft.): 40.5-41				
Soil Description:	Lean Clay				
Test Condition:	Mod Cal				
	Confining Pressure = 34 PSI				
Remarks:					

INITIAL CONDITION OF SPECIMEN

				Before	After
Diameter (d)	2.41	in			
Sample Area (A)	4.56	in²			
Length (L)	3.02	in	Container No.		
Weight Before	454.30	g	Wt. Wet Soil+Container(gms)	128.81	612.66
			Wt. Dry Soil+Container(gms)	114.74	517.54
Wet Density	125.53	pcf	Wt. Container (gms)	49.54	148.1
Dry Density	103.25	pcf	Moisture, (%)	21.58	25.75

TEST RESULTS



Time (min)	Flow Rdg (cm)	Burette Factor	Q (cc)	Head, h (psi)	h/L	Q/t (cc/s)
0	48.8	0.082	0.0	5.0	45.8	0
420	47.8	0.082	0.1	5.0	45.8	3.42E-06
533	47.5	0.082	0.1	5.0	45.8	3.02E-06
1314	45.6	0.082	0.3	5.0	45.8	3.32E-06
1699	44.7	0.082	0.3	5.0	45.8	3.19E-06
2811	42.1	0.082	0.6	5.0	45.8	3.26E-06
3170	41.2	0.082	0.6	5.0	45.8	3.24E-06
3334	40.8	0.082	0.7	5.0	45.8	3.33E-06
4239	38.7	0.082	0.8	5.0	45.8	3.17E-06
4535	38.0	0.082	0.9	5.0	45.8	3.23E-06

Hydraulic Conductivity (cm/sec): 2.41E-09

AP Engineering & Testing, Inc.

CONSTANT HEAD PERMEABILITY TEST

ASTM D2434

Project	Reid Gardner Wells		Tested by	KM	Date 03/06/12
Project No.	11-35120-01		Calculated by	KM	Date 03/22/12
Boring No.	BG-3D		Checked by	AP	Date 03/24/12
Sample No.	-	Depth (ft): 60-60.5			
Soil Description	Fine Sand w/silt		Max. Size:	N/A	

CONDITION OF SPECIMEN

				Before	After
Diameter	6.13	cm	Container No.		
Sample Area	29.55	cm^2	Wt. Wet Soil+Container(gms)	250.61	358.85
Length	7.62	cm	Wt. Dry Soil+Container(gms)	243.78	315.66
Weight Before	380.15	g	Wt. Container (gms)	50.17	150.90
Wet Density	105.37	pcf	Moisture, (%)	3.53	26.21
Dry Density	101.78	pcf			

Sample Type	Rings	Max. Dry Density (pcf)	N/A
	Mod. Cal.	Optimum Moisture (%)	N/A
		Relative Compaction (%)	N/A

PERMEABILITY DATA

Trial No.	Manometers		Head, h	Outflow	Time	Q/At	h/L	Temp.	k
	H1	H2	cm	Q, ml	sec			°c	cm/sec
1	43.7	20.2	23.5	25	139.8	0.0061	3.0840	18.3	1.96E-03
2	43.7	20.2	23.5	25	139.1	0.0061	3.0840	18.3	1.97E-03
3	43.7	18.3	25.4	25	114.7	0.0074	3.3333	18.3	2.21E-03
4	43.7	18.3	25.4	25	115.4	0.0073	3.3333	18.3	2.20E-03
5	43.7	16.3	27.4	25	106.5	0.0079	3.5958	18.3	2.21E-03
6	43.7	16.3	27.4	25	105.8	0.0080	3.5958	18.3	2.22E-03
7	43.7	14.2	29.5	25	98.5	0.0086	3.8714	18.3	2.22E-03
8	43.7	14.2	29.5	25	98.5	0.0086	3.8714	18.3	2.22E-03
9	43.7	12.2	31.5	25	91.1	0.0093	4.1339	18.3	2.25E-03
10	43.7	12.2	31.5	25	91.0	0.0093	4.1339	18.3	2.25E-03
						Corrected k_{20} (cm/sec) :			2.27E-03

AP Engineering & Testing, Inc.

CONSTANT HEAD PERMEABILITY TEST

ASTM D2434

Project	Reid Gardner Wells		Tested by	KM	Date 03/07/12
Project No.	11-35120-01		Calculated by	KM	Date 03/22/12
Boring No.	BG-3D		Checked by	AP	Date 03/24/12
Sample No.	-	Depth (ft): 80-80.5			
Soil Description	Fine Sand w/silt		Max. Size:	N/A	

CONDITION OF SPECIMEN

				Before	After
Diameter	6.13	cm	Container No.		
Sample Area	29.55	cm^2	Wt. Wet Soil+Container(gms)	192.38	788.11
Length	7.62	cm	Wt. Dry Soil+Container(gms)	164.18	685.05
Weight Before	469.66	g	Wt. Container (gms)	48.10	149.83
Wet Density	130.18	pcf	Moisture, (%)	24.29	19.26
Dry Density	104.74	pcf			

Sample Type	Rings	Max. Dry Density (pcf)	N/A
	Mod. Cal.	Optimum Moisture (%)	N/A
		Relative Compaction (%)	N/A

PERMEABILITY DATA

Trial No.	Manometers		Head, h	Outflow	Time	Q/At	h/L	Temp.	k
	H1	H2	cm	Q, ml	sec			°c	cm/sec
1	97.2	14.2	83.0	10	361.2	0.0009	10.8924	21	8.60E-05
2	97.2	14.2	83.0	10	361.8	0.0009	10.8924	21	8.59E-05
3	97.2	13.7	83.5	10	270.7	0.0013	10.9580	21	1.14E-04
4	97.2	13.7	83.5	10	270.3	0.0013	10.9580	21	1.14E-04
5	97.2	13.1	84.1	10	237.7	0.0014	11.0367	21	1.29E-04
6	97.2	13.1	84.1	10	238.1	0.0014	11.0367	21	1.29E-04
7	97.2	8.5	88.7	10	212.6	0.0016	11.6404	21	1.37E-04
8	97.2	8.5	88.7	10	212.7	0.0016	11.6404	21	1.37E-04
9	97.2	7.2	90.0	10	187.2	0.0018	11.8110	21	1.53E-04
10	97.2	7.2	90.0	10	187.5	0.0018	11.8110	21	1.53E-04
Corrected k_{20} (cm/sec) :									1.21E-04

AP Engineering & Testing, Inc.

CONSTANT HEAD PERMEABILITY TEST

ASTM D2434

Project	Reid Gardner Wells		Tested by	KM	Date 03/07/12
Project No.	11-35120-01		Calculated by	KM	Date 03/22/12
Boring No.	BG-3D		Checked by	AP	Date 03/24/12
Sample No.	-	Depth (ft): 100.5-101			
Soil Description	Fine Sand w/silt		Max. Size:	N/A	

CONDITION OF SPECIMEN

				Before	After
Diameter	6.13	cm	Container No.		
Sample Area	29.55	cm^2	Wt. Wet Soil+Container(gms)	178.74	614.86
Length	7.62	cm	Wt. Dry Soil+Container(gms)	159.35	550.21
Weight Before	464.54	g	Wt. Container (gms)	50.15	148.56
Wet Density	128.76	pcf	Moisture, (%)	17.76	16.10
Dry Density	109.35	pcf			

Sample Type	Rings	Max. Dry Density (pcf)	N/A
	Mod. Cal.	Optimum Moisture (%)	N/A
		Relative Compaction (%)	N/A

PERMEABILITY DATA

Trial No.	Manometers		Head, h	Outflow	Time	Q/At	h/L	Temp.	k
	H1	H2	cm	Q, ml	sec			°c	cm/sec
1	63.7	17.4	46.3	10	819.1	0.0004	6.0761	23	6.80E-05
2	63.7	16.3	47.4	10	802.7	0.0004	6.2205	23	6.78E-05
3	63.7	14.2	49.5	10	783.3	0.0004	6.4961	23	6.65E-05
4	63.7	12.2	51.5	10	777.2	0.0004	6.7585	23	6.44E-05
5	63.7	10.4	53.3	10	772.2	0.0004	6.9948	23	6.26E-05
Corrected k_{20} (cm/sec) :									6.13E-05

AP Engineering & Testing, Inc.

CONSTANT HEAD PERMEABILITY TEST

ASTM D2434

Project	Reid Gardner Wells		Tested by	KM	Date 03/08/12
Project No.	11-35120-01		Calculated by	KM	Date 03/22/12
Boring No.	BG-3D		Checked by	AP	Date 03/24/12
Sample No.	-	Depth (ft): 120.5-121			
Soil Description	Fine Sand w/silt		Max. Size:	N/A	

CONDITION OF SPECIMEN

				Before	After
Diameter	6.13	cm	Container No.		
Sample Area	29.55	cm^2	Wt. Wet Soil+Container(gms)	243.83	629.95
Length	7.62	cm	Wt. Dry Soil+Container(gms)	210.96	552.52
Weight Before	481.53	g	Wt. Container (gms)	49.88	150.28
Wet Density	133.47	pcf	Moisture, (%)	20.41	19.25
Dry Density	110.85	pcf			

Sample Type	Rings	Max. Dry Density (pcf)	N/A
	Mod. Cal.	Optimum Moisture (%)	N/A
		Relative Compaction (%)	N/A

PERMEABILITY DATA

Trial No.	Manometers		Head, h	Outflow	Time	Q/At	h/L	Temp.	k
	H1	H2	cm	Q, ml	sec			°c	cm/sec
1	96.7	11.0	85.7	2	1212.7	0.0001	11.2467	18.2	4.96E-06
2	96.7	9.0	87.7	2	1153.2	0.0001	11.5092	18.2	5.10E-06
3	96.7	7.7	89.0	2	1055.4	0.0001	11.6798	18.2	5.49E-06
4	96.7	6.5	90.2	2.1	1103.2	0.0001	11.8373	18.2	5.44E-06
5	96.7	5.3	91.4	2	984.2	0.0001	11.9948	18.2	5.73E-06
6	96.7	3.3	93.4	2	919.4	0.0001	12.2572	18.2	6.01E-06
7	96.7	1.3	95.4	2	862.4	0.0001	12.5197	18.2	6.27E-06
Corrected k_{20} (cm/sec) :									5.83E-06

AP Engineering & Testing, Inc.

CONSTANT HEAD PERMEABILITY TEST

ASTM D2434

Project	Reid Gardner Wells		Tested by	KM	Date 03/20/12
Project No.	11-35120-01		Calculated by	KM	Date 03/22/12
Boring No.	BG-3D		Checked by	AP	Date 03/24/12
Sample No.	-	Depth (ft): 143-143.5			
Soil Description	Fine Sand w/silt		Max. Size:	N/A	

CONDITION OF SPECIMEN

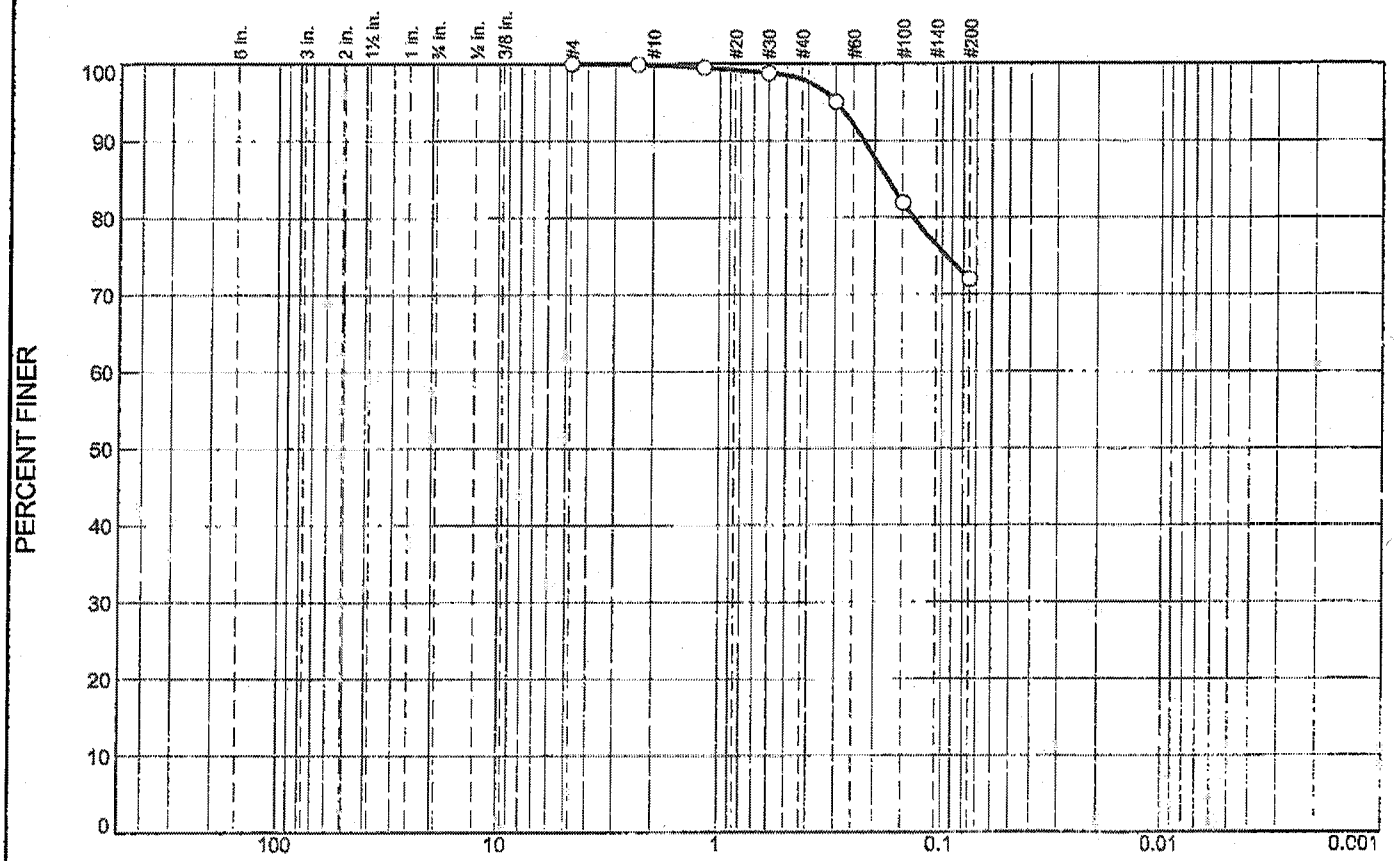
				Before	After
Diameter	6.13	cm	Container No.		
Sample Area	29.55	cm^2	Wt. Wet Soil+Container(gms)	244.66	602.23
Length	7.62	cm	Wt. Dry Soil+Container(gms)	212.91	516.12
Weight Before	458.44	g	Wt. Container (gms)	50.20	149.62
Wet Density	127.07	pcf	Moisture, (%)	19.51	23.50
Dry Density	106.32	pcf			

Sample Type	Rings	Max. Dry Density (pcf)	N/A
	Mod. Cal.	Optimum Moisture (%)	N/A
		Relative Compaction (%)	N/A

PERMEABILITY DATA

Trial No.	Manometers		Head, h	Outflow	Time	Q/At	h/L	Temp.	k
	H1	H2	cm	Q, ml	sec			°c	cm/sec
1	96.7	15.3	81.4	3.2	12464.0	0.0000	10.6824	17.3	8.13E-07
2	96.7	11.2	85.5	2.6	9756.0	0.0000	11.2205	17.3	8.04E-07
3	96.7	9.0	87.7	13	49651.0	0.0000	11.5092	17.3	7.70E-07
4	96.7	6.0	90.7	2.2	8074.0	0.0000	11.9029	17.3	7.75E-07
Corrected k_{20} (cm/sec) :									8.46E-07

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.0	28.0	72.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	99.9		
#16	99.5		
#30	98.8		
#50	95.0		
#100	81.9		
#200	72.0		

* (no specification provided)

Material Description

Lean Clay with Sand

Atterberg Limits

PL= 17 LL= 41 PI= 24

Coefficients

D_{90}= 0.2236 D_{85}= 0.1754 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(16)

Remarks

Source of Sample: BG-3D **Depth:** 40-42

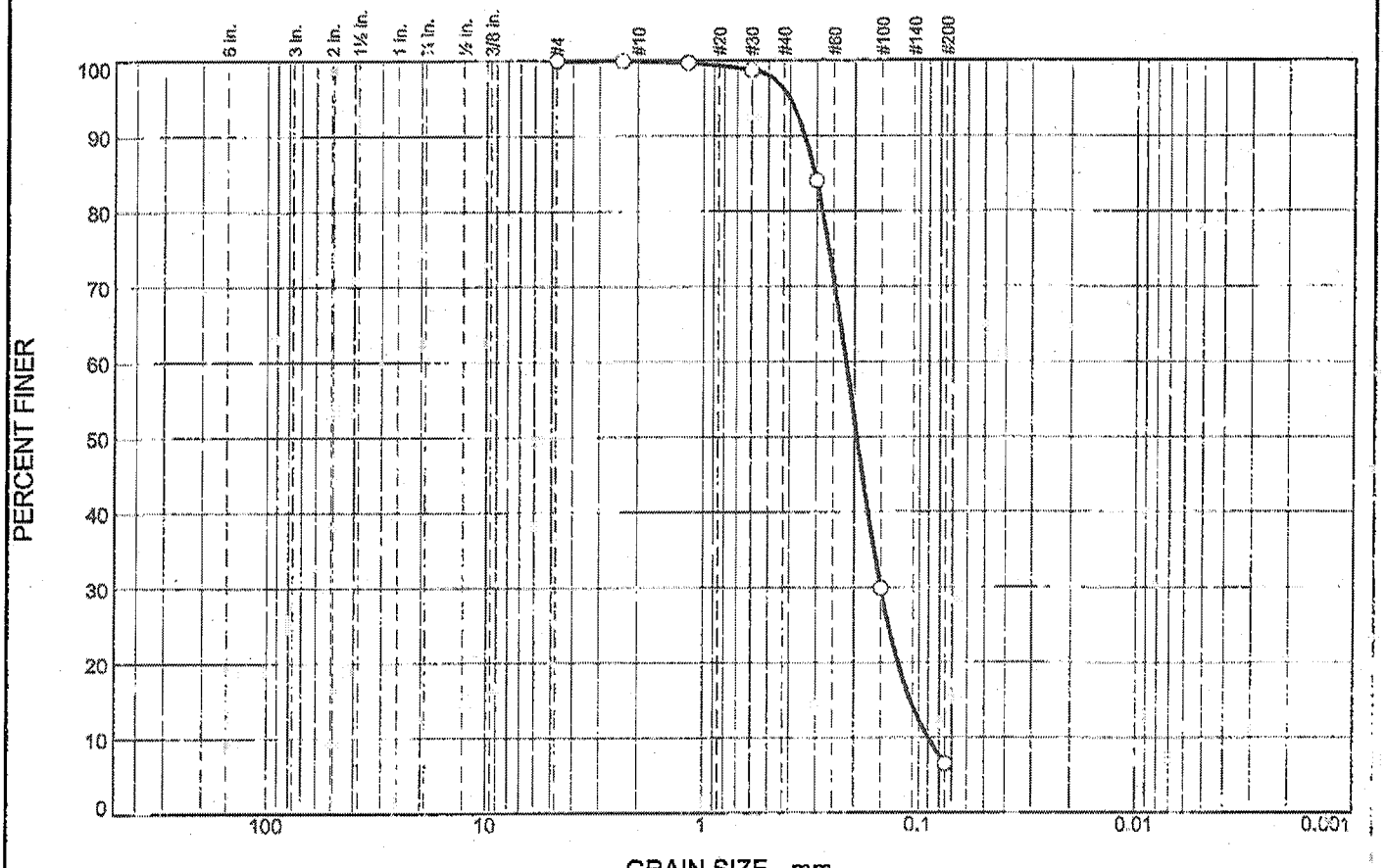
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.0	93.5	6.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	100.0		
#16	99.7		
#30	98.7		
#50	84.0		
#100	29.9		
#200	6.5		

* (no specification provided)

Material Description

Poorly Graded Sand with Silt

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.3391 D_{85}= 0.3051 D_{60}= 0.2181
D_{50}= 0.1943 D_{30}= 0.1503 D_{15}= 0.1091
D_{10}= 0.0900 C_u= 2.42 C_c= 1.15

Classification

USCS= SP-SM AASHTO= A-3

Remarks

Source of Sample: BG-3D **Depth:** 58-60

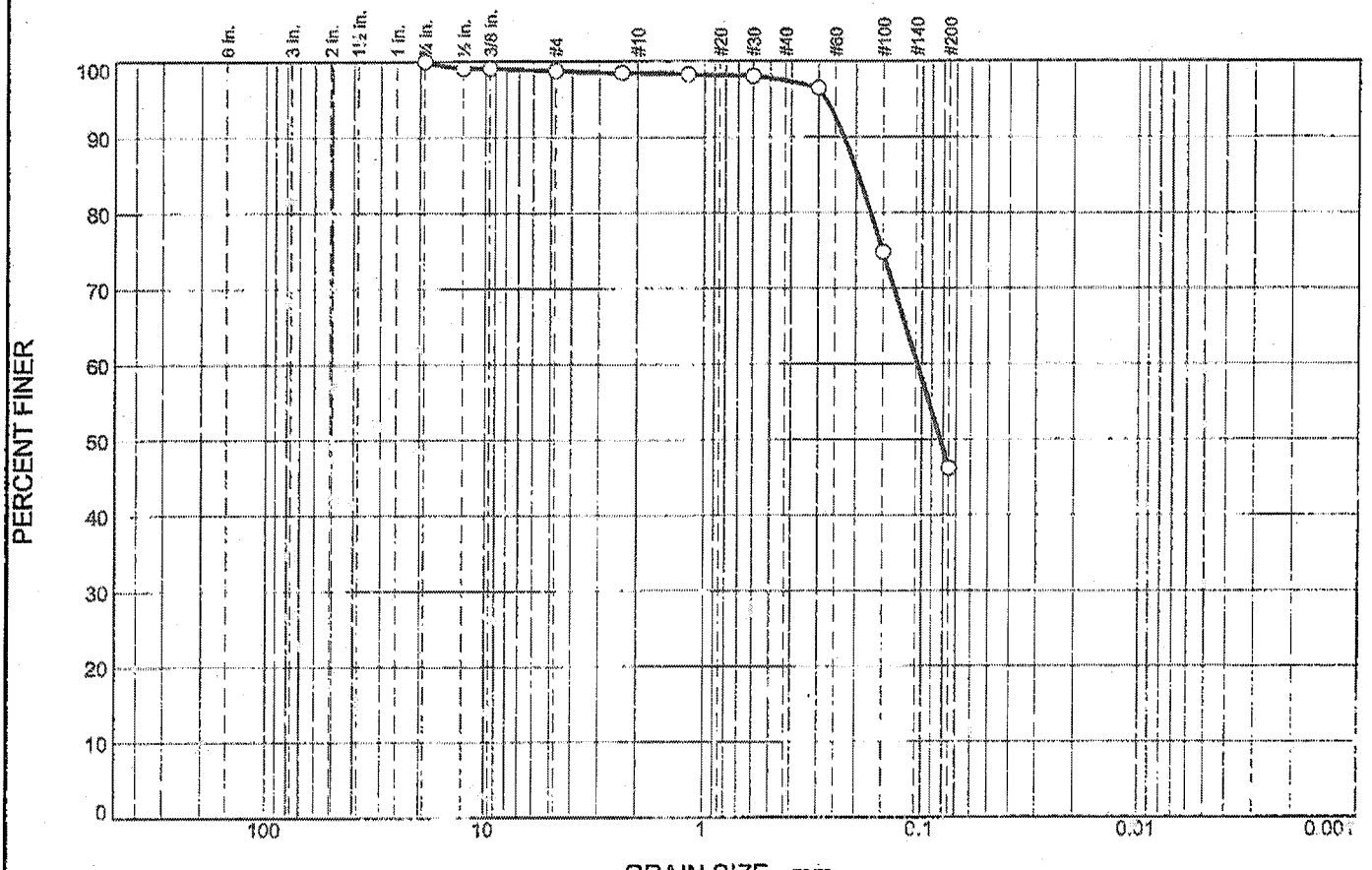
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	1.2	52.6	46.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	99.1		
3/8"	99.1		
#4	98.8		
#8	98.5		
#16	98.2		
#30	98.1		
#50	96.5		
#100	74.8		
#200	46.2		

* (no specification provided)

Material Description

Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.2279 D_{85}= 0.1958 D_{60}= 0.1044
D_{50}= 0.0822 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Source of Sample: BG-3D **Depth:** 80-82

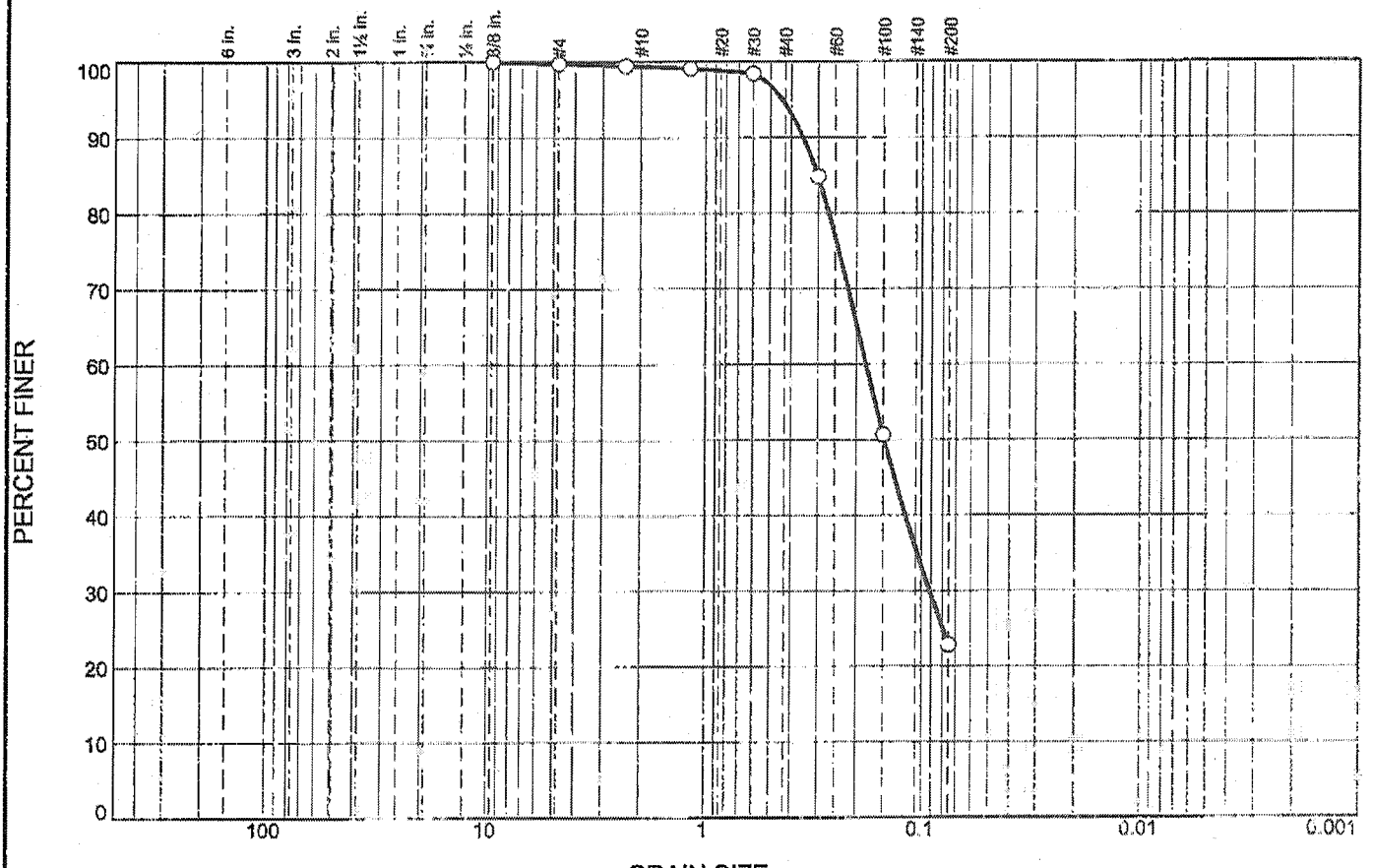
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.3	76.9	22.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	99.7		
#8	99.4		
#16	99.1		
#30	98.4		
#50	84.8		
#100	50.6		
#200	22.8		

* (no specification provided)

Material Description

Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.3513 D_{85}= 0.3017 D_{60}= 0.1802
D_{50}= 0.1480 D_{30}= 0.0914 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Source of Sample: BG-3D **Depth:** 100-102

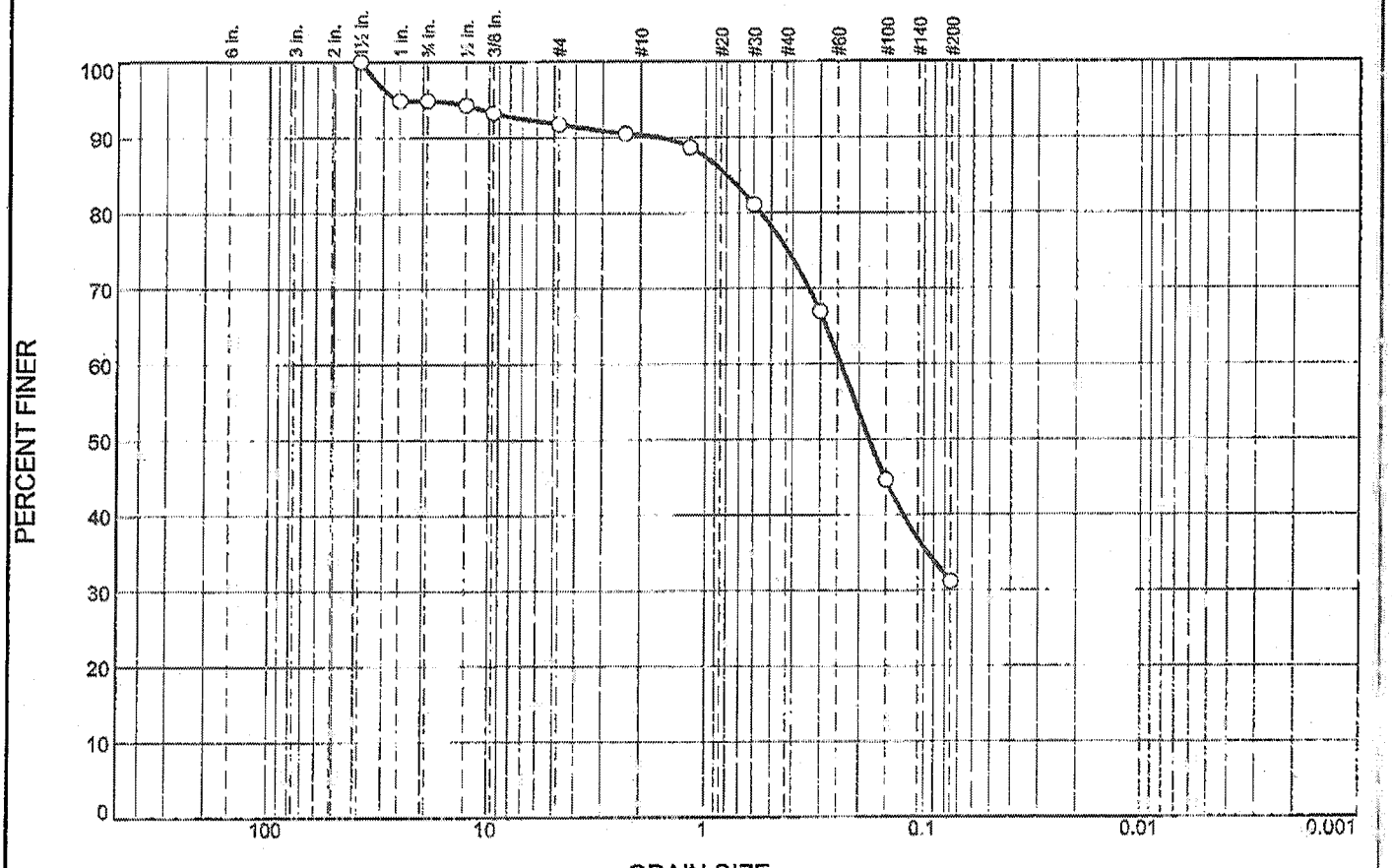
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	8.3	60.6	31.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1-1/2"	100.0		
1"	94.9		
3/4"	94.9		
1/2"	94.2		
3/8"	93.2		
#4	91.7		
#8	90.5		
#16	88.7		
#30	81.1		
#50	66.9		
#100	44.6		
#200	31.1		

* (no specification provided)

Material Description

Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 1.6509 D_{85}= 0.8004 D_{60}= 0.2409
D_{50}= 0.1792 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Source of Sample: BG-3D **Depth:** 120-122

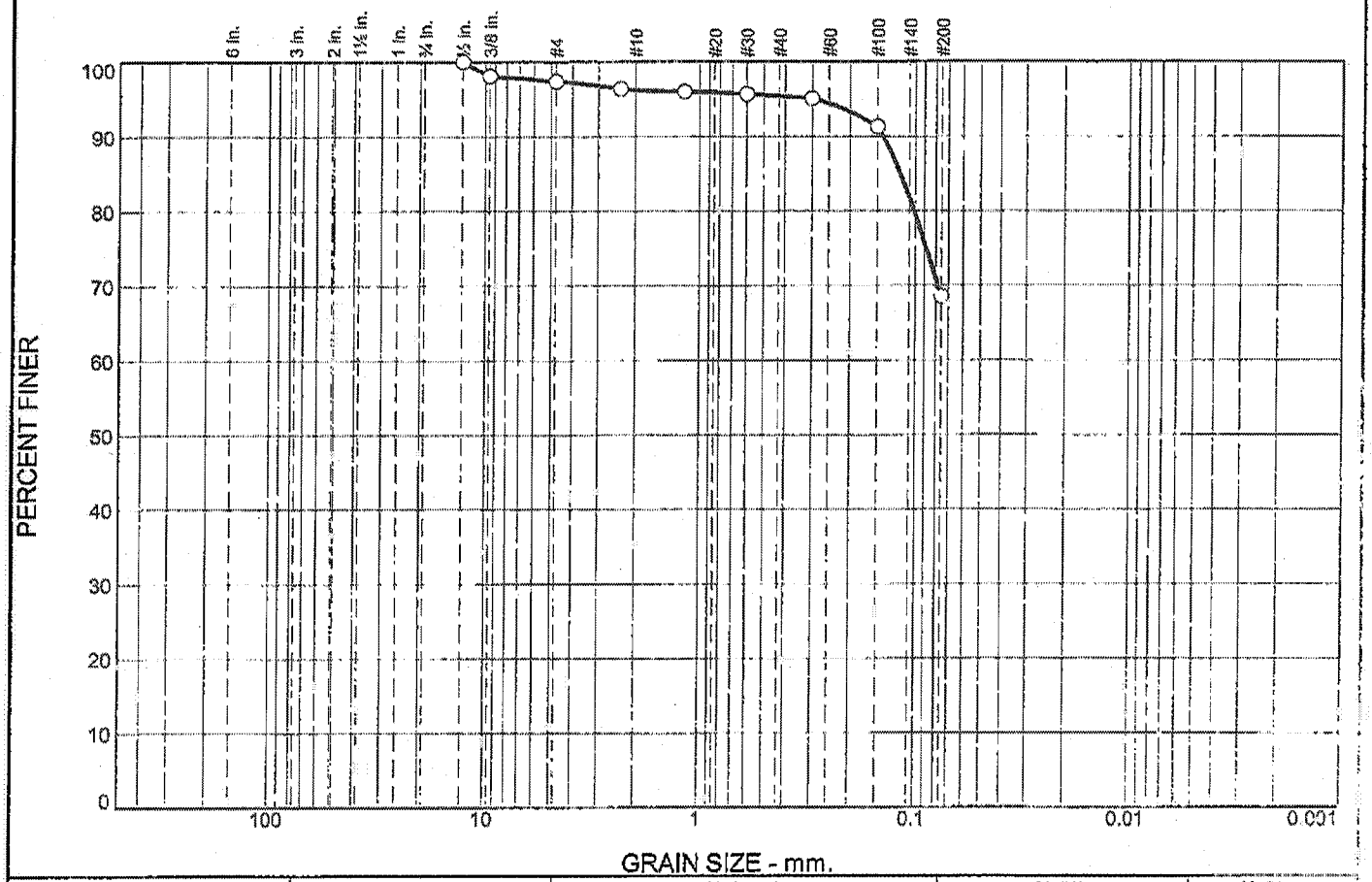
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	2.6	28.9	68.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	98.1		
#4	97.4		
#8	96.4		
#16	96.0		
#30	95.6		
#50	95.1		
#100	91.3		
#200	68.5		

* (no specification provided)

Material Description

Sandy Silt

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.1410 D_{85}= 0.1172 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Source of Sample: BG-3D **Depth:** 142.5-144.5

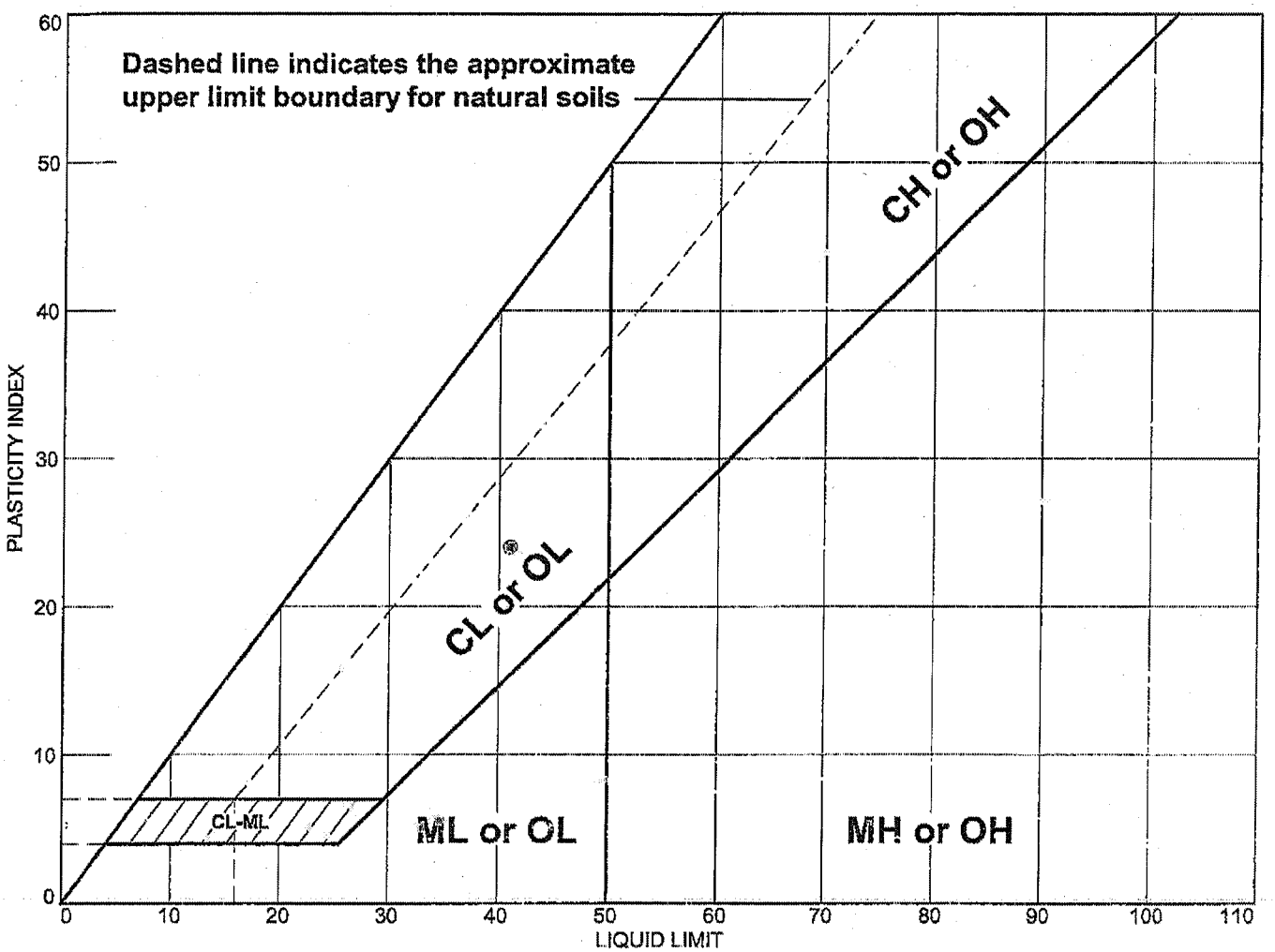
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay with Sand	41	17	24	98.0	72.0	CL
■	Poorly Graded Sand with Silt	NV	NP	NP	96.2	6.5	SP-SM
▲	Silty Sand	NV	NP	NP	97.4	46.2	SM
◆	Silty Sand	NV	NP	NP	94.4	22.8	SM
▼	Silty Sand	NV	NP	NP	75.2	31.1	SM

Project No. 11-35120-01 **Client:** NV Energy

Project: REPLACEMENT WELLS

● **Source of Sample:** BG-3D **Depth:** 40-42
■ **Source of Sample:** BG-3D **Depth:** 58-60
▲ **Source of Sample:** BG-3D **Depth:** 80-82
◆ **Source of Sample:** BG-3D **Depth:** 100-102
▼ **Source of Sample:** BG-3D **Depth:** 120-122

Remarks:

Converse Consultants

Figure

Total Organic Content Results (ASTM-D2974)

Location	Depth (feet)	Total Organic Content (%)
BG-4D	20-22	1.0
BG-4D	40-42	2.4
BG-4D	60-62	1.1
BG-4D	80-82	1.6
BG-4D	100-102	0.7
BG-4D	120-122	0.9
BG-4D	140-142	1.5
BG-4D	160-162	1.3

Converse Consultants
731 Pilot Rd. Suite H
Las Vegas, NV 89119

Project: Reid Gardner Replacement Well
Project No.: 11-35120-011

Assigned By: MDJ/ACD
Date Assigned: 1/20/12

Checked By:
Date Needed: 1/31/12

Page No: 3 of

Permeability tests to be sent to AP Engineers

Other tests include pH + Total Organic Carbon D2974

Boring No	Bulk	Brass Rings	Amount of Sample (inches)	Depth (feet)	Unit Class. Symbol	Moisture Content	MC & Unit Weight	Atterberg Limits (LL & PI)	Consolidation	Swell	Solubility	Sieve	%>No. 4 & < No. 200	R-Value	D1557	Single-Point Check	CBR-Permeability	Miller Box Resistivity	Direct Shear (Single Point)	Direct Shear (3 Point)	Unconfined Compressive Strength	NDOT Resistivity	Water Soluble Sodium Sulfate & Solubility	Resistivity Analysis	Corrosivity Analysis	Corrosivity, Resistivity & Sodium Sulfate	Other Tests pH Carbon	Instructions / Remarks
B5-4D																												
	/		19	20-22	CH-SM			/				/															/	
		/	6	20.5-21	CH-SM												/											
		/	6	21-21.5	CH-SM																							
	/		19	40-42	CH			/				/															/	
		/	6	40.5-41	CH												/											
		/	6	41-41.5	CH																							
	/		SM	60-62	SM			/				/															/	↕ combine samples for 1 set
	/		SM	60-62	SM			/				/															/	
		/	6	60-60.5	SM												/											only 6 rings (split sample to send to AP)
	/		19	80-82	CH			/				/															/	
		/	6	80.5-81	CH												/											
		/	6	81-81.5	CH																							
	/		19	100-102	CH			/				/															/	
		/	6	101-101.5	SM												/											
		/	6	101.5-102	SM																							
	/		19	120-122	SM-CL			/				/															/	
		/	6	120.5-121	SM-CL												/											
		/	6	121-121.5	SM																							

(continued on next page)

Converse Consultants
731 Pilot Rd. Suite H
Las Vegas, NV 89119

Project: Reid Gardner Replacement Wells
Project No.: 11-35120-01

Assigned By: MDJ/ACD
Date Assigned: 2/27/12

Checked By:
Date Needed: 2/6/12

Page No: 4 of

Boring No. (Continued)	Bulk	Brass Rings	Amount of Sample (inches)	Depth (feet)	Unit Class. Symbol	Moisture Content	MC & Unit Weight	Atterberg Limits (L.L. & PI)	Consolidation	Swell	Solubility	Sieve	%>No. 4 & < No. 200	R-Value	D1557	Single-Point Check	~~CBR~~ Permeability	Miller Box Resistivity	Direct Shear (Single Point)	Direct Shear (3 Point)	Unconfined Compressive Strength	NDOT Resistivity	Water Soluble Sodium Sulfate & Solubility	Resistivity Analysis	Corrosivity Analysis	Corrosivity, Resistivity & Sodium Sulfate	Other Tests pH TOC	Instructions / Remarks
BG 50																												
	/		19	140-142	CL			/				/															/	
		/	6	141-141.5	ML-CL												/											
		/	6	141.5-142	ML-CL																							
	/		19	160-162	ML-CL			/				/															/	
		/	6	161-161.5	ML-CL												/											
		/	6	161.5-162	SM-ML																							

Permeability Tests to be sent to AP Engineers

Other Tests include pH + Total Organic Carbon

SilverState
Analytical Laboratories

LABORATORY REPORT

DATE: January 31, 2012

REPORT NUMBER: 12-0388

CLIENT: Converse Consultants
731 Pilot Road, Suite H
Las Vegas, NV 89119

PAGE: 1 of 1

CLIENT PROJECT: 11-35120-01

CLIENT PO #: 25462

Sampled By: Client
Date Sampled: 01/30/12
Time Sampled: Refer to COC

Submitted by: Client
Date Received: 01/30/12
Time Received: 1600

Report Attention: R. Clark

Sample ID	Parameter	Result	Unit	Method	Date Analyzed	Analyst
BG4D @ 20'-22'	pH	8.10	S.U.	SM4500H+B	01/31/12	SW
BG4D @ 40'-42'	pH	8.24	S.U.	SM4500H+B	01/31/12	SW
BG4D @ 60'-62'	pH	8.66	S.U.	SM4500H+B	01/31/12	SW
BG4D @ 80'-82'	pH	8.37	S.U.	SM4500H+B	01/31/12	SW
BG4D @ 100'-102'	pH	8.22	S.U.	SM4500H+B	01/31/12	SW
BG4D @ 120'-122'	pH	8.34	S.U.	SM4500H+B	01/31/12	SW
BG4D @ 140'-142'	pH	8.44	S.U.	SM4500H+B	01/31/12	SW
BG4D @ 160'-162'	pH	8.71	S.U.	SM4500H+B	01/31/12	SW

NOTES: The results for each constituent denote the percentage (%) for that particular element which is soluble in a 1:5 (soil to water) extraction ratio and corrected for dilution.

REVIEWED BY:

John Sloan
Laboratory Director

3638 East Sunset Road, Suite 100 Las Vegas, NV 89120
Tel: 702-873-4478 Fax: 702-873-7967 www.ssalabs.com

AP Engineering & Testing, Inc.

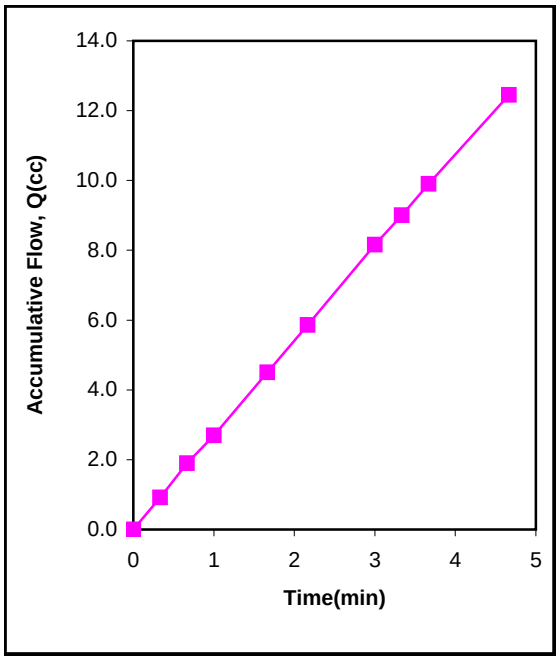
FLEXIBLE WALL HYDRAULIC CONDUCTIVITY TEST
ASTM D 5084

Project Name:	Reid Gardner Wells	Tested by	ST	Date	02/13/12
Project No.:	11-35120-01	Calculated by	KM	Date	02/27/12
Boring No.:	BG4D	Checked by	AP	Date	02/28/12
Sample No.:	- Depth (ft.): 20.5-21				
Soil Description:	Sand w/silt				
Test Condition:	Mod Cal				
	Confining Pressure = 18 PSI				
Remarks:					

INITIAL CONDITION OF SPECIMEN

				Before	After
Diameter (d)	2.42	in			
Sample Area (A)	4.58	in²			
Length (L)	3.00	in	Container No.		
Weight Before	385.60	g	Wt. Wet Soil+Container(gms)	184.6	604
			Wt. Dry Soil+Container(gms)	180.41	519.63
Wet Density	106.88	pcf	Wt. Container (gms)	49.94	150.67
Dry Density	103.56	pcf	Moisture, (%)	3.21	22.87

TEST RESULTS



Time (min)	Flow Rdg (cm)	Burette Factor	Q (cc)	Head, h (psi)	h/L	Q/t (cc/s)
0	47.0	1	0.0	1.0	9.23	0
0.333	46.1	1	0.9	1.0	9.23	4.60E-02
0.667	45.1	1	1.9	1.0	9.23	4.90E-02
1	44.3	1	2.7	1.0	9.23	4.00E-02
1.667	42.5	1	4.5	1.0	9.23	4.50E-02
2.167	41.1	1	5.9	1.0	9.23	4.53E-02
3	38.8	1	8.2	1.0	9.23	4.60E-02
3.333	38.0	1	9.0	1.0	9.23	4.20E-02
3.667	37.1	1	9.9	1.0	9.23	4.50E-02
4.667	34.6	1	12.5	1.0	9.23	4.25E-02

Hydraulic Conductivity (cm/sec): 1.62E-04

AP Engineering & Testing, Inc.

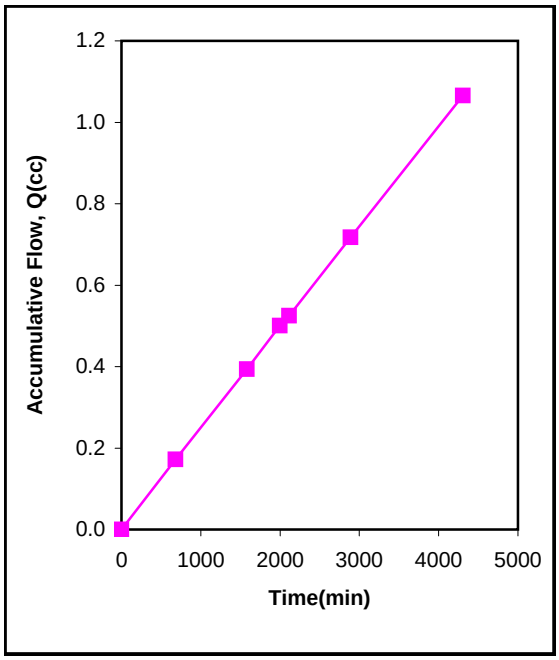
FLEXIBLE WALL HYDRAULIC CONDUCTIVITY TEST
ASTM D 5084

Project Name:	Reid Gardner Wells	Tested by	ST	Date	02/13/12
Project No.:	11-35120-01	Calculated by	KM	Date	02/27/12
Boring No.:	BG4D	Checked by	AP	Date	02/28/12
Sample No.:	- Depth (ft.): 40.5-41				
Soil Description:	Lean Clay				
Test Condition:	Mod Cal				
	Confining Pressure = 34 PSI				
Remarks:					

INITIAL CONDITION OF SPECIMEN

				Before	After
Diameter (d)	2.41	in			
Sample Area (A)	4.55	in²			
Length (L)	3.03	in	Container No.		
Weight Before	483.72	g	Wt. Wet Soil+Container(gms)	246.26	640.24
			Wt. Dry Soil+Container(gms)	219.02	561.56
Wet Density	133.70	pcf	Wt. Container (gms)	49.88	148.54
Dry Density	115.16	pcf	Moisture, (%)	16.11	19.05

TEST RESULTS



Time (min)	Flow Rdg (cm)	Burette Factor	Q (cc)	Head, h (psi)	h/L	Q/t (cc/s)
0	44.8	0.082	0.0	9.0	82.4	0
680	42.7	0.082	0.2	9.0	82.4	4.22E-06
1583	40.0	0.082	0.4	9.0	82.4	4.09E-06
1998	38.7	0.082	0.5	9.0	82.4	4.28E-06
2115	38.4	0.082	0.5	9.0	82.4	3.50E-06
2891	36.1	0.082	0.7	9.0	82.4	4.14E-06
4305	31.8	0.082	1.1	9.0	82.4	4.11E-06

Hydraulic Conductivity (cm/sec): 1.70E-09

AP Engineering & Testing, Inc.

FLEXIBLE WALL HYDRAULIC CONDUCTIVITY TEST
ASTM D 5084

Project Name:	Reid Gardner Wells	Tested by	ST	Date	02/20/12
Project No.:	11-35120-01	Calculated by	KM	Date	02/27/12
Boring No.:	BG4D	Checked by	AP	Date	02/28/12
Sample No.:	- Depth (ft.): 60-60.5				
Soil Description:	Siltstone Fragments				
Test Condition:	Mod Cal				
	Confining Pressure = PSI				
Remarks:					

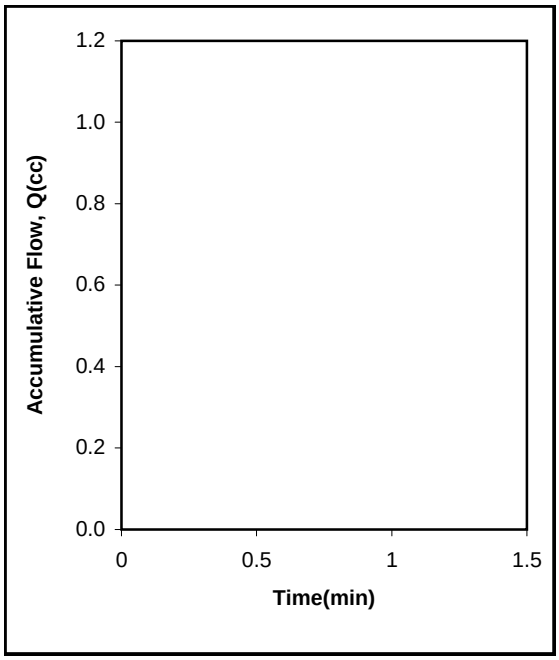
INITIAL CONDITION OF SPECIMEN

Sample Disturbed.

Broken into Small Pieces

				Before	After
Diameter (d)	in				
Sample Area (A)					
Length (L)	in	Container No.			
Weight Before	g	Wt. Wet Soil+Container(gms)			
		Wt. Dry Soil+Container(gms)			
Wet Density	pcf	Wt. Container (gms)			
Dry Density	pcf	Moisture, (%)			

TEST RESULTS



Time (min)	Flow Rdg (cm)	Burette Factor	Q (cc)	Head, h (psi)	h/L	Q/t (cc/s)

Hydraulic Conductivity (cm/sec):

AP Engineering & Testing, Inc.

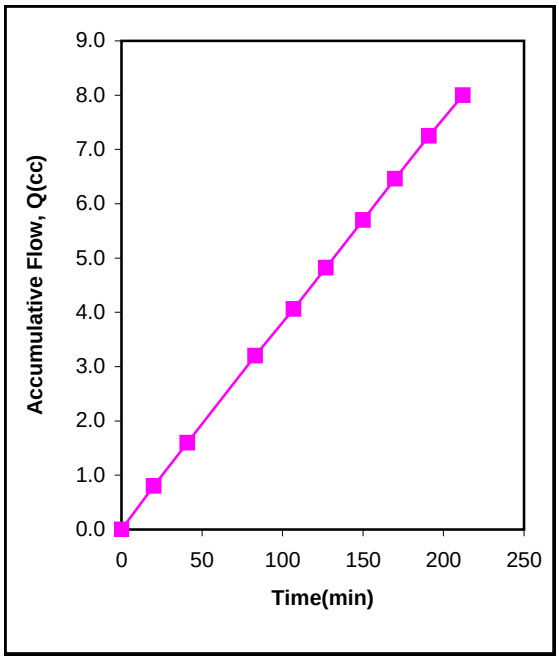
FLEXIBLE WALL HYDRAULIC CONDUCTIVITY TEST
ASTM D 5084

Project Name:	Reid Gardner Wells	Tested by	ST	Date	02/13/12
Project No.:	11-35120-01	Calculated by	KM	Date	02/27/12
Boring No.:	BG4D	Checked by	AP	Date	02/28/12
Sample No.:	- Depth (ft.): 80.5-81				
Soil Description:	Silt w/sand				
Test Condition:	Mod Cal				
	Confining Pressure = 50 PSI				
Remarks:					

INITIAL CONDITION OF SPECIMEN

				Before	After
Diameter (d)	2.42	in			
Sample Area (A)	4.58	in²			
Length (L)	3.01	in	Container No.		
Weight Before	464.09	g	Wt. Wet Soil+Container(gms)	182.18	615.86
			Wt. Dry Soil+Container(gms)	161.34	537.21
Wet Density	128.42	pcf	Wt. Container (gms)	50.46	149.82
Dry Density	108.11	pcf	Moisture, (%)	18.80	20.30

TEST RESULTS



Time (min)	Flow Rdg (cm)	Burette Factor	Q (cc)	Head, h (psi)	h/L	Q/t (cc/s)
0	37.2	1	0.0	3.0	27.6	0
20	36.4	1	0.8	3.0	27.6	6.67E-04
41	35.6	1	1.6	3.0	27.6	6.35E-04
83	34.0	1	3.2	3.0	27.6	6.35E-04
107	33.1	1	4.1	3.0	27.6	5.97E-04
127	32.4	1	4.8	3.0	27.6	6.33E-04
150	31.5	1	5.7	3.0	27.6	6.38E-04
170	30.7	1	6.5	3.0	27.6	6.33E-04
191	30.0	1	7.3	3.0	27.6	6.27E-04
212	29.2	1	8.0	3.0	27.6	5.95E-04

Hydraulic Conductivity (cm/sec): 7.65E-07

AP Engineering & Testing, Inc.

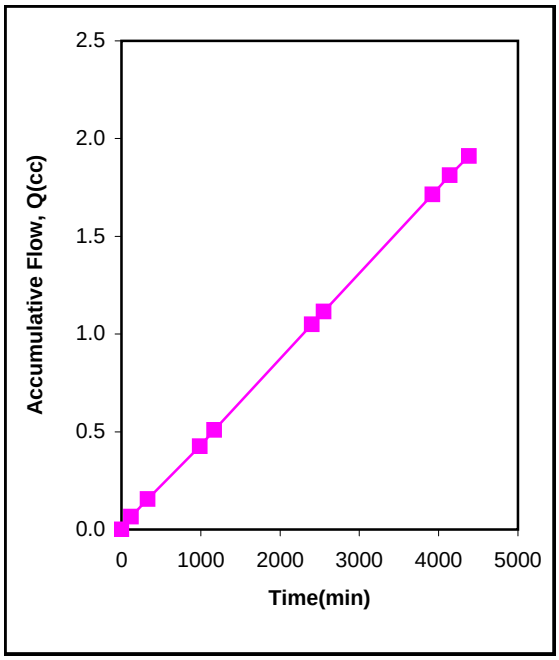
FLEXIBLE WALL HYDRAULIC CONDUCTIVITY TEST
ASTM D 5084

Project Name:	Reid Gardner Wells	Tested by	ST	Date	02/09/12
Project No.:	11-35120-01	Calculated by	KM	Date	02/27/12
Boring No.:	BG4D	Checked by	AP	Date	02/28/12
Sample No.:	- Depth (ft.): 101.5-102				
Soil Description:	Silty Sand-Lean clay Interbedded				
Test Condition:	Mod Cal				
	Confining Pressure = 60 PSI				
Remarks:					

INITIAL CONDITION OF SPECIMEN

				Before	After
Diameter (d)	2.42	in			
Sample Area (A)	4.58	in²			
Length (L)	3.08	in	Container No.		
Weight Before	475.55	g	Wt. Wet Soil+Container(gms)	196.82	623.4
			Wt. Dry Soil+Container(gms)	175.71	543.62
Wet Density	128.43	pcf	Wt. Container (gms)	50.25	151.48
Dry Density	109.93	pcf	Moisture, (%)	16.83	20.34

TEST RESULTS



Time (min)	Flow Rdg (cm)	Burette Factor	Q (cc)	Head, h (psi)	h/L	Q/t (cc/s)
0	28.5	0.082	0.0	5.0	45	0
121	27.7	0.082	0.1	5.0	45	9.04E-06
332	26.6	0.082	0.2	5.0	45	7.12E-06
987	23.3	0.082	0.4	5.0	45	6.89E-06
1169	22.3	0.082	0.5	5.0	45	7.51E-06
2402	15.7	0.082	1.0	5.0	45	7.32E-06
2549	14.9	0.082	1.1	5.0	45	7.44E-06
3921	7.6	0.082	1.7	5.0	45	7.27E-06
4140	6.4	0.082	1.8	5.0	45	7.49E-06
4383	5.2	0.082	1.9	5.0	45	6.75E-06

Hydraulic Conductivity (cm/sec): 5.46E-09

AP Engineering & Testing, Inc.

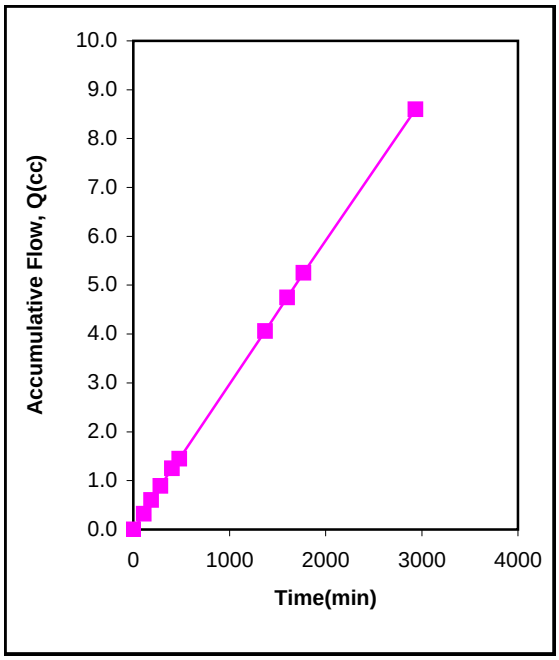
FLEXIBLE WALL HYDRAULIC CONDUCTIVITY TEST
ASTM D 5084

Project Name:	Reid Gardner Wells	Tested by	ST	Date	02/10/12
Project No.:	11-35120-01	Calculated by	KM	Date	02/27/12
Boring No.:	BG4D	Checked by	AP	Date	02/28/12
Sample No.:	- Depth (ft.): 120.5-121				
Soil Description:	Silty Sand with lean clay interbeds				
Test Condition:	Mod Cal				
	Confining Pressure = 65 PSI				
Remarks:					

INITIAL CONDITION OF SPECIMEN

				Before	After
Diameter (d)	2.42	in			
Sample Area (A)	4.58	in²			
Length (L)	3.20	in	Container No.		
Weight Before	471.48	g	Wt. Wet Soil+Container(gms)	225.5	522.21
			Wt. Dry Soil+Container(gms)	202.3	436.18
Wet Density	122.67	pcf	Wt. Container (gms)	50.02	50.48
Dry Density	106.45	pcf	Moisture, (%)	15.24	22.30

TEST RESULTS



Time (min)	Flow Rdg (cm)	Burette Factor	Q (cc)	Head, h (psi)	h/L	Q/t (cc/s)
0	44.7	1	0.0	5.0	43.3	0
111	44.4	1	0.3	5.0	43.3	4.80E-05
186	44.1	1	0.6	5.0	43.3	6.22E-05
283	43.8	1	0.9	5.0	43.3	4.98E-05
403	43.5	1	1.3	5.0	43.3	5.00E-05
479	43.3	1	1.5	5.0	43.3	4.39E-05
1372	40.6	1	4.1	5.0	43.3	4.87E-05
1600	40.0	1	4.8	5.0	43.3	5.04E-05
1769	39.5	1	5.3	5.0	43.3	4.93E-05
2934	36.1	1	8.6	5.0	43.3	4.79E-05

Hydraulic Conductivity (cm/sec): 3.75E-08

AP Engineering & Testing, Inc.

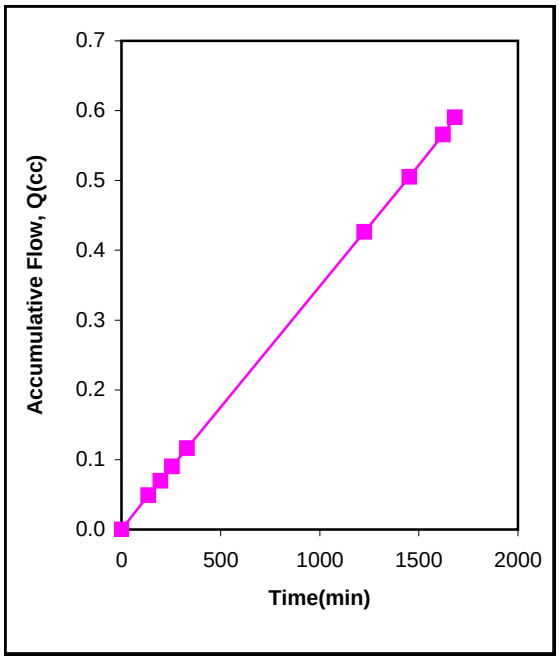
FLEXIBLE WALL HYDRAULIC CONDUCTIVITY TEST
ASTM D 5084

Project Name:	Reid Gardner Wells	Tested by	ST	Date	02/20/12
Project No.:	11-35120-01	Calculated by	KM	Date	02/27/12
Boring No.:	BG4D	Checked by	AP	Date	02/28/12
Sample No.:	- Depth (ft.): 141-141.5				
Soil Description:	Lean Clay				
Test Condition:	Mod Cal				
	Confining Pressure = 70 PSI				
Remarks:					

INITIAL CONDITION OF SPECIMEN

				Before	After
Diameter (d)	2.32	in			
Sample Area (A)	4.21	in²			
Length (L)	3.20	in	Container No.		
Weight Before	473.10	g	Wt. Wet Soil+Container(gms)	210.12	622.98
			Wt. Dry Soil+Container(gms)	183.77	543.12
Wet Density	133.55	pcf	Wt. Container (gms)	49.93	149.88
Dry Density	111.58	pcf	Moisture, (%)	19.69	20.31

TEST RESULTS



Time (min)	Flow Rdg (cm)	Burette Factor	Q (cc)	Head, h (psi)	h/L	Q/t (cc/s)
0	40.9	0.082	0.0	7.0	60.5	0
136	40.3	0.082	0.0	7.0	60.5	6.03E-06
197	40.1	0.082	0.1	7.0	60.5	5.60E-06
255	39.8	0.082	0.1	7.0	60.5	5.89E-06
331	39.5	0.082	0.1	7.0	60.5	5.75E-06
1225	35.7	0.082	0.4	7.0	60.5	5.78E-06
1452	34.7	0.082	0.5	7.0	60.5	5.78E-06
1622	34.0	0.082	0.6	7.0	60.5	5.95E-06
1682	33.7	0.082	0.6	7.0	60.5	6.83E-06

Hydraulic Conductivity (cm/sec): 3.70E-09

AP Engineering & Testing, Inc.

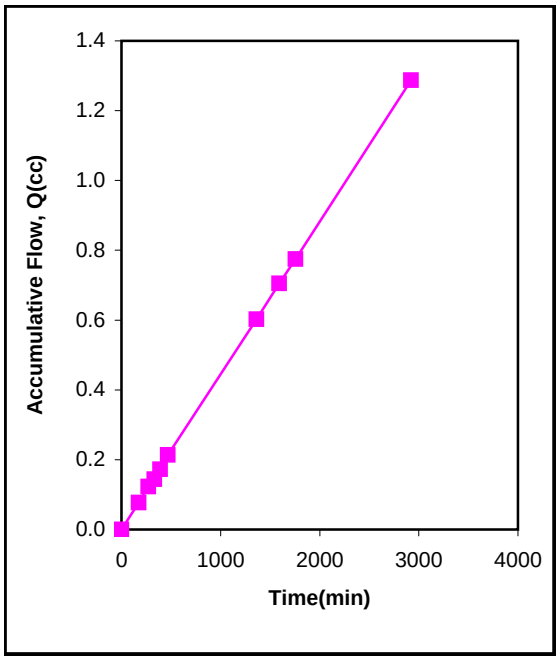
FLEXIBLE WALL HYDRAULIC CONDUCTIVITY TEST
ASTM D 5084

Project Name:	Reid Gardner Wells	Tested by	ST	Date	02/18/12
Project No.:	11-35120-01	Calculated by	KM	Date	02/27/12
Boring No.:	BG4D	Checked by	AP	Date	02/28/12
Sample No.:	- Depth (ft.): 161-161.5				
Soil Description:	Lean Clay				
Test Condition:	Mod Cal				
	Confining Pressure = 75 PSI				
Remarks:					

INITIAL CONDITION OF SPECIMEN

				Before	After
Diameter (d)	2.42	in			
Sample Area (A)	4.59	in²			
Length (L)	3.07	in	Container No.		
Weight Before	485.88	g	Wt. Wet Soil+Container(gms)	135.43	542.4
			Wt. Dry Soil+Container(gms)	124.13	463.23
Wet Density	131.37	pcf	Wt. Container (gms)	49.54	49.48
Dry Density	114.08	pcf	Moisture, (%)	15.15	19.13

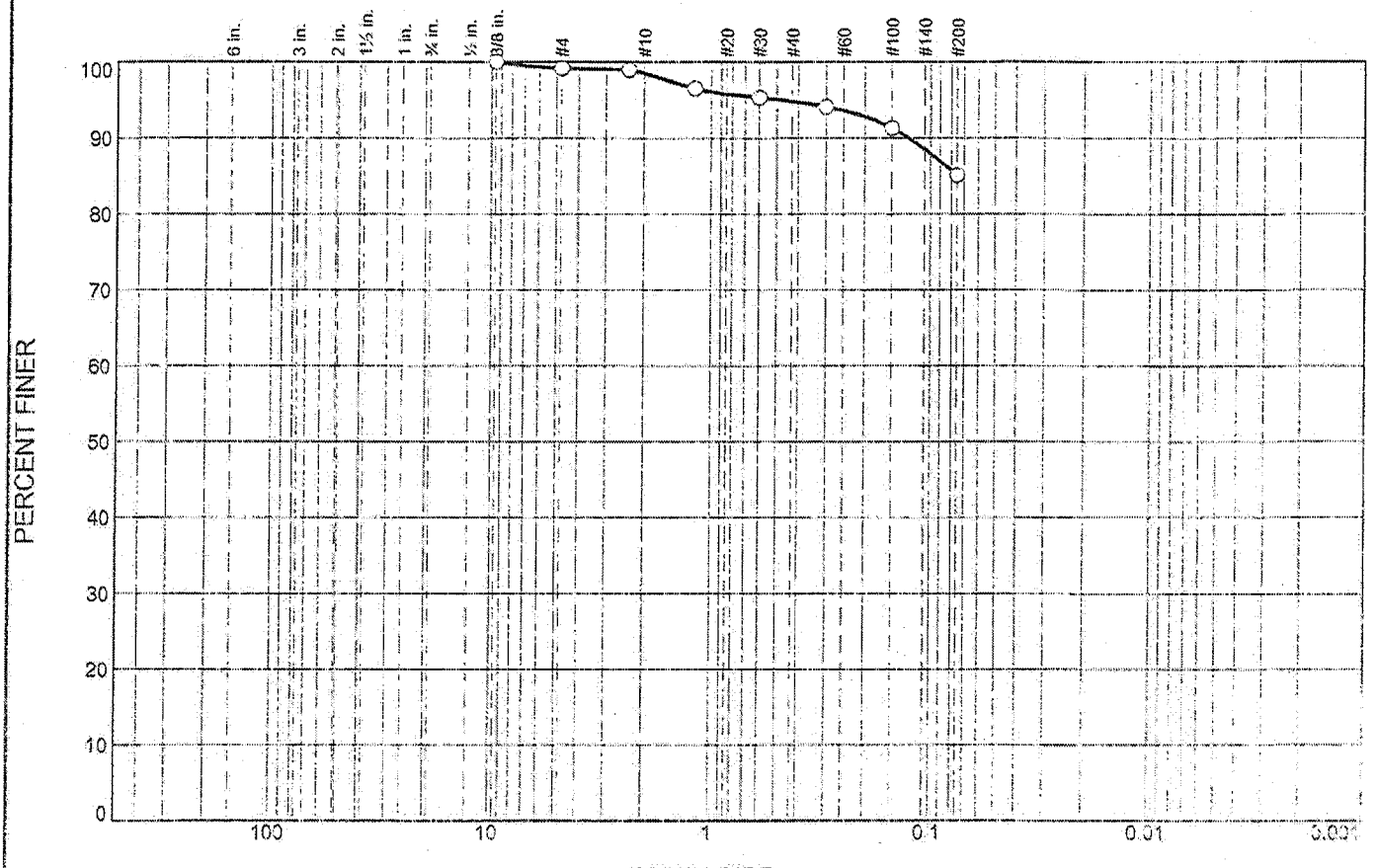
TEST RESULTS



Time (min)	Flow Rdg (cm)	Burette Factor	Q (cc)	Head, h (psi)	h/L	Q/t (cc/s)
0	45.3	0.082	0.0	7.0	63.2	0
174	44.4	0.082	0.1	7.0	63.2	7.38E-06
271	43.8	0.082	0.1	7.0	63.2	7.89E-06
333	43.6	0.082	0.1	7.0	63.2	5.51E-06
392	43.2	0.082	0.2	7.0	63.2	8.11E-06
468	42.7	0.082	0.2	7.0	63.2	8.99E-06
1361	38.0	0.082	0.6	7.0	63.2	7.27E-06
1590	36.7	0.082	0.7	7.0	63.2	7.46E-06
1757	35.9	0.082	0.8	7.0	63.2	6.96E-06
2922	29.6	0.082	1.3	7.0	63.2	7.33E-06

Hydraulic Conductivity (cm/sec): 4.06E-09

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.8	14.1	85.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	99.2		
#8	99.0		
#16	96.5		
#30	95.3		
#50	94.1		
#100	91.3		
#200	85.1		

* (no specification provided)

Material Description

Lean Clay

Atterberg Limits

PL= 18 LL= 47 PI= 29

Coefficients

D_{90}= 0.1262 D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(25)

Remarks

Source of Sample: BG-4D **Depth:** 20-22

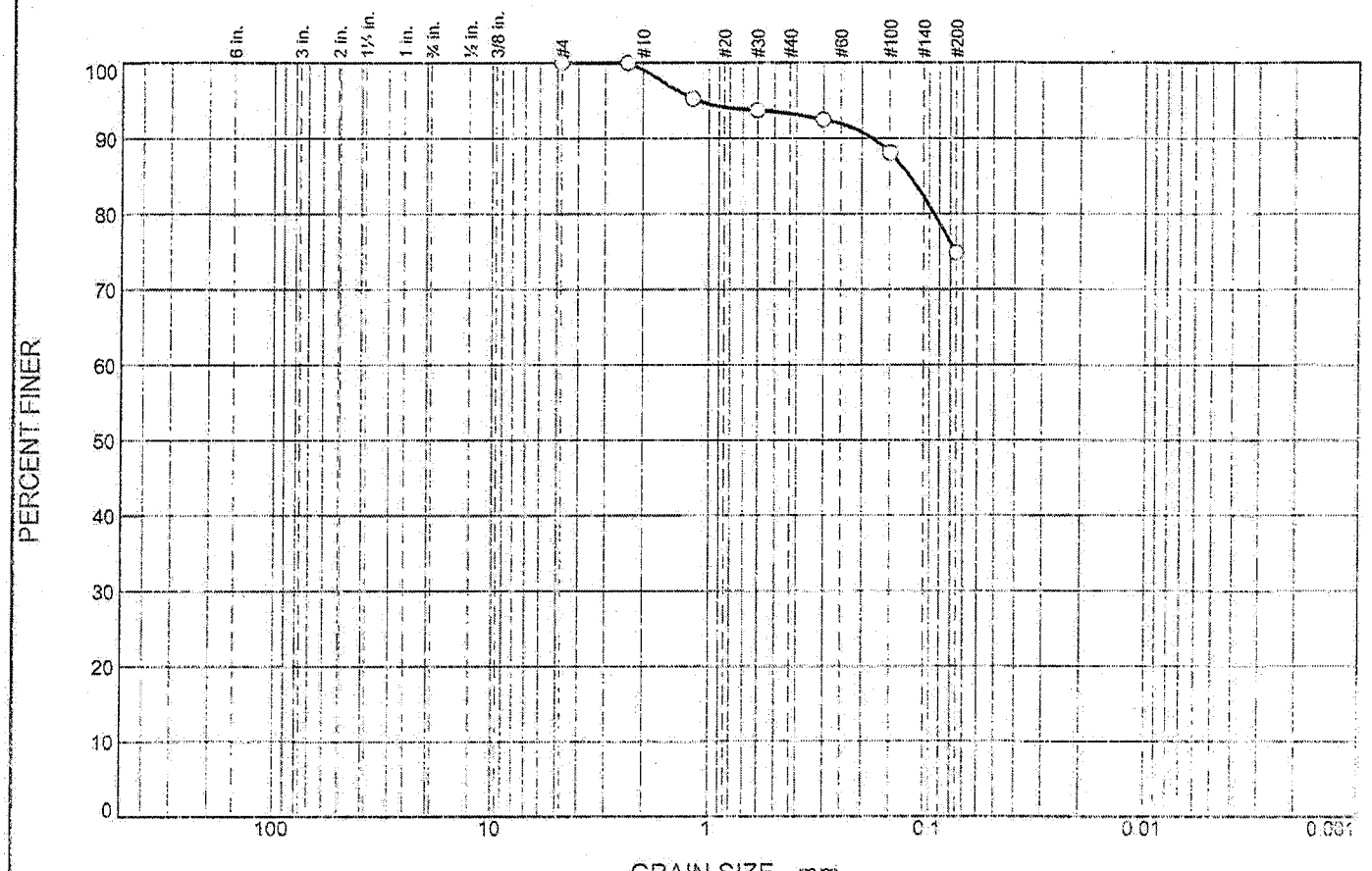
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.0	25.2	74.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	100.0		
#16	95.3		
#30	93.7		
#50	92.5		
#100	88.1		
#200	74.8		

* (no specification provided)

Material Description

Lean Clay with Sand

Atterberg Limits

PL= 16 LL= 39 PI= 23

Coefficients

D_{90}= 0.1797 D_{85}= 0.1228 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(16)

Remarks

Source of Sample: BG-4D **Depth:** 40-42

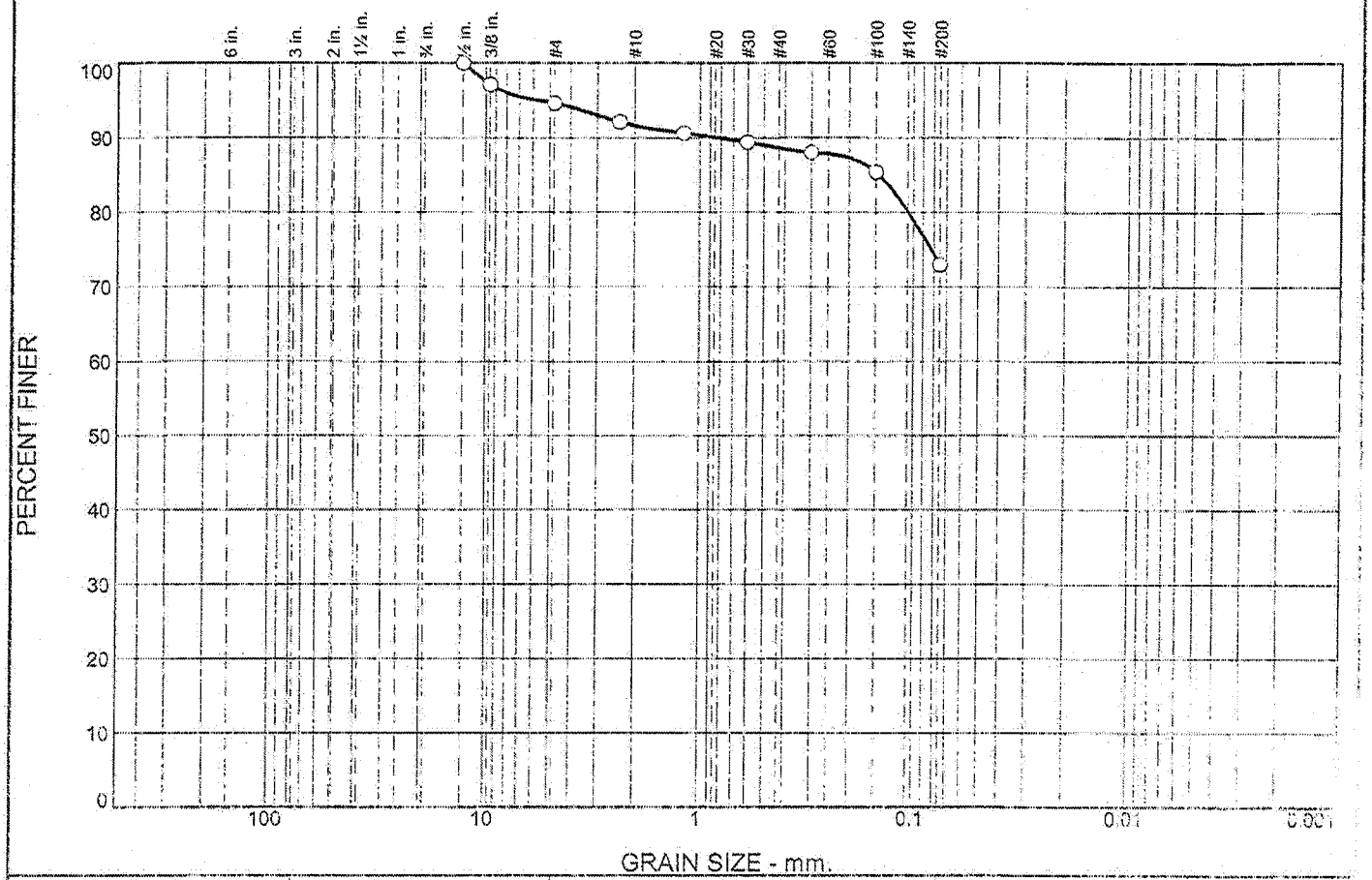
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	5.4	21.6	73.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	97.1		
#4	94.6		
#8	92.1		
#16	90.6		
#30	89.4		
#50	88.0		
#100	85.4		
#200	73.0		

* (no specification provided)

Material Description

Silt with Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.8260 D_{85}= 0.1450 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Source of Sample: BG-4D **Depth:** 60-62

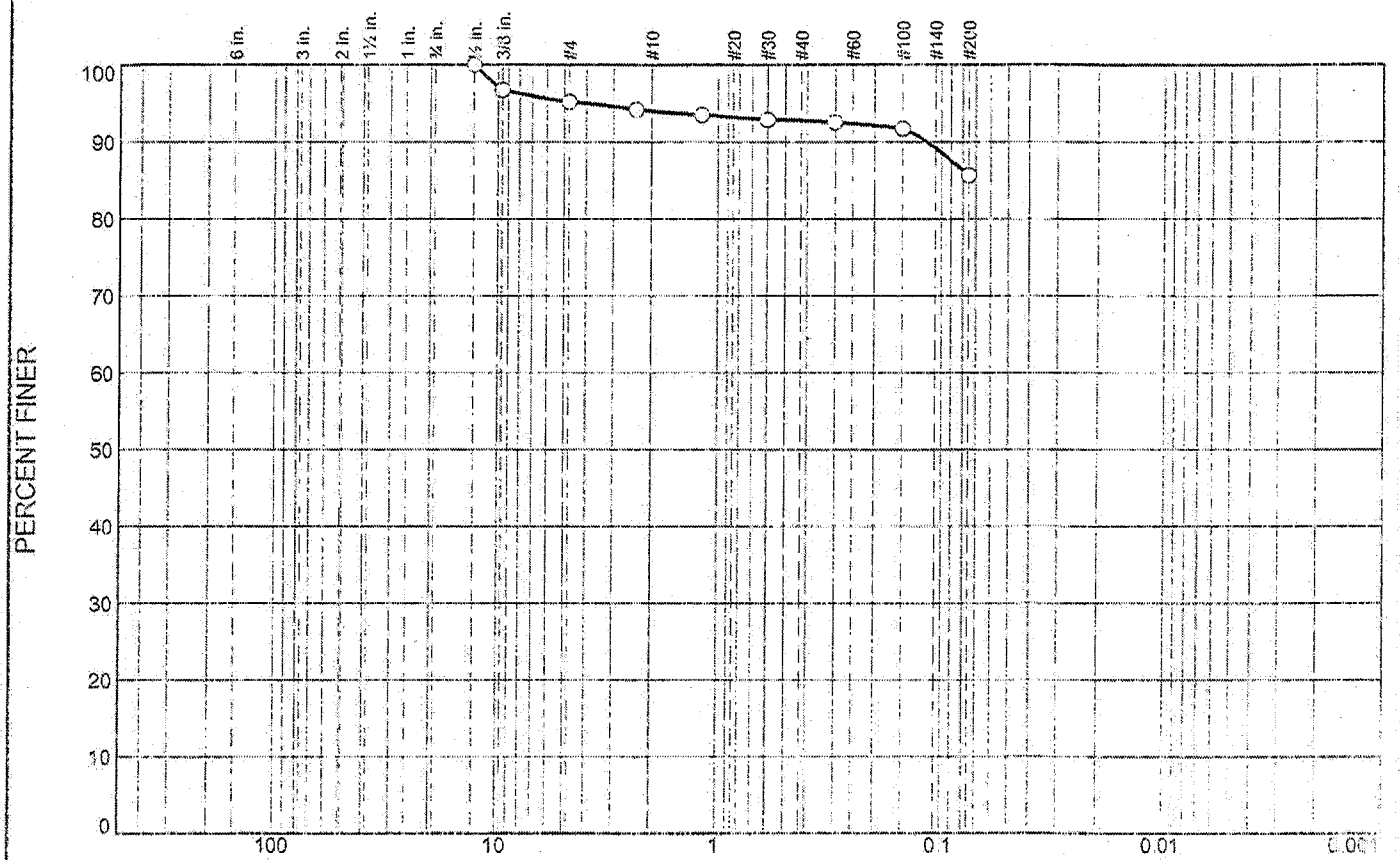
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	4.8	9.6	85.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	96.7		
#4	95.2		
#8	94.2		
#16	93.5		
#30	92.9		
#50	92.5		
#100	91.7		
#200	85.6		

* (no specification provided)

Material Description

Silty Clay

Atterberg Limits

PL= 21 LL= 28 PI= 7

Coefficients

D_{90}= 0.1163 D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL-ML AASHTO= A-4(5)

Remarks

Source of Sample: BG-4D **Depth:** 80-82

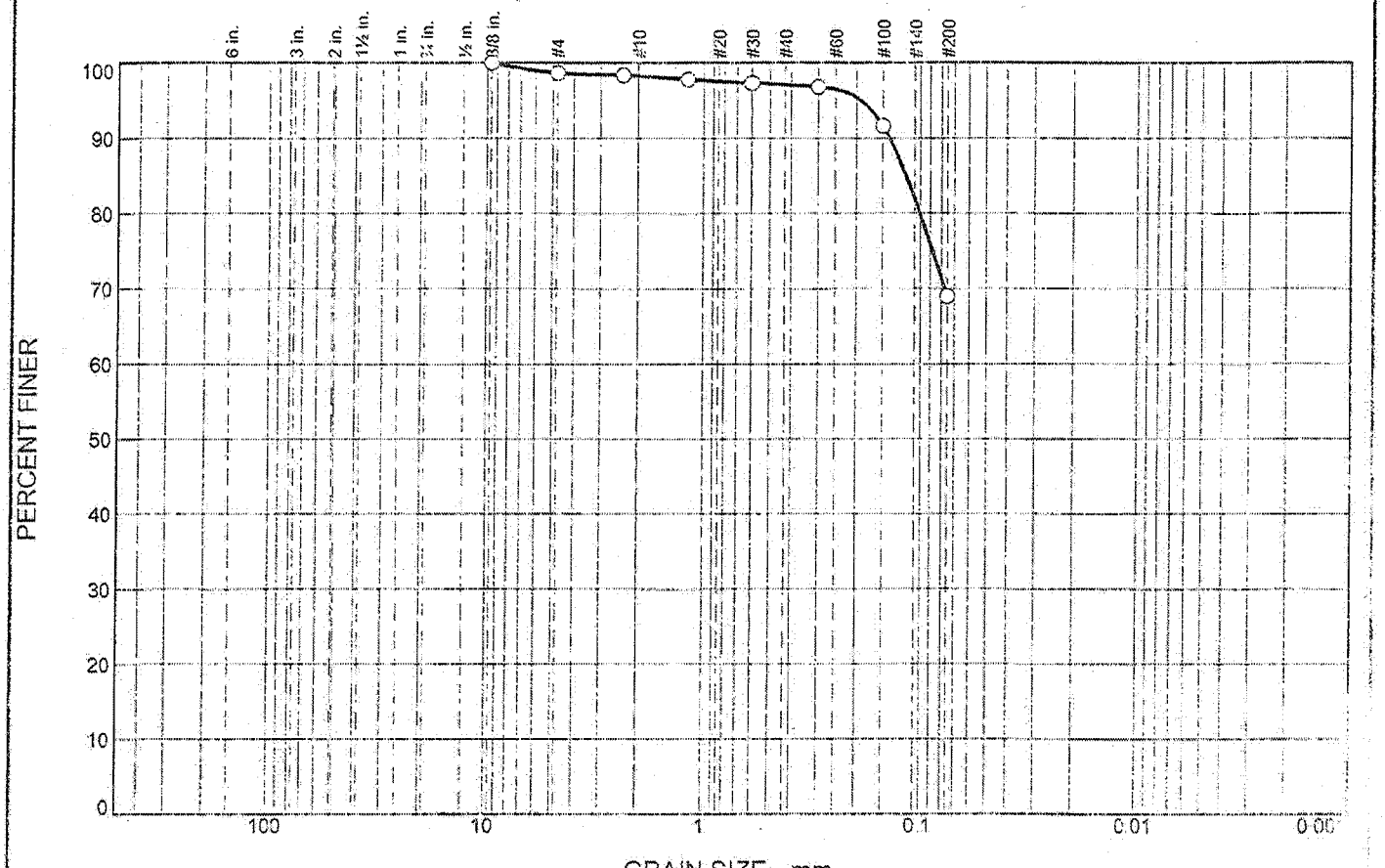
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	1.4	29.6	69.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	98.6		
#8	98.4		
#16	97.8		
#30	97.3		
#50	96.8		
#100	91.6		
#200	69.0		

* (no specification provided)

Material Description

Sandy Lean Clay

Atterberg Limits

PL= 17 LL= 34 PI= 17

Coefficients

D_{90}= 0.1396 D_{85}= 0.1166 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(10)

Remarks

Source of Sample: BG-4D **Depth:** 100

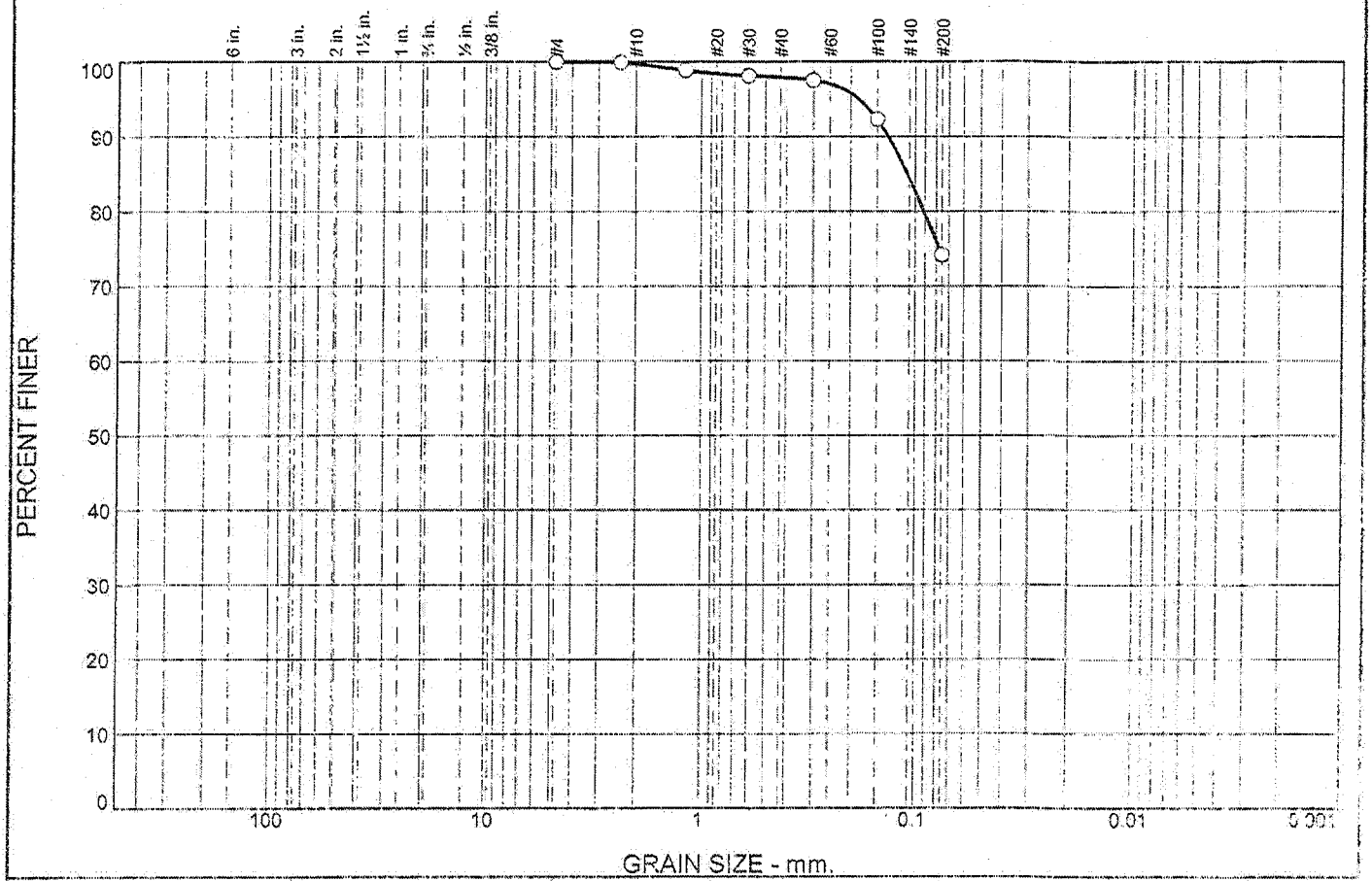
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.0	25.9	74.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	100.0		
#16	98.9		
#30	98.1		
#50	97.5		
#100	92.3		
#200	74.1		

* (no specification provided)

Material Description

Lean Clay with Sand

Atterberg Limits

PL= 19 LL= 41 PI= 22

Coefficients

D_{90}= 0.1331 D_{85}= 0.1084 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(15)

Remarks

Source of Sample: BG-4D **Depth:** 120

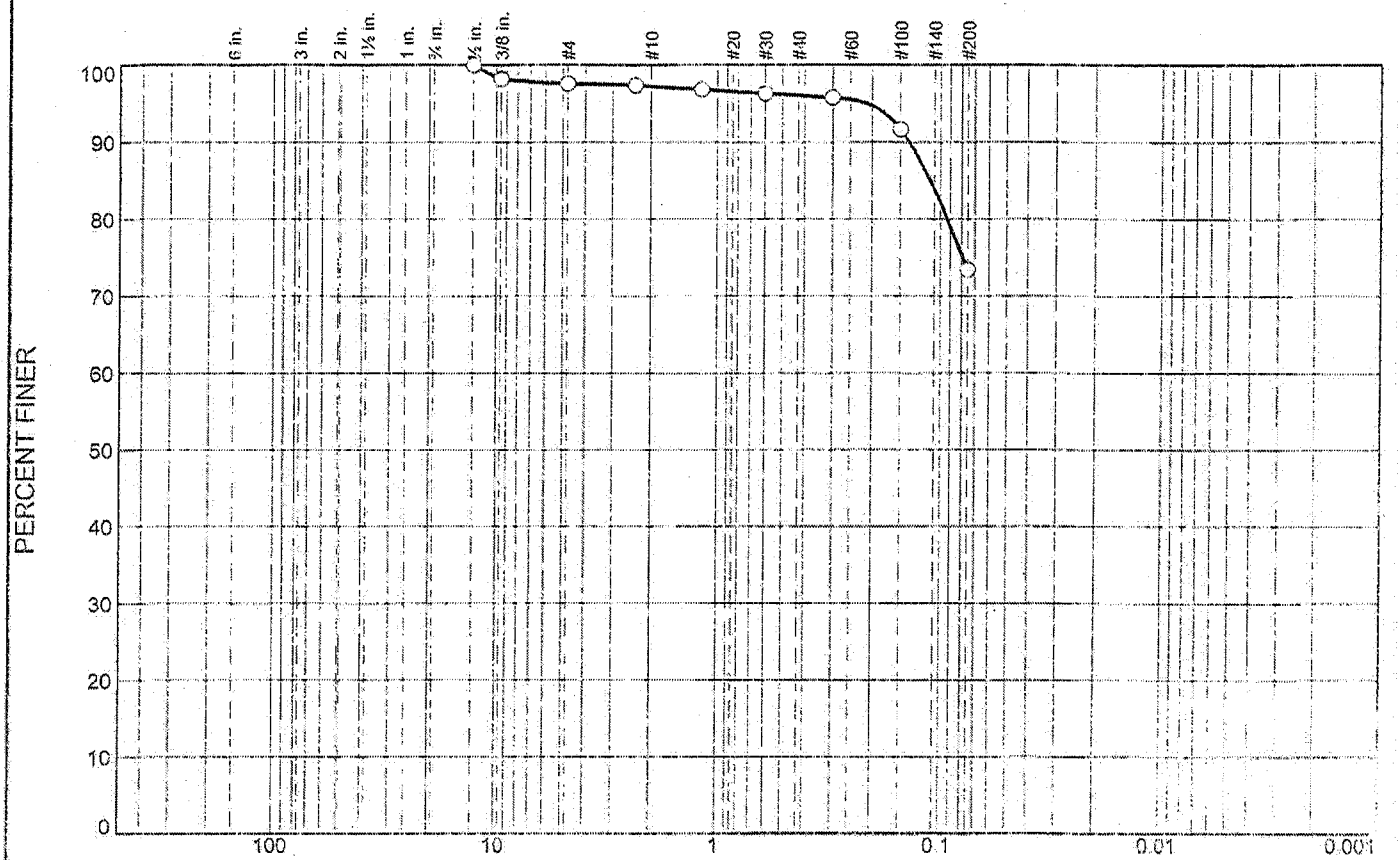
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	2.4	24.2	73.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	98.2		
#4	97.6		
#8	97.4		
#16	96.8		
#30	96.3		
#50	95.8		
#100	91.7		
#200	73.4		

* (no specification provided)

Material Description

Lean Clay with Sand

Atterberg Limits

PL= 17 LL= 35 PI= 18

Coefficients

D_{90}= 0.1367 D_{85}= 0.1106 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(11)

Remarks

Source of Sample: BG-4D **Depth:** 140

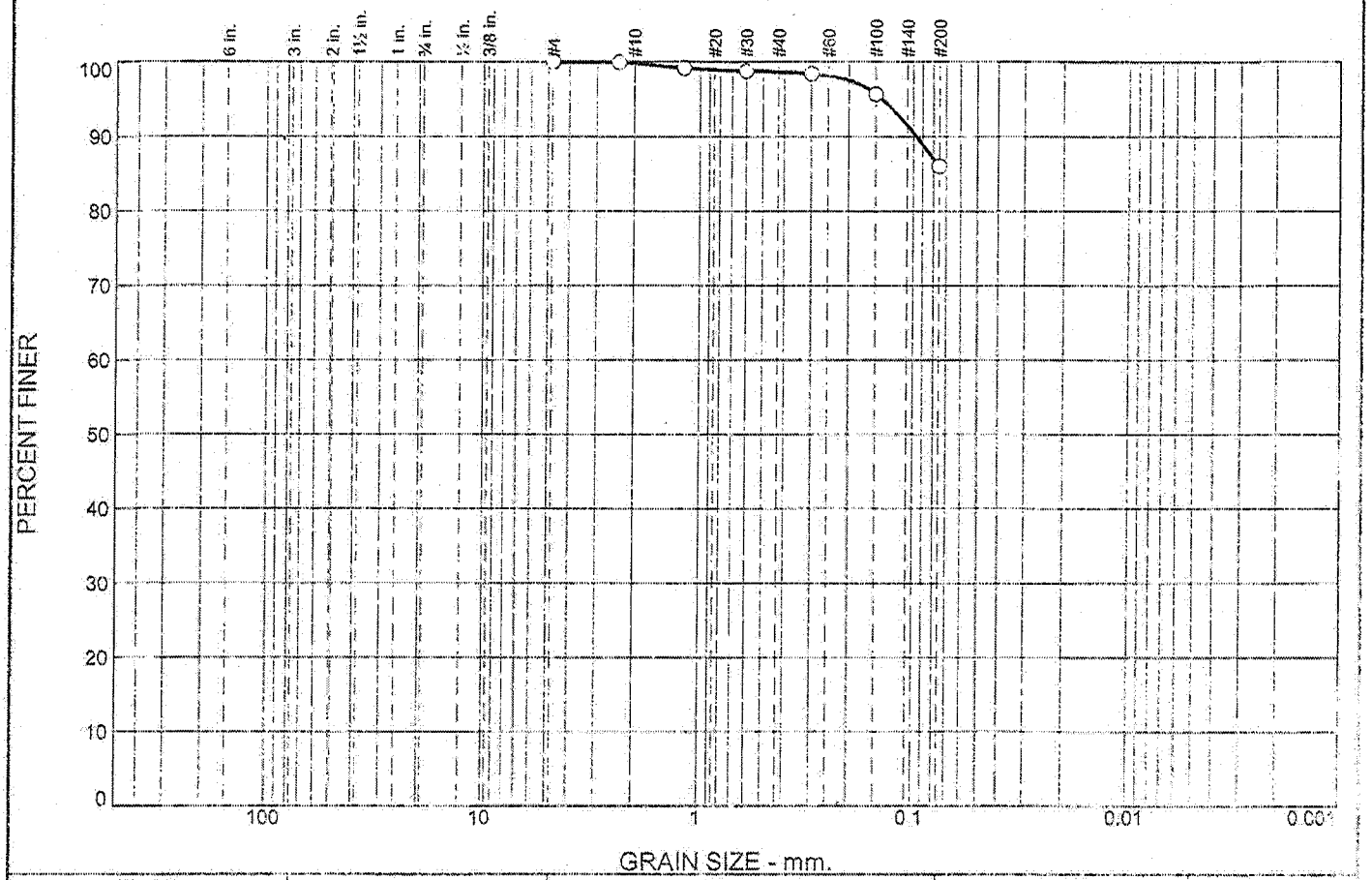
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.0	14.0	86.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	99.9		
#16	99.2		
#30	98.8		
#50	98.4		
#100	95.7		
#200	86.0		

* (no specification provided)

Material Description

Lean Clay

Atterberg Limits

PL= 16 LL= 25 PI= 9

Coefficients

D_{90}= 0.0962 D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-4(6)

Remarks

Source of Sample: BG-4D **Depth:** 160

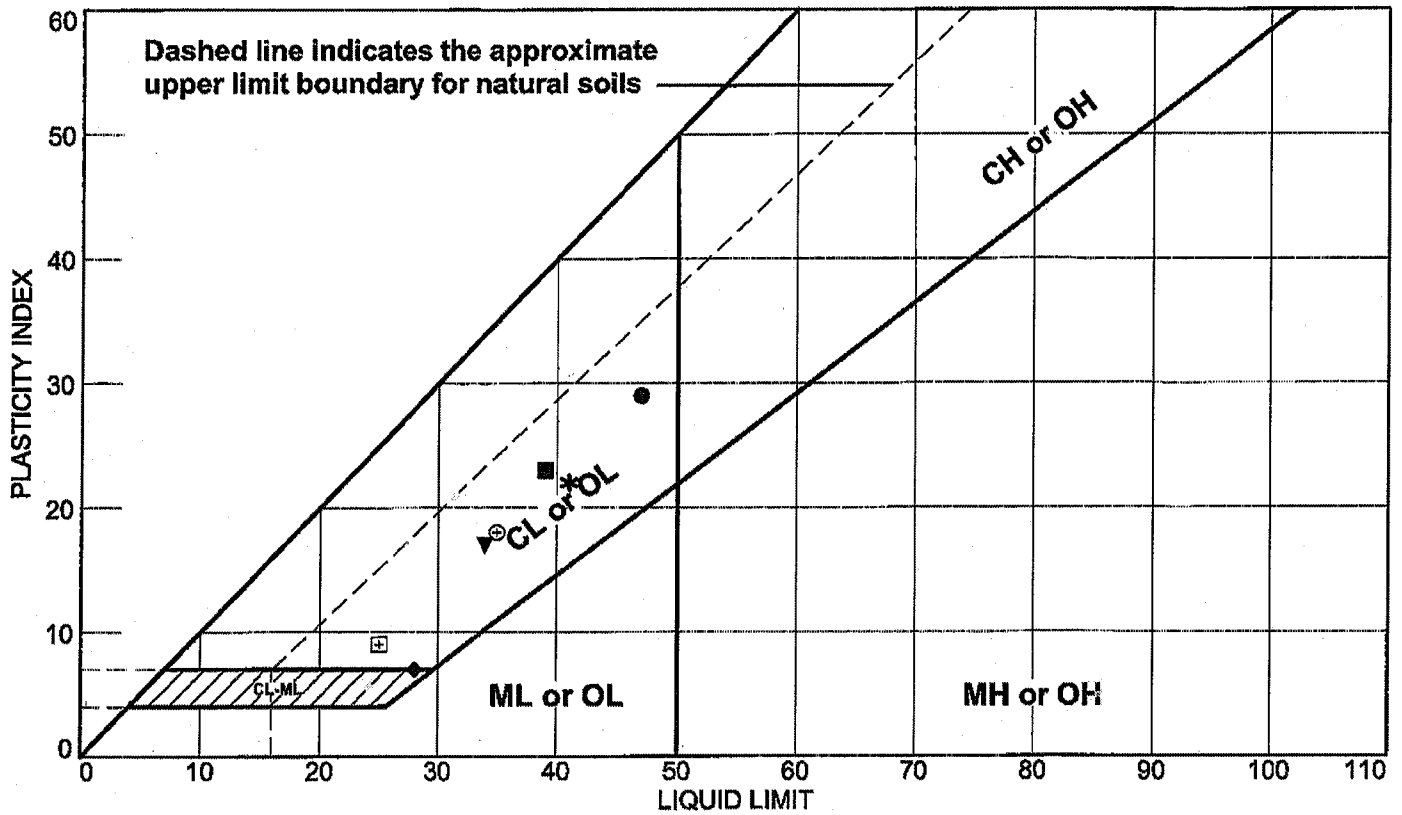
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	BG-4D		20-22		18	47	29	CL
■	BG-4D		40-42		16	39	23	CL
▲	BG-4D		60-62		NP	NV	NP	ML
◆	BG-4D		80-82		21	28	7	CL-ML
▼	BG-4D		100-102		17	34	17	CL
✱	BG-4D		120-122		19	41	22	CL
⊕	BG-4D		140-142		17	35	18	CL
⊞	BG-4D		160-162		16	25	9	CL

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No.: 11-35120-01 **Drawing No.**

Location	Depth (feet)	Total Organic Content (%)
BG-6D	19-22	0.2
BG-6D	40-42	0.2
BG-6D	72-74	0.5
BG-6D	79-82	0.2
BG-6D	99-102	0.1
BG-6D	119-122	0.1

Converse Consultants
731 Pilot Rd. Suite H
Las Vegas, NV 89119

Project: Reid Gardner Replacement Wells
Project No.: 11-35120-01

Assigned By: MDJ/ACD
Date Assigned: 2-8-12

Checked By:
Date Needed:

Page No: 5 of

Boring No.	Bulk	Brass Rings	Amount of Sample (inches)	Depth (feet)	Unit Class Symbol	Moisture Content	MC & Unit Weight	Atterberg Limits (L.L. & PI)	Consolidation	Swell	Solubility	Sieve	%>No. 4 & < No. 200	R-Value	D1557	Single-Point Check	~~CBR~~ Permeability	Miller Box Resistivity	Direct Shear (Single Point)	Direct Shear (3 Point)	Unconfined Compressive Strength	NDOT Resistivity	Water Soluble Sodium Sulfate & Solubility	Resistivity Analysis	Corrosivity Analysis	Corrosivity, Resistivity & Sodium Sulfate	Other Tests pH TOC	Instructions / Remarks
BG 6D																												
	/		19	19-22	SM			/				/															/	
		/	6	20-20.5	SM												/											
		/	6	20.5-21	SM																							
	/		19	40-42	SM			/				/															/	
		/	6	40.5-41	SM												/											
		/	6	41-41.5	SM																							
	/		19	72-74	SM-CL			/				/															/	
		/	6	73-73.5	SM-CL												/											
		/	6	73.5-74	SM-CL																							
	/		19	79-82	SM-CL			/				/															/	
		/	6	80-80.5	SM												/											
		/	6	80.5-81	SM																							
	/		19	99-102	SM			/				/															/	
		/	3	100-100.5	SM																							
		/	6	100.5-101	SM												/											
	/		19	117-122	SM			/				/															/	
		/	6	120.5-121	SM																							
		/	6	121-121.5	SM												/											

Permeability samples to be sent to AP Engineers

Other tests include pH + TOC D2974 → Silver State

SilverState
Analytical Laboratories

LABORATORY REPORT

DATE: February 17, 2012

REPORT NUMBER: 12-0683

CLIENT: Converse Consultants
731 Pilot Road, Suite H
Las Vegas, NV 89119

PAGE: 1 of 1

CLIENT PROJECT: 11-35120-01

CLIENT PO #: 25477

Sampled By: Client
Date Sampled: 02/16/12
Time Sampled: --

Submitted by: Client
Date Received: 02/17/12
Time Received: 0900

Report Attention:

Sample ID	Parameter	Result	Unit	Method	Date Analyzed	Analyst
BG6D @ 19-22'	pH	8.33	S.U.	SM4500H+B	02/17/12	SW
BG6D @ 40-42'	pH	8.62	S.U.	SM4500H+B	02/17/12	SW
BG6D @ 72-74'	pH	8.37	S.U.	SM4500H+B	02/17/12	SW
BG6D @ 79-82'	pH	8.41	S.U.	SM4500H+B	02/17/12	SW
BG6D @ 99-102'	pH	8.64	S.U.	SM4500H+B	02/17/12	SW
BG6D @ 119-122'	pH	8.26	S.U.	SM4500H+B	02/17/12	SW

NOTES: The results for each constituent denote the percentage (%) for that particular element which is soluble in a 1:5 (soil to water) extraction ratio and corrected for dilution.

REVIEWED BY:
John Sloan
Laboratory Director

3638 East Sunset Road, Suite 100 Las Vegas, NV 89120
Tel: 702-873-4478 Fax: 702-873-7967 www.ssalabs.com

AP Engineering & Testing, Inc.

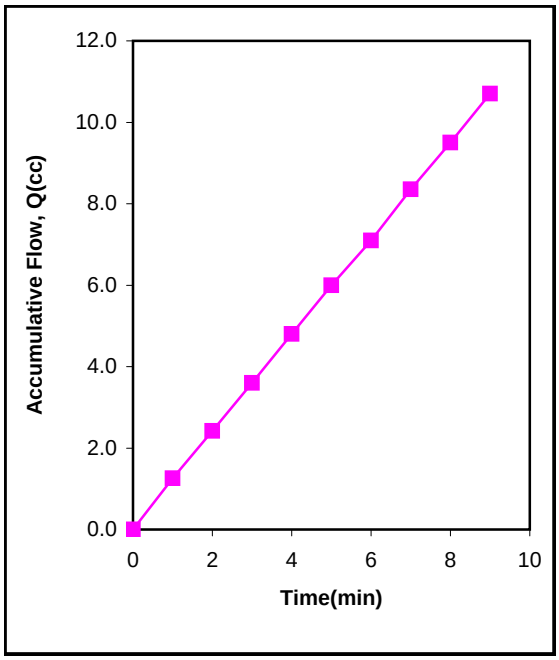
FLEXIBLE WALL HYDRAULIC CONDUCTIVITY TEST
ASTM D 5084

Project Name:	Reid Gardner Wells	Tested by	ST	Date	02/24/12
Project No.:	11-35120-01	Calculated by	KM	Date	03/22/12
Boring No.:	BG-6D	Checked by	AP	Date	03/23/12
Sample No.:	- Depth (ft.): 20-20.5				
Soil Description:	Silty Sand w/clay pocket				
Test Condition:	Mod Cal				
	Confining Pressure = 15 PSI				
Remarks:					

INITIAL CONDITION OF SPECIMEN

				Before	After
Diameter (d)	2.42	in			
Sample Area (A)	4.58	in²			
Length (L)	3.00	in	Container No.		
Weight Before	408.38	g	Wt. Wet Soil+Container(gms)	210.54	613.23
			Wt. Dry Soil+Container(gms)	205.09	535.64
Wet Density	113.20	pcf	Wt. Container (gms)	49.72	150.19
Dry Density	109.36	pcf	Moisture, (%)	3.51	20.13

TEST RESULTS



Time (min)	Flow Rdg (cm)	Burette Factor	Q (cc)	Head, h (psi)	h/L	Q/t (cc/s)
0	43.9	1	0.0	1.0	9.23	0
1	42.6	1	1.3	1.0	9.23	2.10E-02
2	41.5	1	2.4	1.0	9.23	1.93E-02
3	40.3	1	3.6	1.0	9.23	1.97E-02
4	39.1	1	4.8	1.0	9.23	2.00E-02
5	37.9	1	6.0	1.0	9.23	2.00E-02
6	36.8	1	7.1	1.0	9.23	1.83E-02
7	35.6	1	8.4	1.0	9.23	2.08E-02
8	34.4	1	9.5	1.0	9.23	1.92E-02
9	33.2	1	10.7	1.0	9.23	2.00E-02

Hydraulic Conductivity (cm/sec): 7.21E-05

AP Engineering & Testing, Inc.

CONSTANT HEAD PERMEABILITY TEST

ASTM D2434

Project	Reid Gardner Wells		Tested by	KM	Date 03/06/12
Project No.	11-35120-01		Calculated by	KM	Date 03/22/12
Boring No.	BG-6D		Checked by	AP	Date 03/24/12
Sample No.	-	Depth (ft): 40.5-41			
Soil Description	Fine Sand w/silt		Max. Size:	N/A	

CONDITION OF SPECIMEN

				Before	After
Diameter	6.13	cm	Container No.		
Sample Area	29.55	cm^2	Wt. Wet Soil+Container(gms)	215.25	411.92
Length	7.62	cm	Wt. Dry Soil+Container(gms)	210.46	355.70
Weight Before	375.99	g	Wt. Container (gms)	50.31	147.60
Wet Density	104.22	pcf	Moisture, (%)	2.99	27.02
Dry Density	101.19	pcf			

Sample Type	Rings	Max. Dry Density (pcf)	N/A
	Mod. Cal.	Optimum Moisture (%)	N/A
		Relative Compaction (%)	N/A

PERMEABILITY DATA

Trial No.	Manometers		Head, h	Outflow	Time	Q/At	h/L	Temp.	k
	H1	H2	cm	Q, ml	sec			°c	cm/sec
1	23.5	21.3	2.2	25	218.4	0.0039	0.2887	18.9	1.34E-02
2	23.5	21.3	2.2	25	219.5	0.0039	0.2887	18.9	1.33E-02
3	23.5	19.2	4.3	25	103.5	0.0082	0.5643	18.9	1.45E-02
4	23.5	19.2	4.3	25	105.0	0.0081	0.5643	18.9	1.43E-02
5	23.5	18.2	5.3	25	84.6	0.0100	0.6955	18.9	1.44E-02
6	23.5	18.2	5.3	25	85.2	0.0099	0.6955	18.9	1.43E-02
7	23.5	16.9	6.6	25	67.2	0.0126	0.8661	18.9	1.45E-02
8	23.5	16.9	6.6	25	67.1	0.0126	0.8661	18.9	1.46E-02
9	23.5	15.7	7.8	25	56.5	0.0150	1.0236	18.9	1.46E-02
10	23.5	15.7	7.8	25	56.0	0.0151	1.0236	18.9	1.48E-02
						Corrected k_{20} (cm/sec) :			1.47E-02

AP Engineering & Testing, Inc.

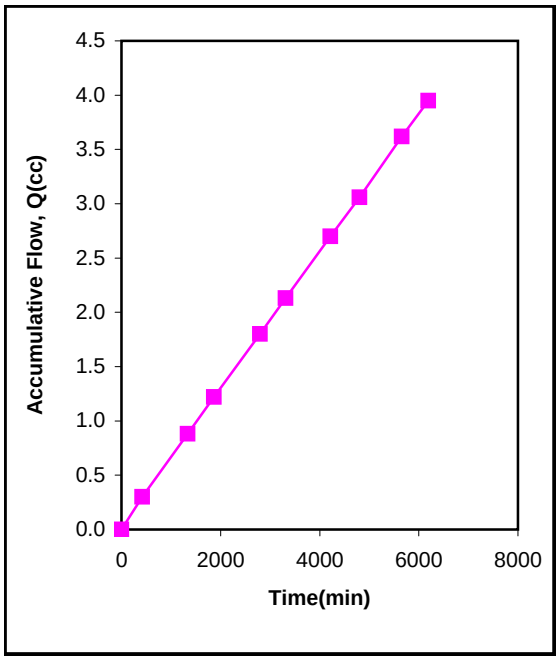
FLEXIBLE WALL HYDRAULIC CONDUCTIVITY TEST
ASTM D 5084

Project Name:	Reid Gardner Wells	Tested by	AP	Date	02/24/12
Project No.:	11-35120-01	Calculated by	KM	Date	03/22/12
Boring No.:	BG-6D	Checked by	AP	Date	03/23/12
Sample No.:	- Depth (ft.): 73-73.5				
Soil Description:	Silty Clay w/gravel				
Test Condition:	Mod Cal				
	Confining Pressure = 40 PSI				
Remarks:					

INITIAL CONDITION OF SPECIMEN

				Before	After
Diameter (d)	2.42	in			
Sample Area (A)	4.58	in²			
Length (L)	3.00	in	Container No.		
Weight Before	466.61	g	Wt. Wet Soil+Container(gms)	165.73	613.92
			Wt. Dry Soil+Container(gms)	147.07	538.6
Wet Density	129.34	pcf	Wt. Container (gms)	49.9	148.84
Dry Density	108.50	pcf	Moisture, (%)	19.20	19.32

TEST RESULTS



Time (min)	Flow Rdg (cm)	Burette Factor	Q (cc)	Head, h (psi)	h/L	Q/t (cc/s)
0	47.6	1	0.0	3.0	27.7	0
421	47.3	1	0.3	3.0	27.7	1.19E-05
1337	46.7	1	0.9	3.0	27.7	1.06E-05
1868	46.4	1	1.2	3.0	27.7	1.07E-05
2795	45.8	1	1.8	3.0	27.7	1.04E-05
3310	45.5	1	2.1	3.0	27.7	1.07E-05
4218	44.9	1	2.7	3.0	27.7	1.05E-05
4805	44.5	1	3.1	3.0	27.7	1.02E-05
5655	44.0	1	3.6	3.0	27.7	1.10E-05
6192	43.7	1	4.0	3.0	27.7	1.02E-05

Hydraulic Conductivity (cm/sec): 1.29E-08

AP Engineering & Testing, Inc.

CONSTANT HEAD PERMEABILITY TEST

ASTM D2434

Project	Reid Gardner Wells		Tested by	KM	Date 03/06/12
Project No.	11-35120-01		Calculated by	KM	Date 03/22/12
Boring No.	BG-6D		Checked by	AP	Date 03/24/12
Sample No.	-	Depth (ft): 80-80.5			
Soil Description	Fine Sand w/silt		Max. Size:	N/A	

CONDITION OF SPECIMEN

				Before	After
Diameter	6.13	cm	Container No.		
Sample Area	29.55	cm^2	Wt. Wet Soil+Container(gms)	125.29	449.84
Length	7.62	cm	Wt. Dry Soil+Container(gms)	111.88	384.09
Weight Before	470.84	g	Wt. Container (gms)	50.27	146.25
Wet Density	130.51	pcf	Moisture, (%)	21.77	27.64
Dry Density	107.18	pcf			

		Max. Dry Density (pcf)	N/A
Sample Type	Rings	Optimum Moisture (%)	N/A
	Mod. Cal.	Relative Compaction (%)	N/A

PERMEABILITY DATA

Trial No.	Manometers		Head, h	Outflow	Time	Q/At	h/L	Temp.	k
	H1	H2	cm	Q, ml	sec			°c	cm/sec
1	23.4	20.1	3.3	25	293.1	0.0029	0.4331	19.1	6.66E-03
2	23.4	20.1	3.3	25	293.3	0.0029	0.4331	19.1	6.66E-03
3	23.4	19.5	3.9	25	256.6	0.0033	0.5118	19.1	6.44E-03
4	23.4	19.5	3.9	25	256.8	0.0033	0.5118	19.1	6.44E-03
5	23.4	18.7	4.7	25	211.7	0.0040	0.6168	19.1	6.48E-03
6	23.4	18.7	4.7	25	211.6	0.0040	0.6168	19.1	6.48E-03
7	23.4	17.7	5.7	25	198.6	0.0043	0.7480	19.1	5.69E-03
8	23.4	17.7	5.7	25	198.7	0.0043	0.7480	19.1	5.69E-03
9	23.4	16.7	6.7	25	192.3	0.0044	0.8793	19.1	5.00E-03
10	23.4	16.7	6.7	25	192.2	0.0044	0.8793	19.1	5.01E-03
						Corrected k_{20} (cm/sec) :			6.19E-03

AP Engineering & Testing, Inc.

CONSTANT HEAD PERMEABILITY TEST

ASTM D2434

Project	Reid Gardner Wells	Tested by	KM	Date	03/06/12
Project No.	11-35120-01	Calculated by	KM	Date	03/22/12
Boring No.	BG-6D	Checked by	AP	Date	03/24/12
Sample No.	-	Depth (ft):	100.5-101		
Soil Description	Fine Sand w/silt	Max. Size:	N/A		

CONDITION OF SPECIMEN

				Before	After
Diameter	6.13	cm	Container No.		
Sample Area	29.55	cm^2	Wt. Wet Soil+Container(gms)	176.82	537.09
Length	7.62	cm	Wt. Dry Soil+Container(gms)	156.69	465.38
Weight Before	443.57	g	Wt. Container (gms)	50.27	180.60
Wet Density	122.95	pcf	Moisture, (%)	18.92	25.18
Dry Density	103.39	pcf			

Sample Type	Rings	Max. Dry Density (pcf)	N/A
	Mod. Cal.	Optimum Moisture (%)	N/A
		Relative Compaction (%)	N/A

PERMEABILITY DATA

Trial No.	Manometers		Head, h	Outflow	Time	Q/At	h/L	Temp.	k
	H1	H2	cm	Q, ml	sec			°c	cm/sec
1	35.5	18.0	17.5	10	127.7	0.0026	2.2966	19.8	1.15E-03
2	35.5	18.0	17.5	10	125.7	0.0027	2.2966	19.8	1.17E-03
3	35.5	17.1	18.4	10	119.8	0.0028	2.4147	19.8	1.17E-03
4	35.5	17.1	18.4	10	119.5	0.0028	2.4147	19.8	1.17E-03
5	35.5	15.9	19.6	10	117.2	0.0029	2.5722	19.8	1.12E-03
6	35.5	15.9	19.6	10	117.7	0.0029	2.5722	19.8	1.12E-03
7	35.5	13.8	21.7	10	104.9	0.0032	2.8478	19.8	1.13E-03
8	35.5	13.8	21.7	10	104.4	0.0032	2.8478	19.8	1.14E-03
9	35.5	11.8	23.7	10	94.7	0.0036	3.1102	19.8	1.15E-03
10	35.5	11.8	23.7	10	94.2	0.0036	3.1102	19.8	1.15E-03
Corrected k_{20} (cm/sec) :									1.15E-03

AP Engineering & Testing, Inc.

CONSTANT HEAD PERMEABILITY TEST

ASTM D2434

Project	Reid Gardner Wells		Tested by	KM	Date 03/06/12
Project No.	11-35120-01		Calculated by	KM	Date 03/22/12
Boring No.	BG-6D		Checked by	AP	Date 03/24/12
Sample No.	-	Depth (ft): 121-121.5			
Soil Description	Fine Sand w/silt		Max. Size:	N/A	

CONDITION OF SPECIMEN

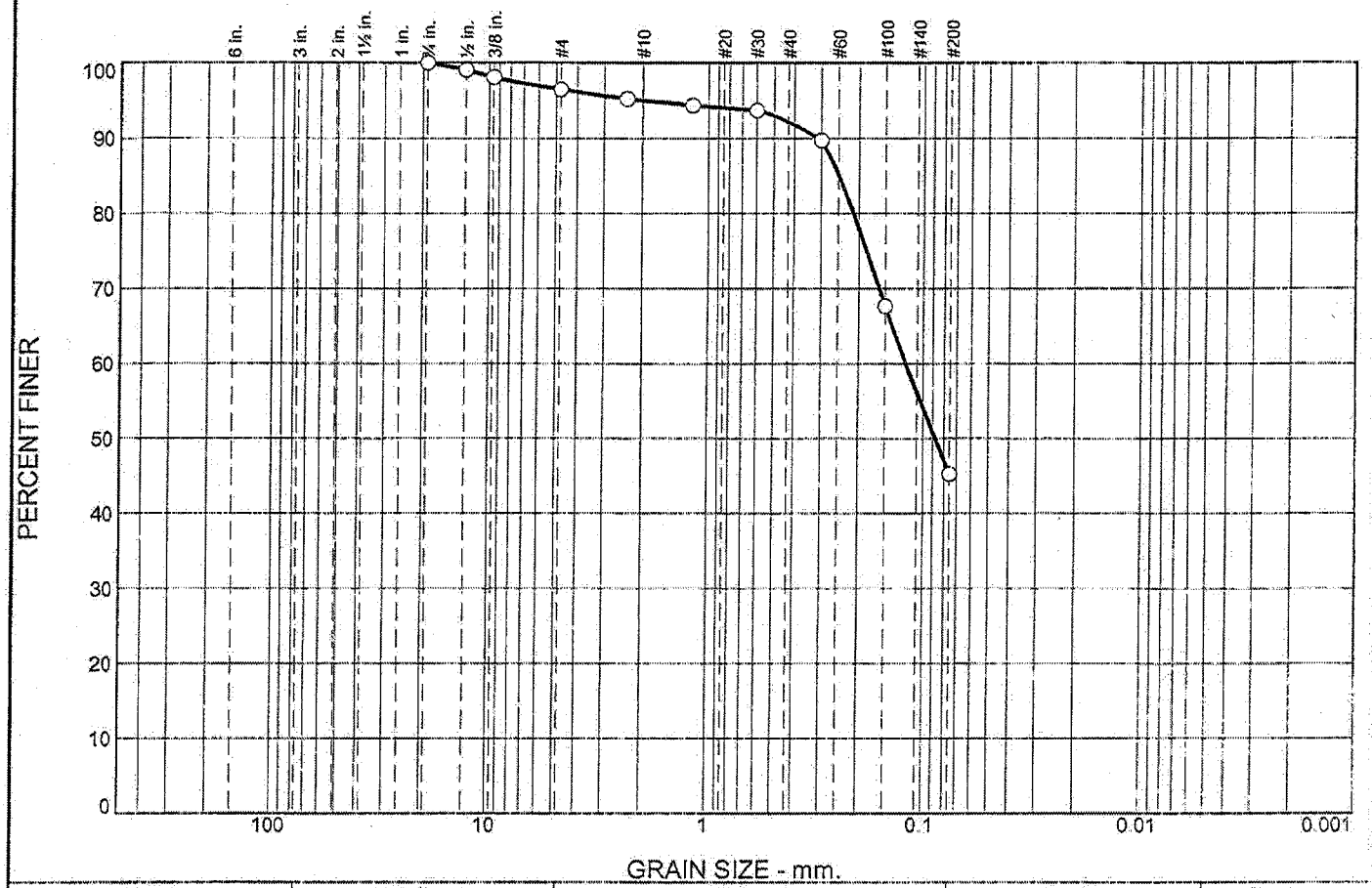
				Before	After
Diameter	6.13	cm	Container No.		
Sample Area	29.55	cm^2	Wt. Wet Soil+Container(gms)	182.74	589.10
Length	7.62	cm	Wt. Dry Soil+Container(gms)	158.52	508.57
Weight Before	455.79	g	Wt. Container (gms)	49.95	148.53
Wet Density	126.34	pcf	Moisture, (%)	22.31	22.37
Dry Density	103.29	pcf			

Sample Type	Rings	Max. Dry Density (pcf)	N/A
	Mod. Cal.	Optimum Moisture (%)	N/A
		Relative Compaction (%)	N/A

PERMEABILITY DATA

Trial No.	Manometers		Head, h	Outflow	Time	Q/At	h/L	Temp.	k
	H1	H2	cm	Q, ml	sec			°c	cm/sec
1	96.8	19.0	77.8	10	1083.4	0.0003	10.2100	20	3.06E-05
2	96.8	17.0	79.8	10	1047.1	0.0003	10.4724	20	3.09E-05
3	96.8	15.2	81.6	10	1000.0	0.0003	10.7087	20	3.16E-05
4	96.8	13.2	83.6	10	988.8	0.0003	10.9711	20	3.12E-05
5	96.8	11.1	85.7	10	949.2	0.0004	11.2467	20	3.17E-05
6	96.8	9.2	87.6	10	936.8	0.0004	11.4961	20	3.14E-05
Corrected k_{20} (cm/sec) :									3.12E-05

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	3.5	51.3	45.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	99.0		
3/8"	98.1		
#4	96.5		
#8	95.2		
#16	94.3		
#30	93.7		
#50	89.7		
#100	67.6		
#200	45.2		

* (no specification provided)

Material Description

Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.3130 D_{85}= 0.2480 D_{60}= 0.1200
D_{50}= 0.0876 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Source of Sample: BG-6D **Depth:** 19-22

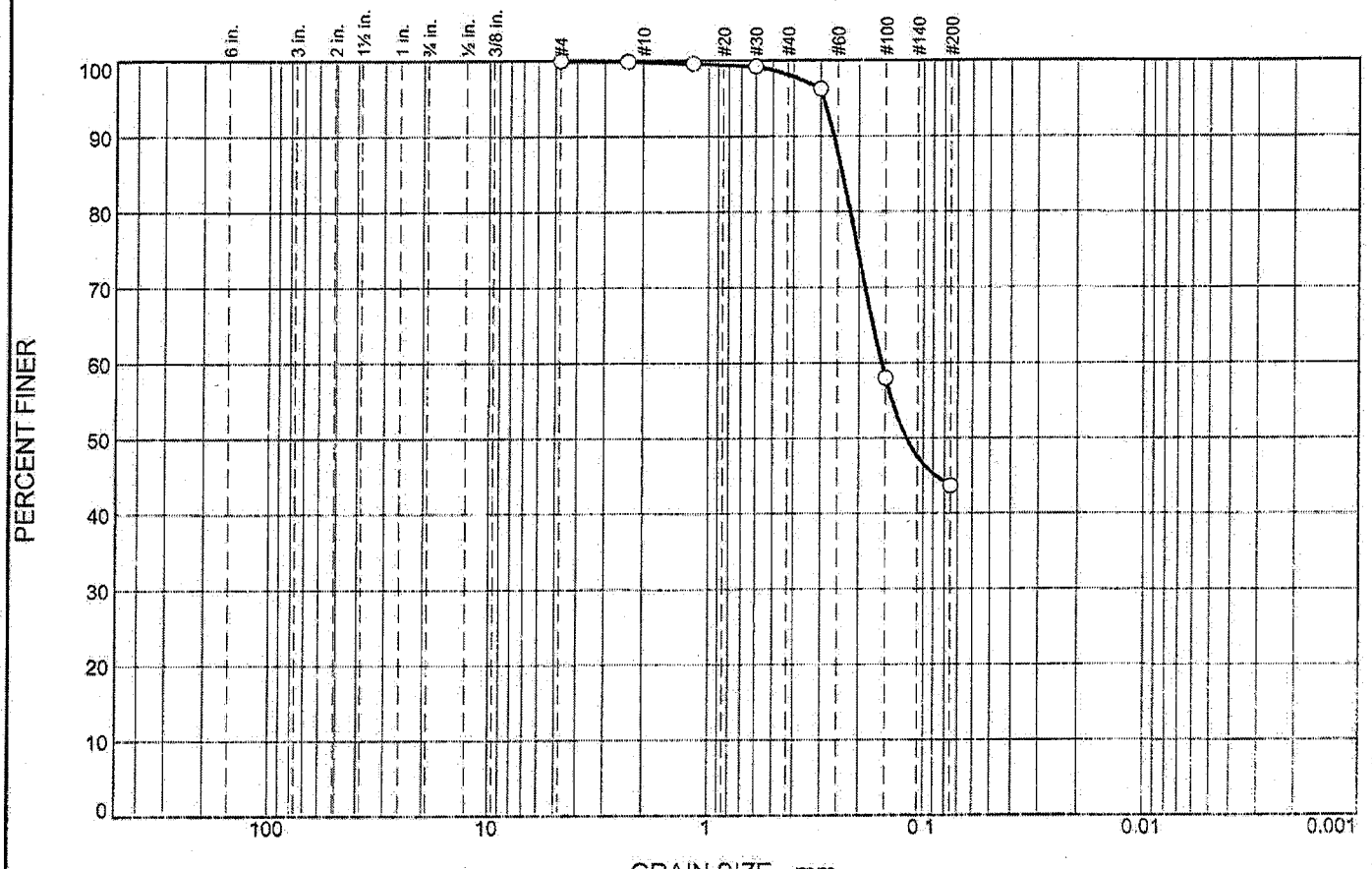
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.0	56.4	43.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	99.9		
#16	99.6		
#30	99.2		
#50	96.3		
#100	58.0		
#200	43.6		

* (no specification provided)

Material Description

Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.2599 D_{85}= 0.2374 D_{60}= 0.1564
D_{50}= 0.1196 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Source of Sample: BG-6D **Depth:** 40-42

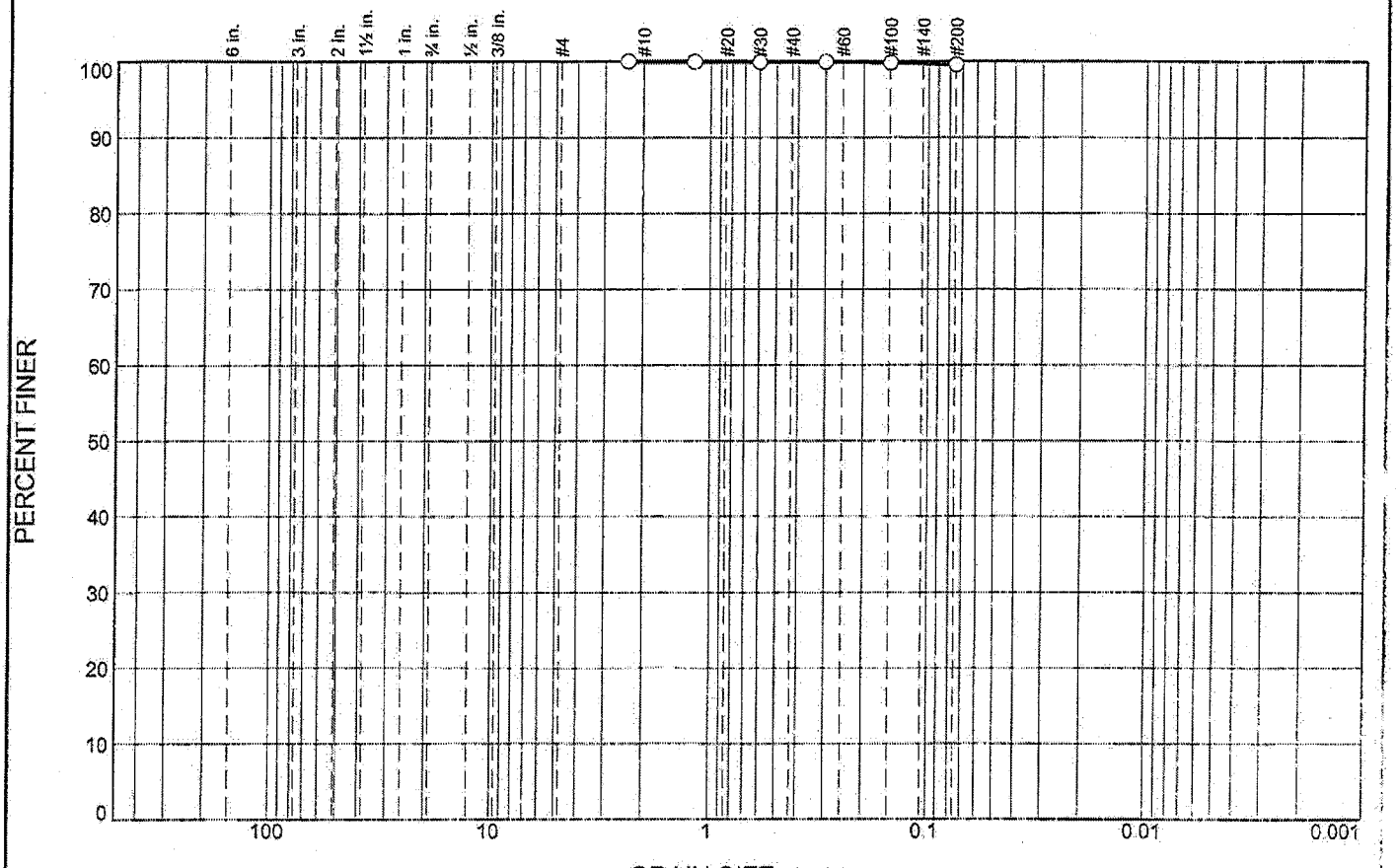
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.0	0.4	99.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#8	100.0		
#16	100.0		
#30	100.0		
#50	99.9		
#100	99.8		
#200	99.6		

* (no specification provided)

Material Description

Fat Clay

Atterberg Limits

PL= 23 LL= 63 PI= 40

Coefficients

D_{90}= D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(46)

Remarks

Source of Sample: BG-6D **Depth:** 72-74

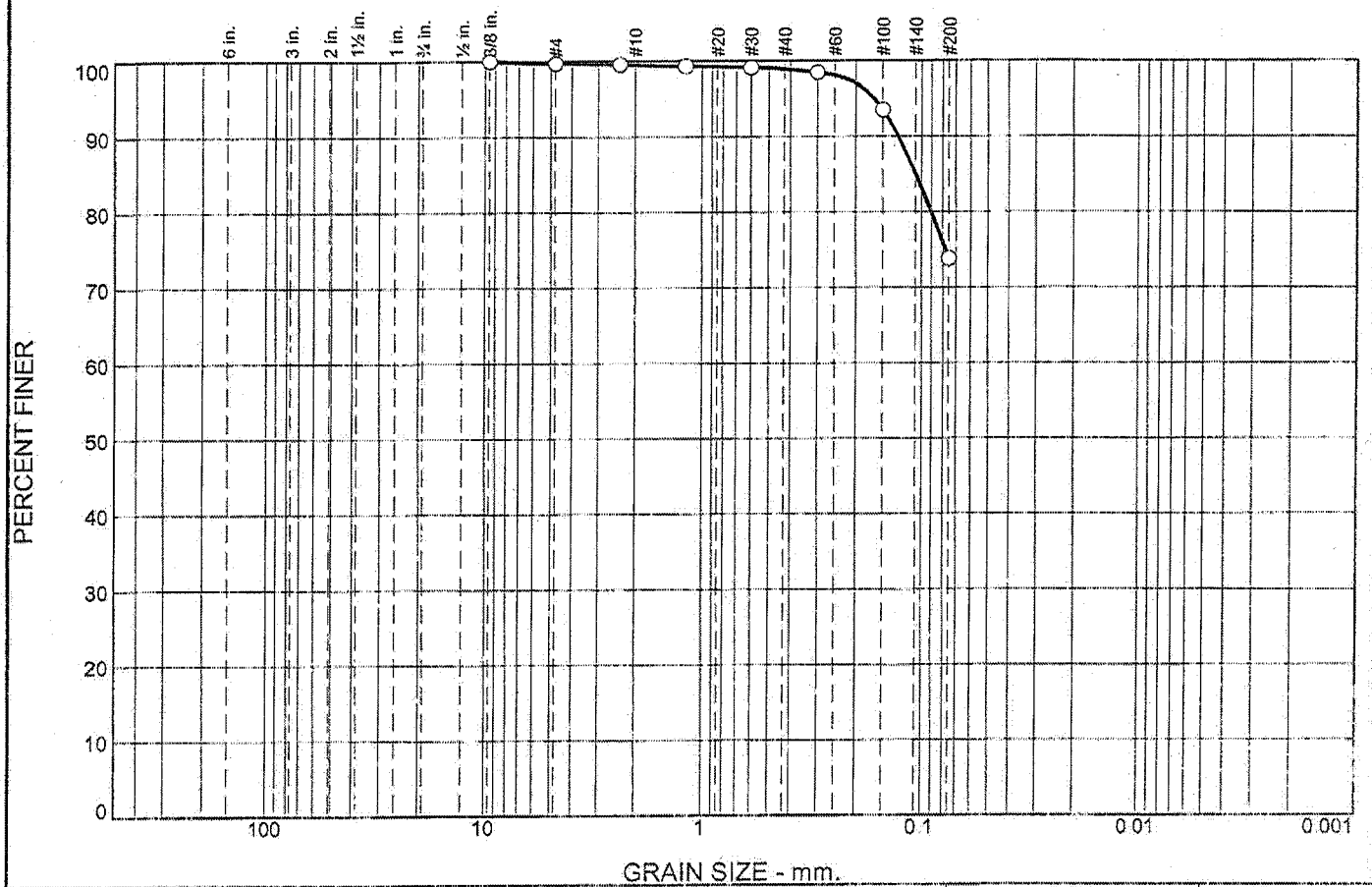
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.3	25.9	73.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	99.7		
#8	99.6		
#16	99.3		
#30	99.2		
#50	98.5		
#100	93.5		
#200	73.8		

* (no specification provided)

Material Description

Lean Clay with Sand

Atterberg Limits

PL= 16 LL= 33 PI= 17

Coefficients

D_{90}= 0.1272 D_{85}= 0.1060 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(11)

Remarks

Source of Sample: BG-6D **Depth:** 79-82

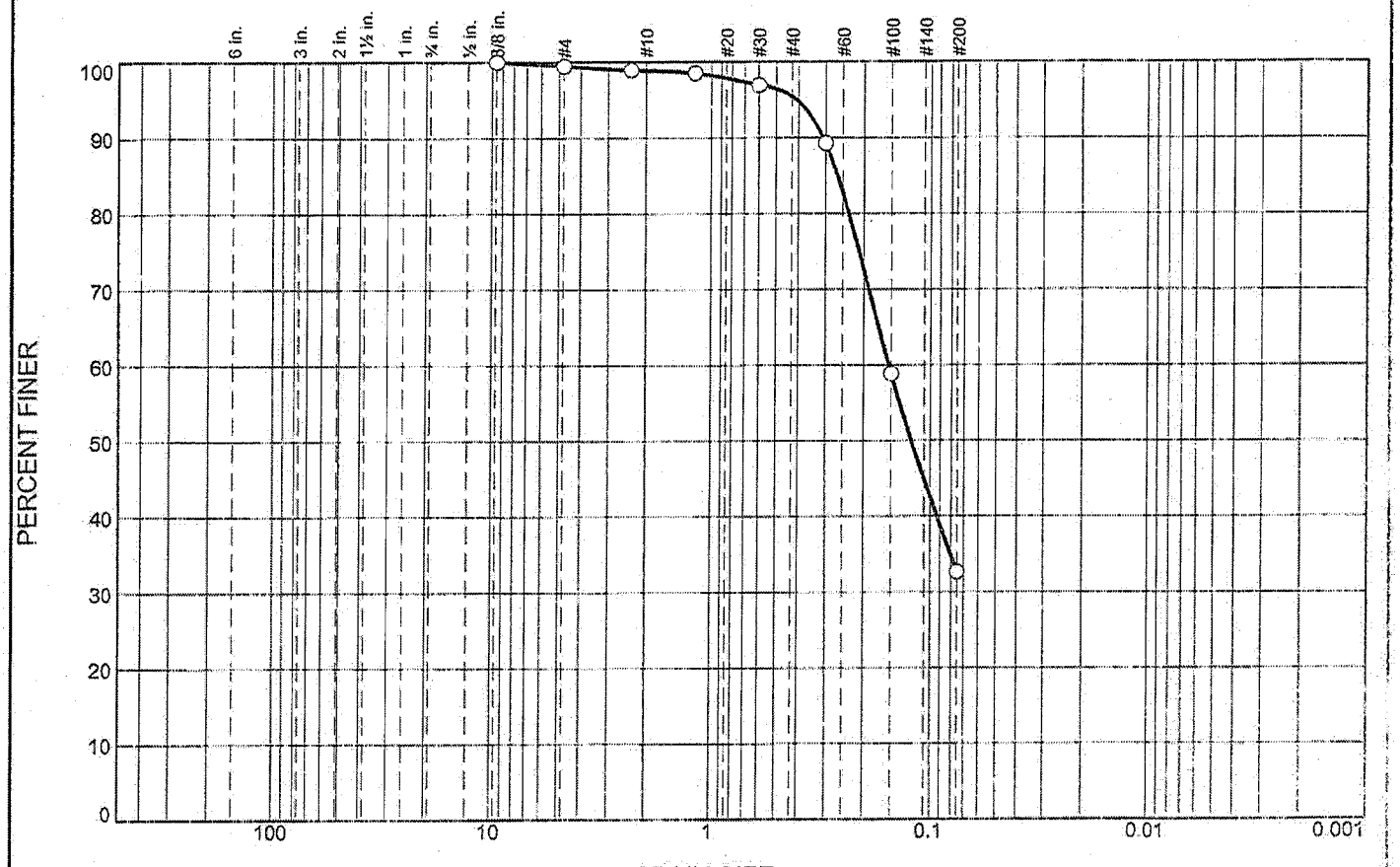
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.5	66.9	32.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	99.5		
#8	98.9		
#16	98.5		
#30	97.0		
#50	89.2		
#100	58.8		
#200	32.6		

* (no specification provided)

Material Description

Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.3084 D_{85}= 0.2648 D_{60}= 0.1539
D_{50}= 0.1218 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Source of Sample: BG-6D **Depth:** 99-102

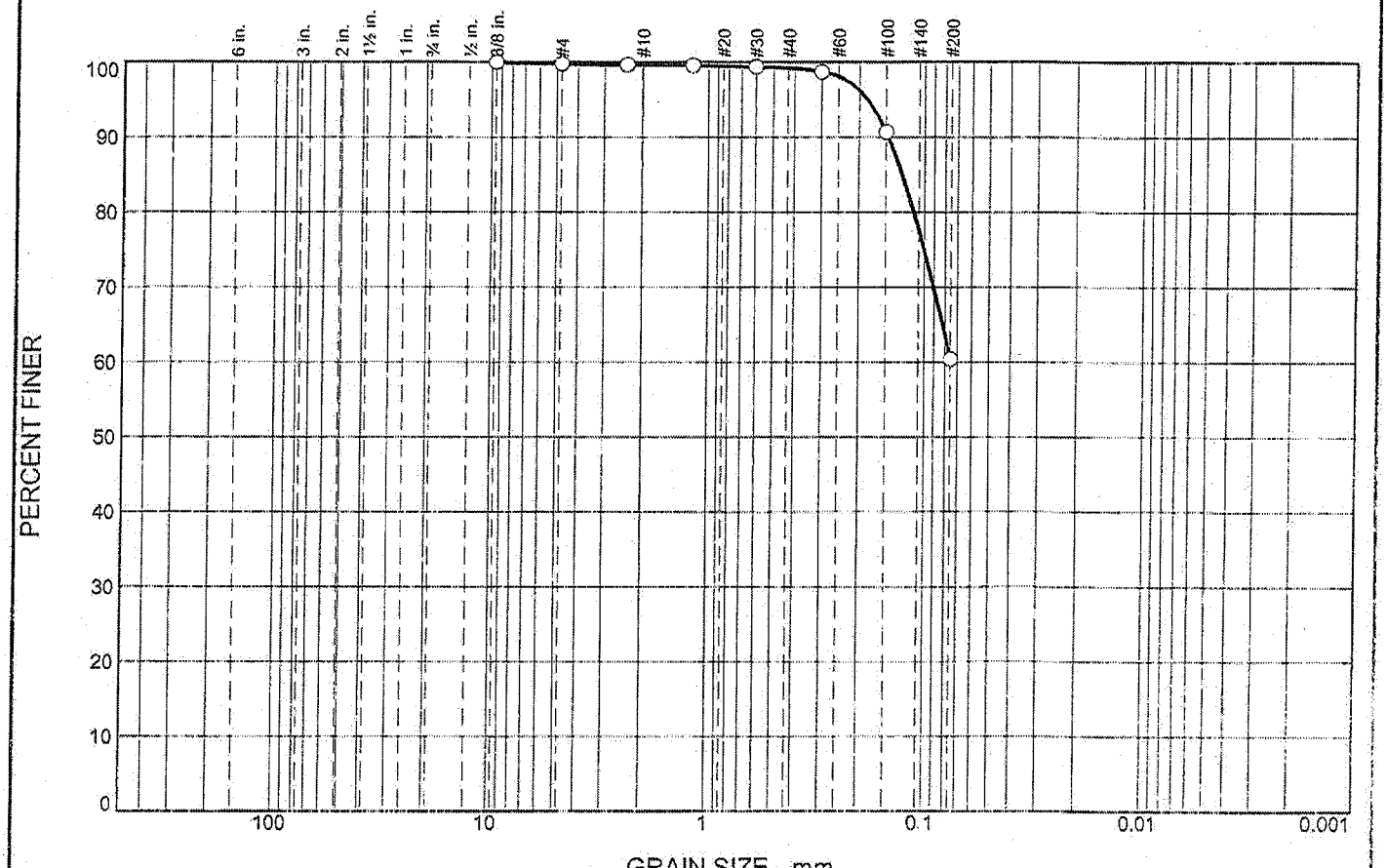
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand	% Silt	% Clay
0.0	0.2	39.4	60.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	99.8		
#8	99.7		
#16	99.6		
#30	99.4		
#50	98.7		
#100	90.7		
#200	60.4		

* (no specification provided)

Material Description

Sandy Silt

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.1466 D_{85}= 0.1266 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Source of Sample: BG-6D **Depth:** 119-122

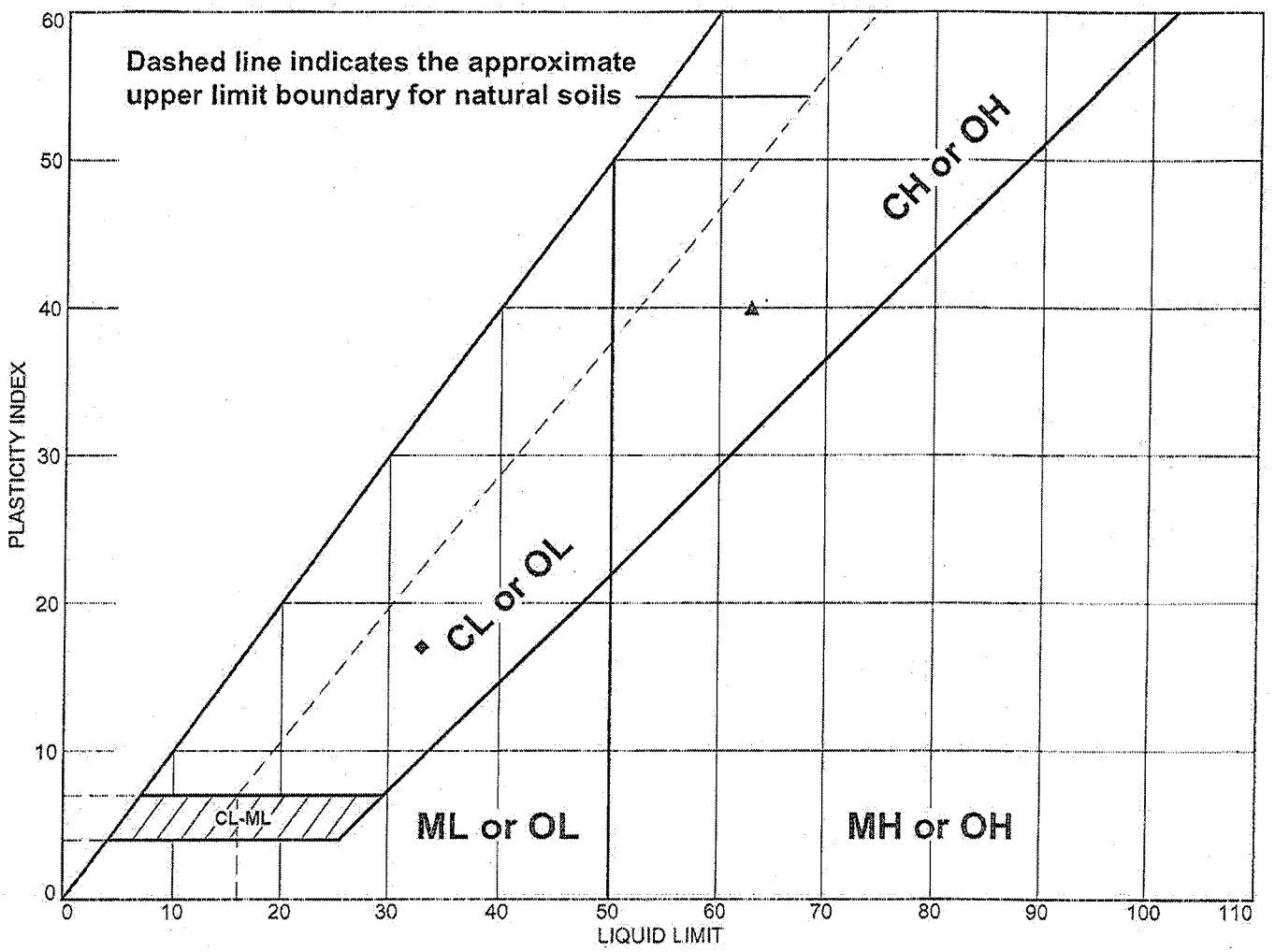
Date:

CONVERSE CONSULTANTS

Client: NV Energy
Project: REPLACEMENT WELLS

Project No: 11-35120-01 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Silty Sand	NV	NP	NP	92.1	45.2	SM
■	Silty Sand	NV	NP	NP	98.1	43.6	SM
▲	Fat Clay	63	23	40	99.9	99.6	CH
◆	Lean Clay with Sand	33	16	17	98.9	73.8	CL
▼	Silty Sand	NV	NP	NP	95.4	32.6	SM

Project No. 11-35120-01 **Client:** NV Energy

Project: REPLACEMENT WELLS

● **Source of Sample:** BG-6D **Depth:** 19-22
■ **Source of Sample:** BG-6D **Depth:** 40-42
▲ **Source of Sample:** BG-6D **Depth:** 72-74
◆ **Source of Sample:** BG-6D **Depth:** 79-82
▼ **Source of Sample:** BG-6D **Depth:** 99-102

Remarks:

Converse Consultants

Figure

Appendix F

Statistical Calculations

Soil Histograms

Histograms for clay vs. non-clay
Histograms for 0 - 20 ft. vs. > 20 ft.
Histograms for undifferentiated populations

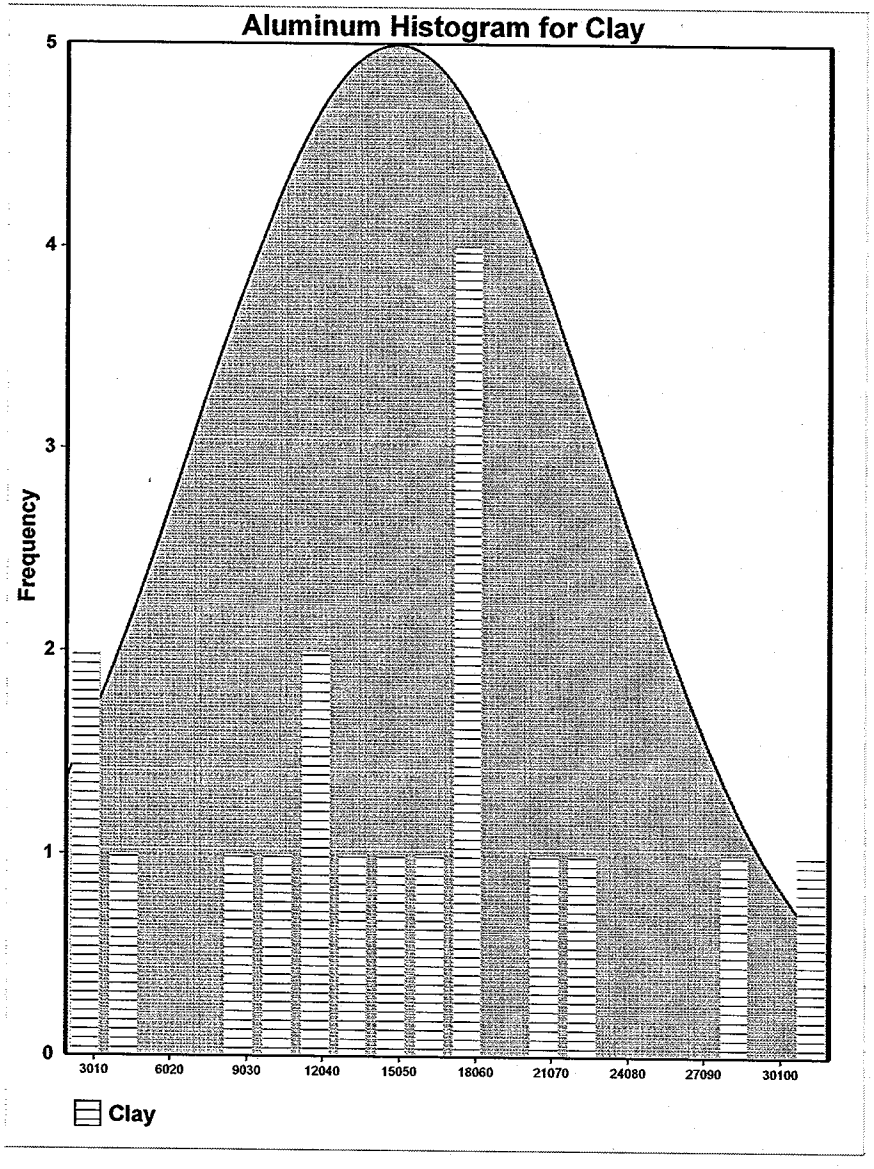
Groundwater Histograms

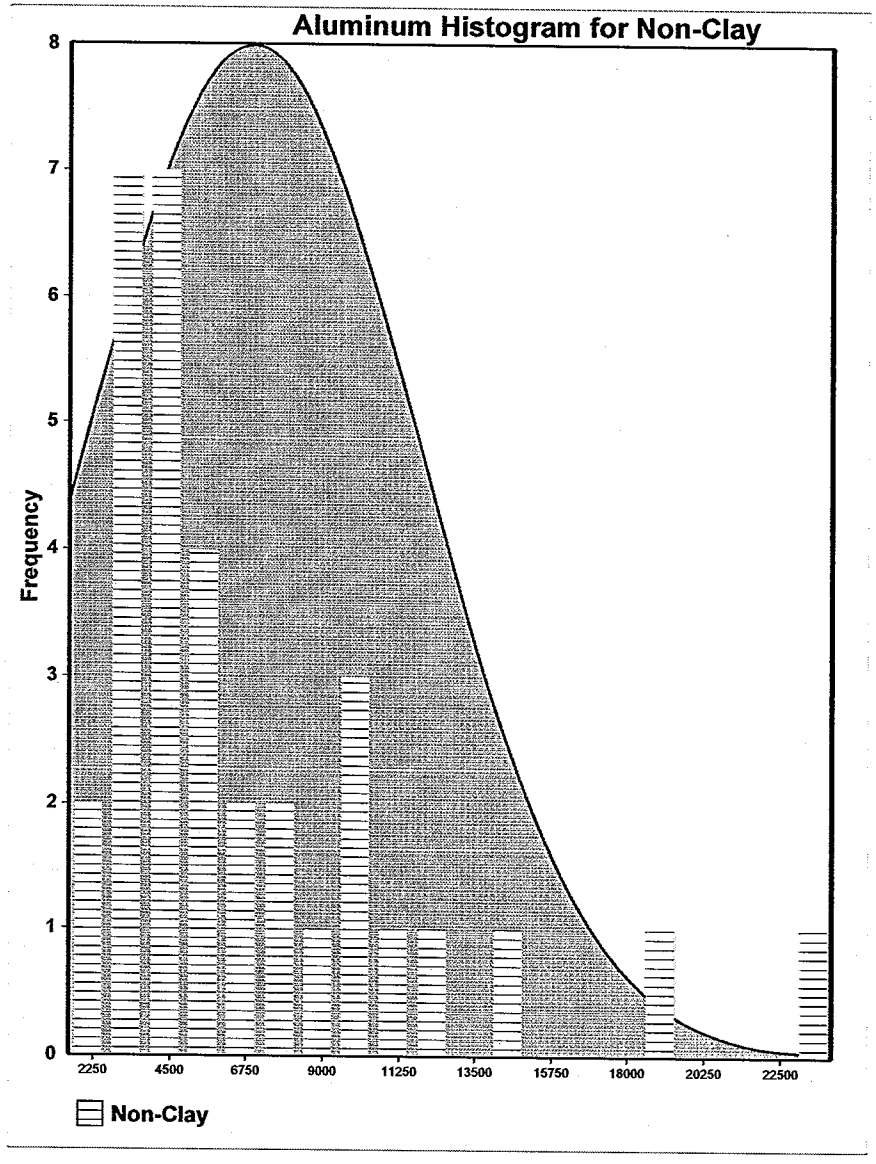
Histograms for three distinct populations
Histograms for undifferentiated populations

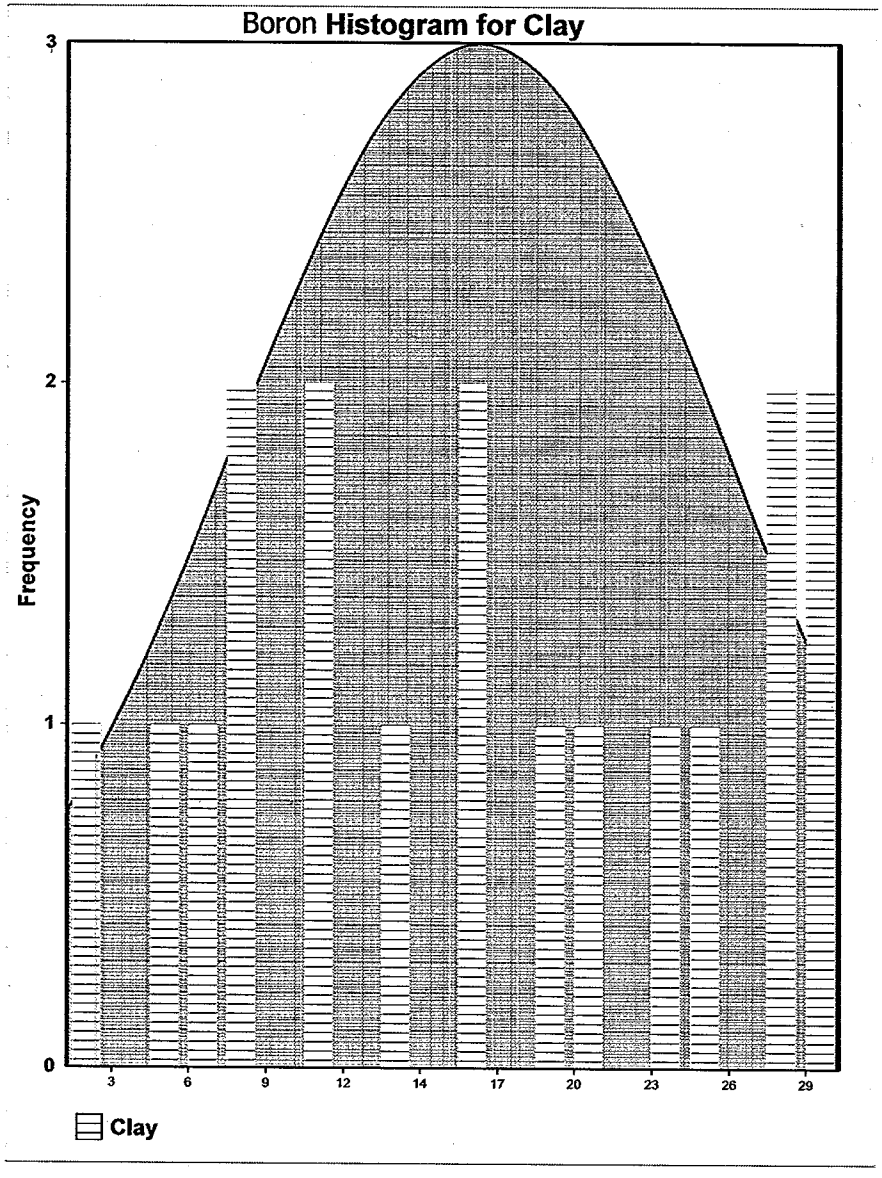
Analytical results prior to 2012 that were used for groundwater modeling are included electronically at the end of this report and were reported in the following documents:

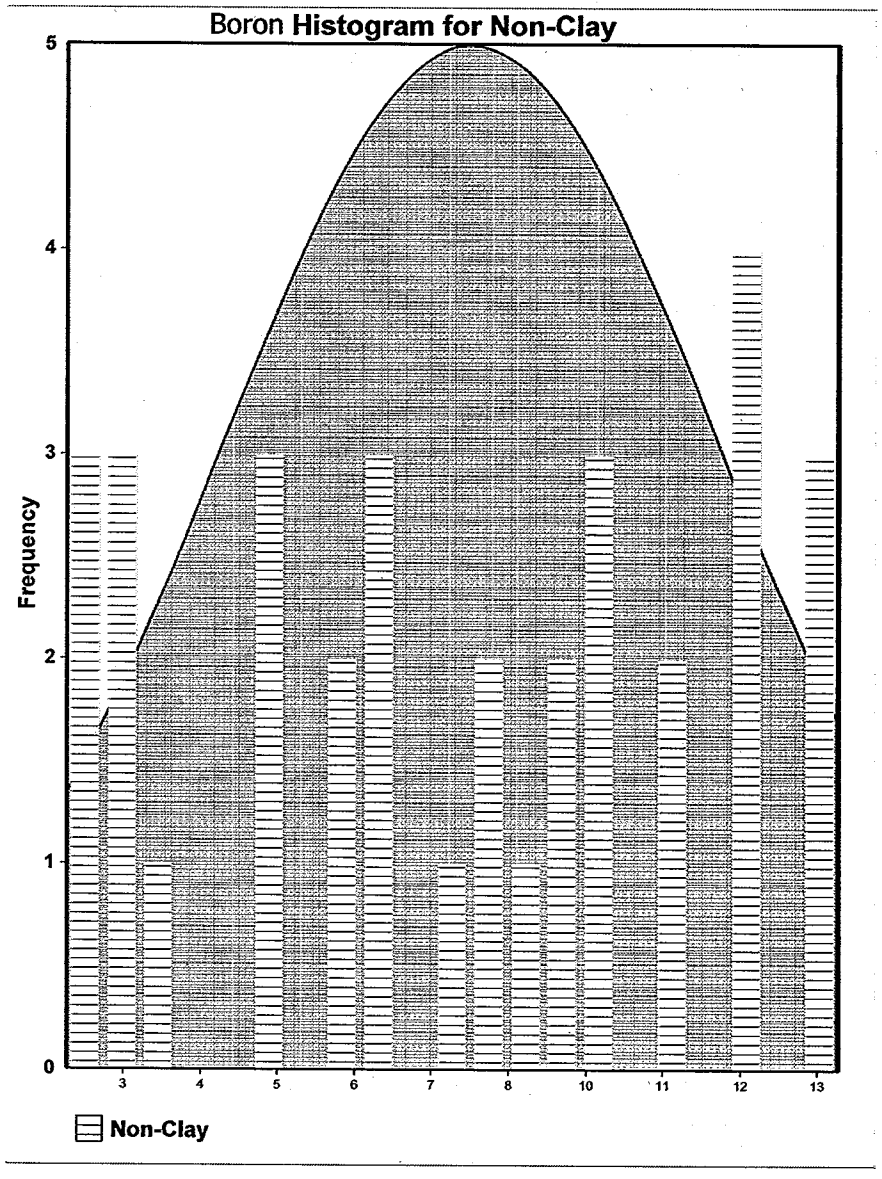
Sample Date	**Document**
March, 2008	NVE, 2008a. *First Quarter 2008 Groundwater Monitoring and Remediation Report,* May, 2008.
June, 2008	NVE, 2008b. *Second Quarter 2008 Groundwater Monitoring and Remediation Report,* August, 2008.
September, 2008	NVE, 2008c. *Third Quarter 2008 Groundwater Monitoring and Remediation Report,* November, 2008.
December, 2008	NVE, 2009a. *Fourth Quarter 2008 Groundwater Monitoring and Remediation Report,* February, 2009.
March, 2009	NVE, 2009b. *First Quarter 2009 Groundwater Monitoring and Remediation Report,* May, 2009.
June, 2009	NVE, 2009c. *Second Quarter 2009 Groundwater Monitoring and Remediation Report,* August, 2009.
September, 2009	NVE, 2009d. *Third Quarter 2009 Groundwater Monitoring and Remediation Report,* November, 2009.
December, 2009	NVE, 2010b. *Fourth Quarter 2009 Groundwater Monitoring and Remediation Report,* March, 2010.
March, 2010	NVE, 2010c *First Quarter 2010 Groundwater Monitoring and Remediation Report,* May, 2010.
June, 2010	NVE, 2010d. *Second Quarter 2010 Groundwater Monitoring and Remediation Report,* August, 2010.
September, 2010	NVE, 2010e. *Third Quarter 2010 Groundwater Monitoring and Remediation Report,* November, 2010.
December, 2010	NVE, 2011a. *Fourth Quarter 2010 Groundwater Monitoring and Remediation Report,* February 2011.
March, 2011	NVE, 2011b. *First Quarter 2011 Groundwater Monitoring and Remediation Report,* May, 2011.
June, 2011	NVE, 2011c. *Second Quarter 2011 Groundwater Monitoring and Remediation Report,* August, 2011.
September, 2011	NVE, 2011d. *Third Quarter 2011 Groundwater Monitoring and Remediation Report,* November, 2011.
December, 2011	NVE, 2012. *Fourth Quarter 2011 Groundwater Monitoring and Remediation Report,* February 2012.

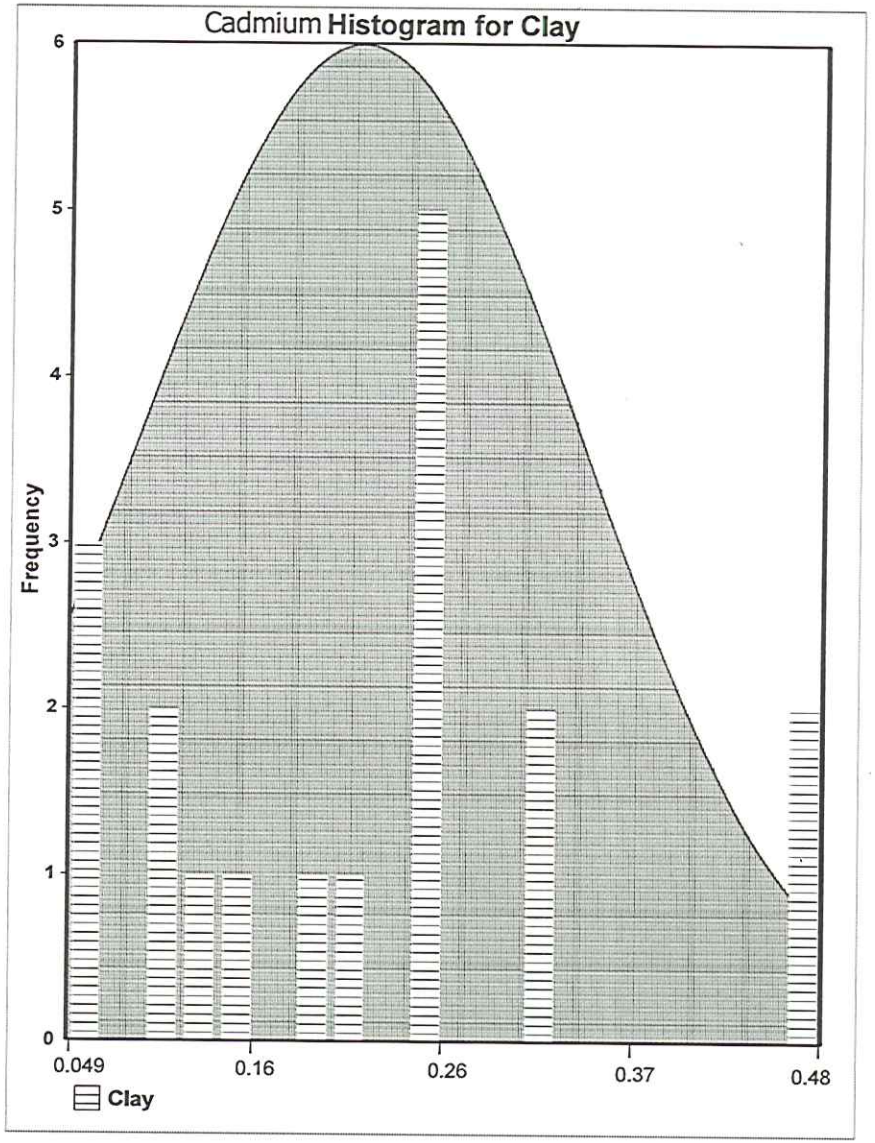
Soil

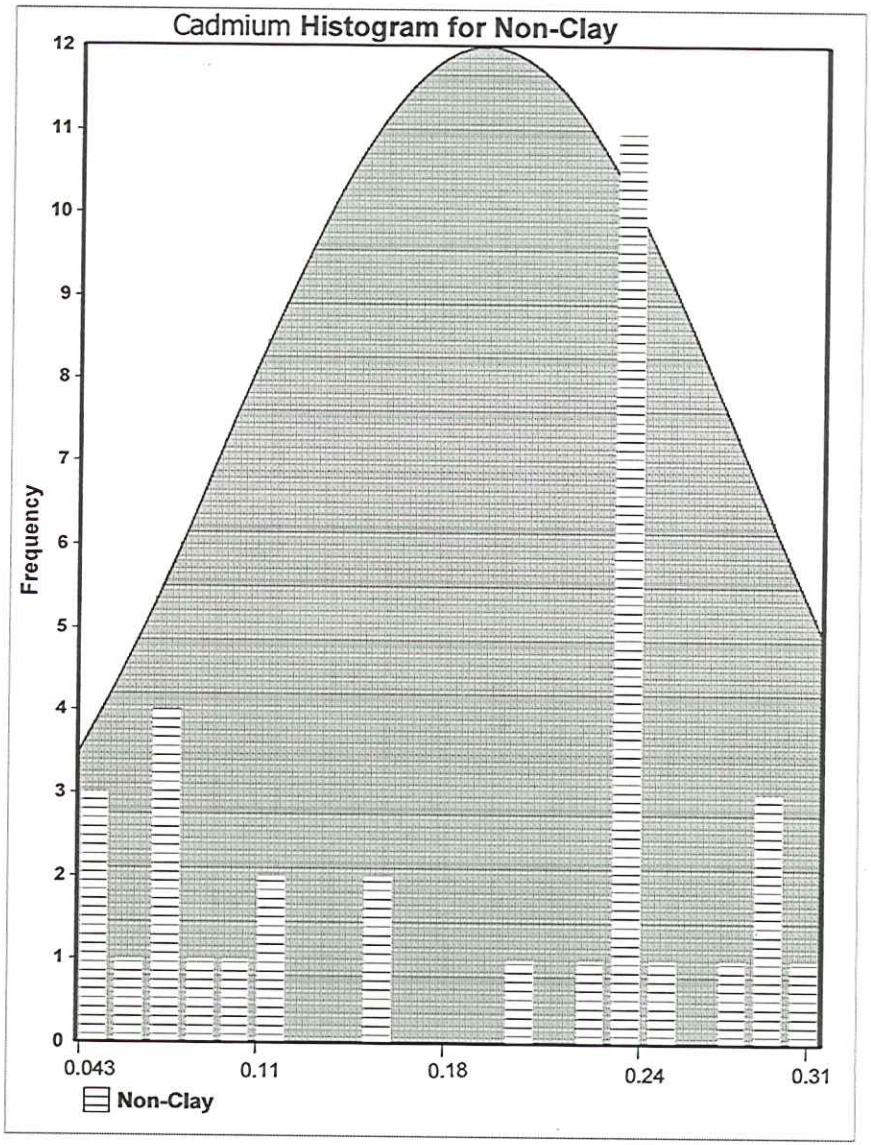

Aluminum Histogram for Clay
Frequency
0
1
2
3
4
5
3010
6020
9030
12040
15050
18060
21070
24080
27090
30100
Clay


Aluminum Histogram for Non-Clay
Frequency
0
1
2
3
4
5
6
7
8
2250
4500
6750
9000
11250
13500
15750
18000
20250
22500
Non-Clay

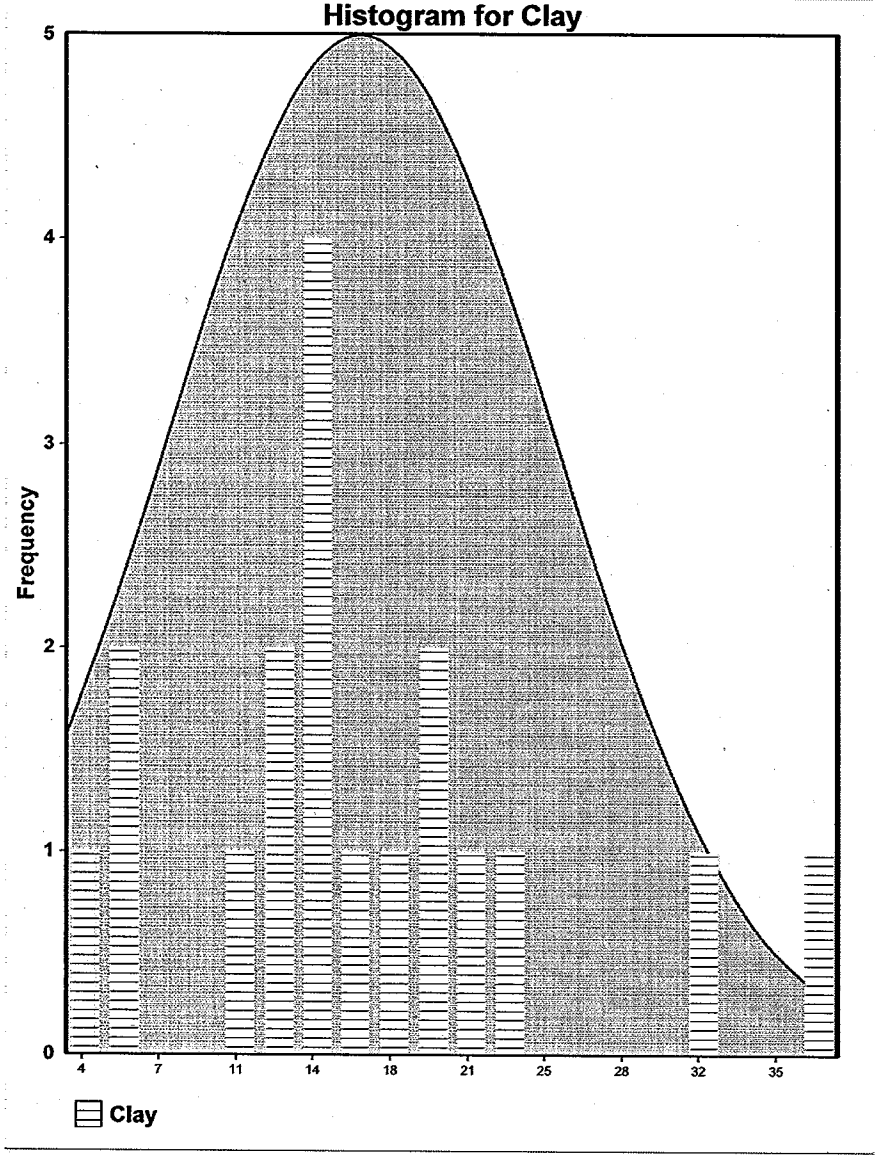

Boron Histogram for Clay
Frequency
0
1
2
3
3
6
9
12
14
17
20
23
26
29
Clay


Boron Histogram for Non-Clay
Frequency
0
1
2
3
4
5
3
4
5
6
7
8
10
11
12
13
Non-Clay

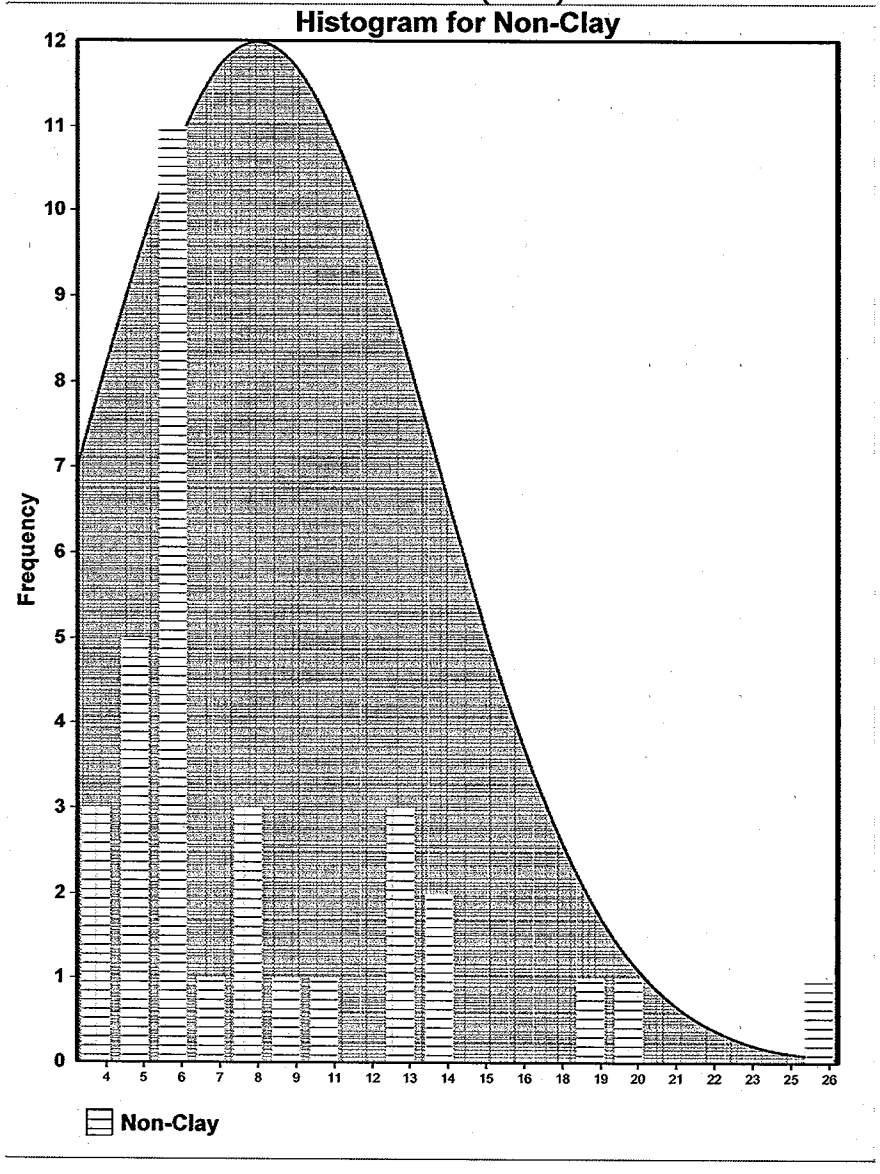

Cadmium Histogram for Clay
Frequency
0
1
2
3
4
5
6
0.049
0.16
0.26
0.37
0.48
Clay

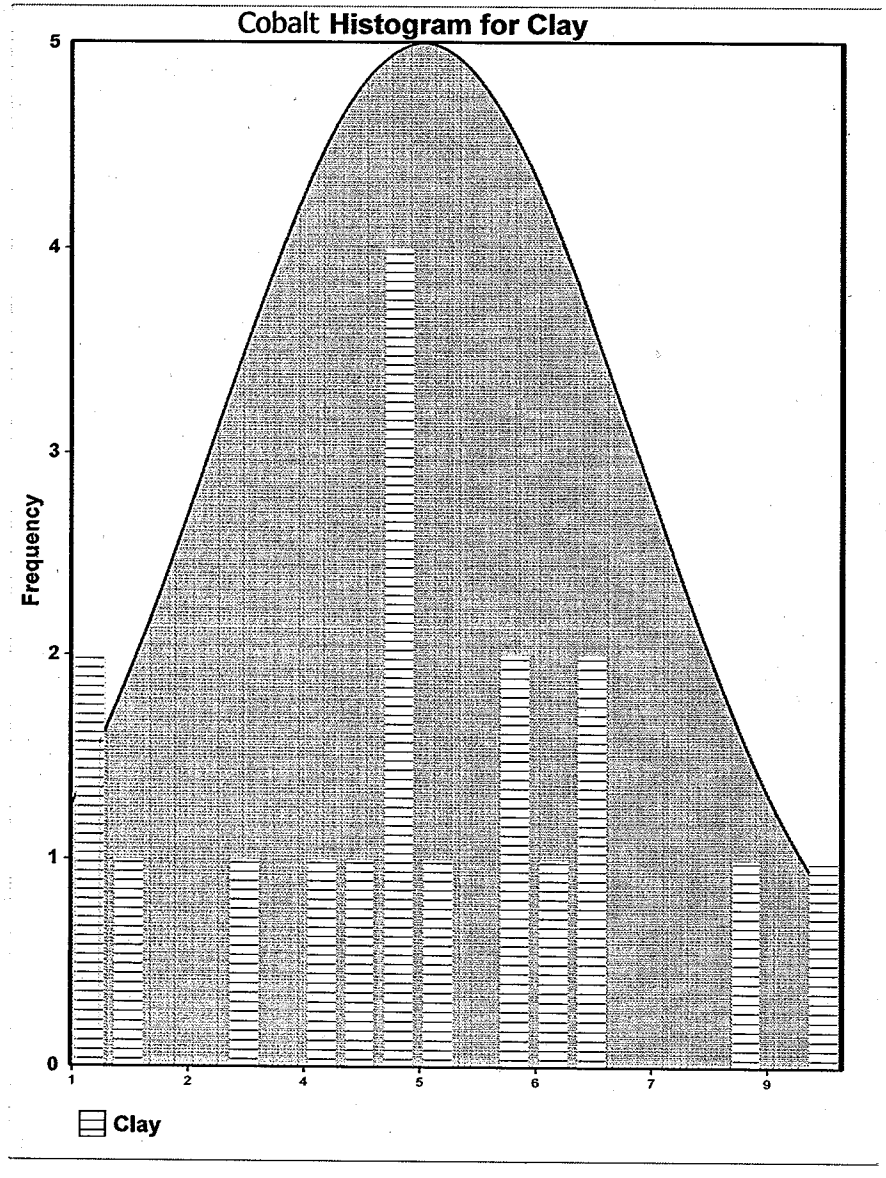

Cadmium Histogram for Non-Clay
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
0.043
0.11
0.18
0.24
0.31
Non-Clay

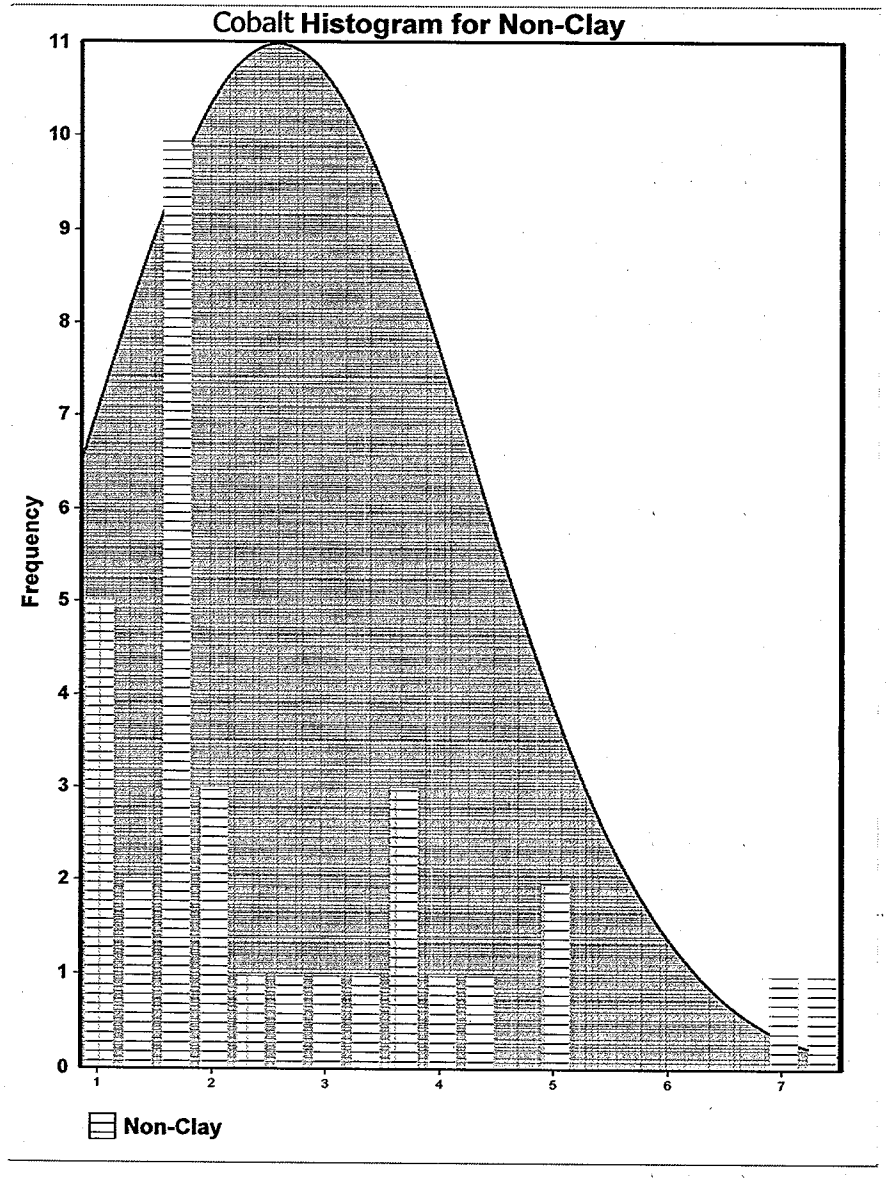
Chromium (Total)

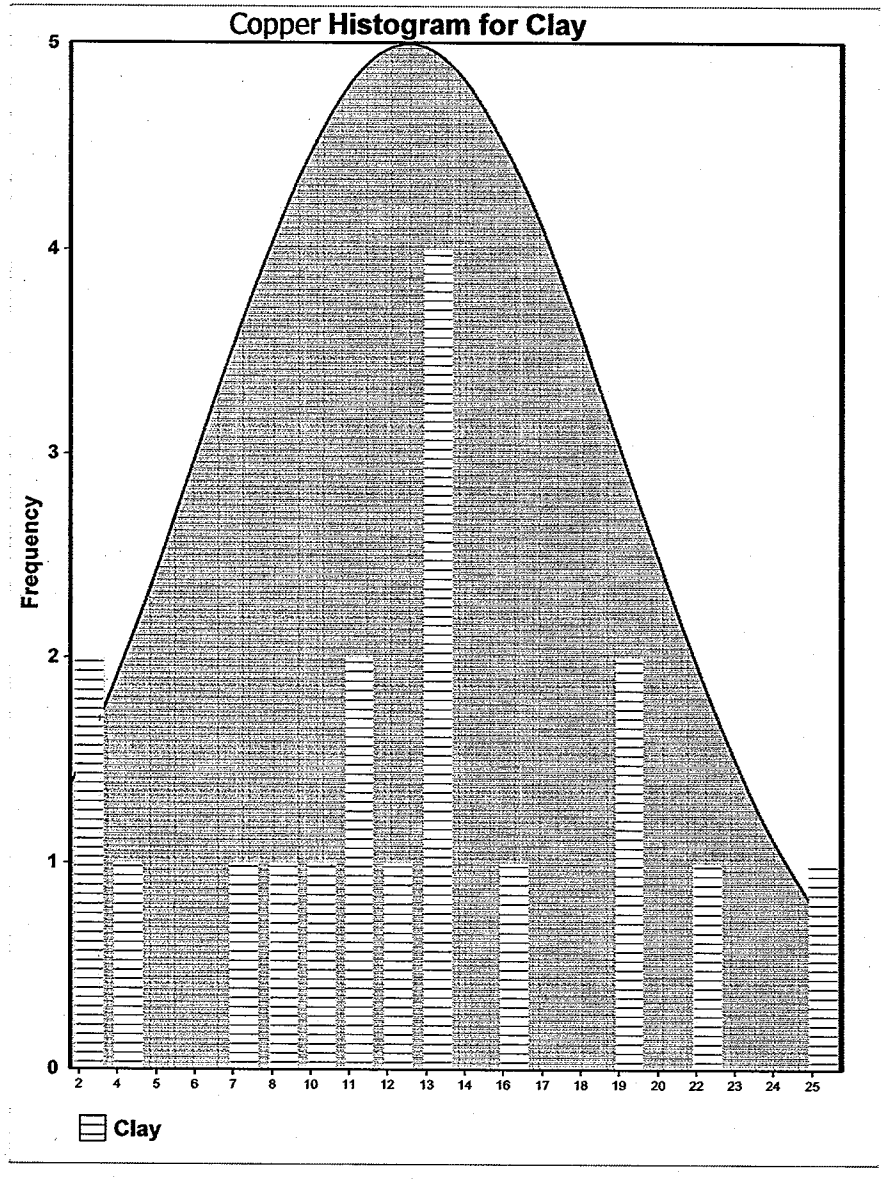


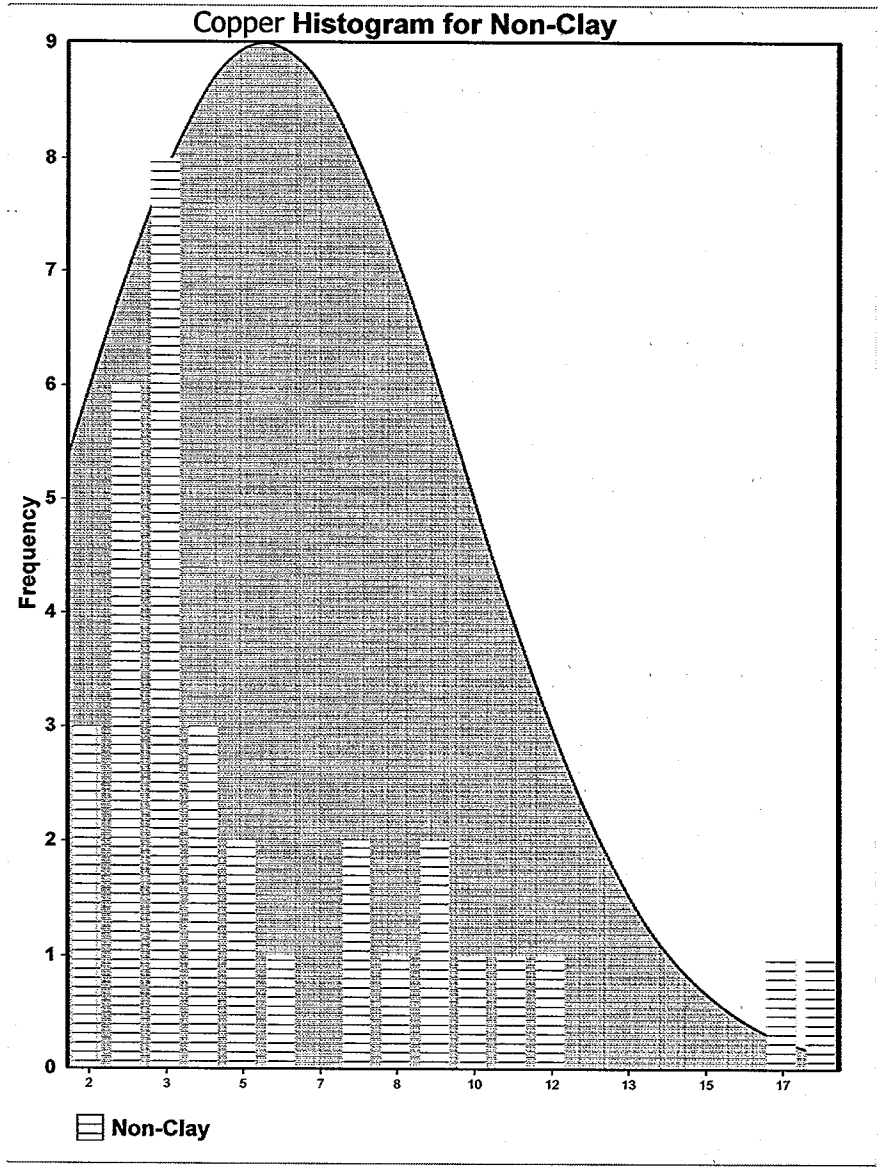
Chromium (Total)

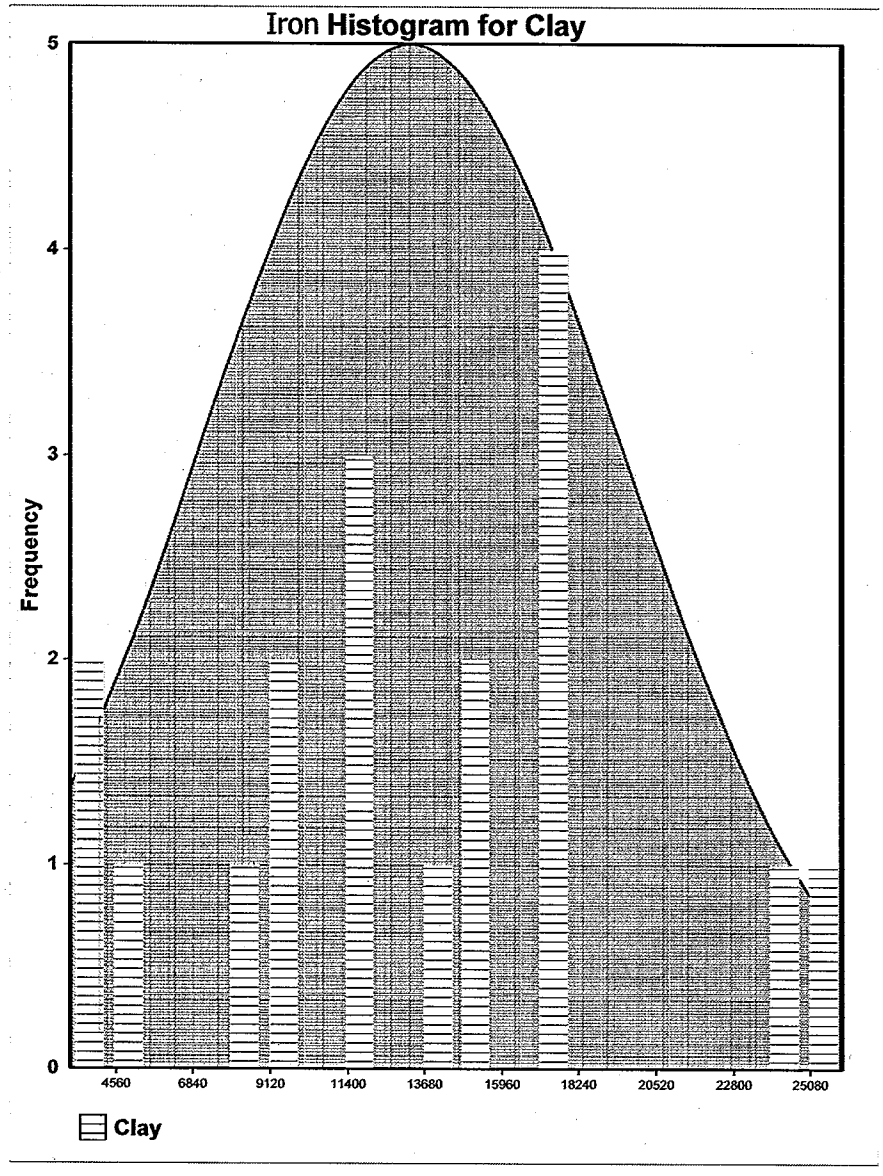


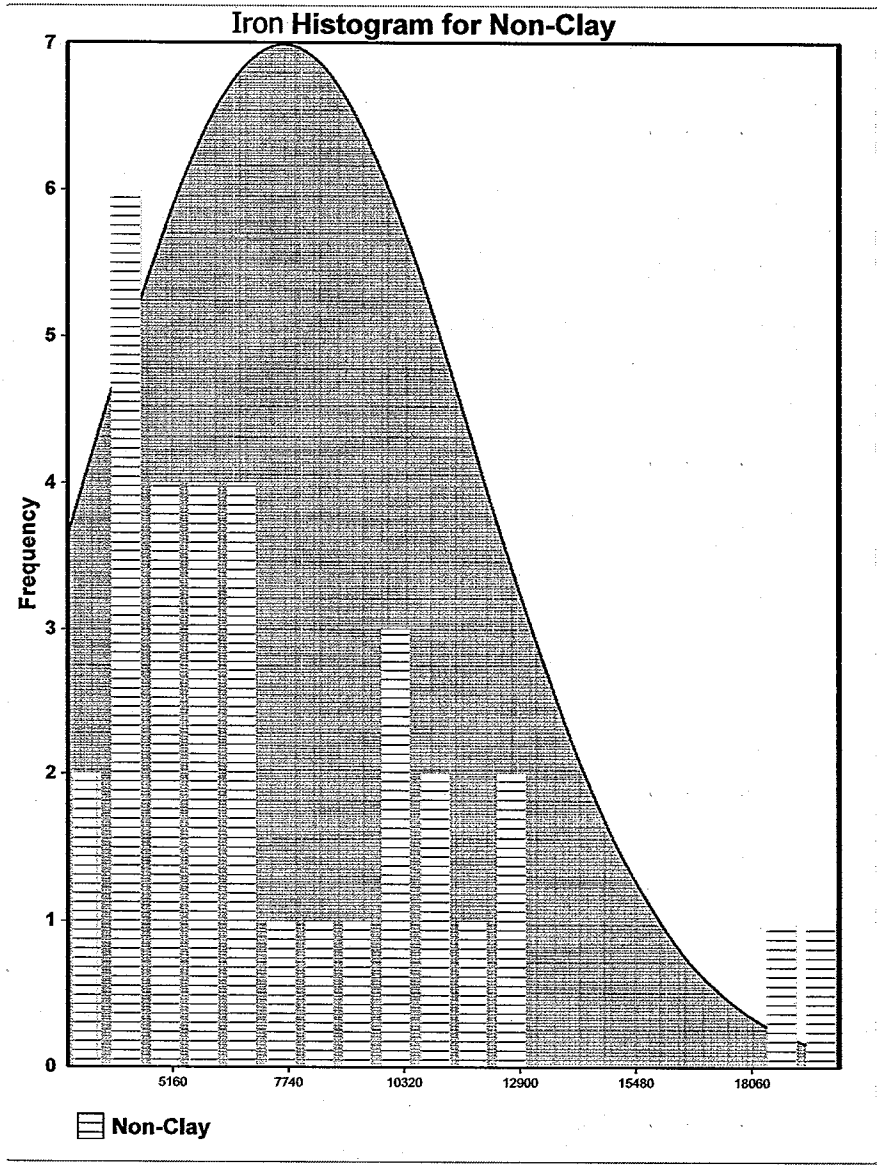

Cobalt Histogram for Clay
Frequency
0
1
2
3
4
5
1
2
4
5
6
7
9
Clay


Cobalt Histogram for Non-Clay
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
1
2
3
4
5
6
7
Non-Clay

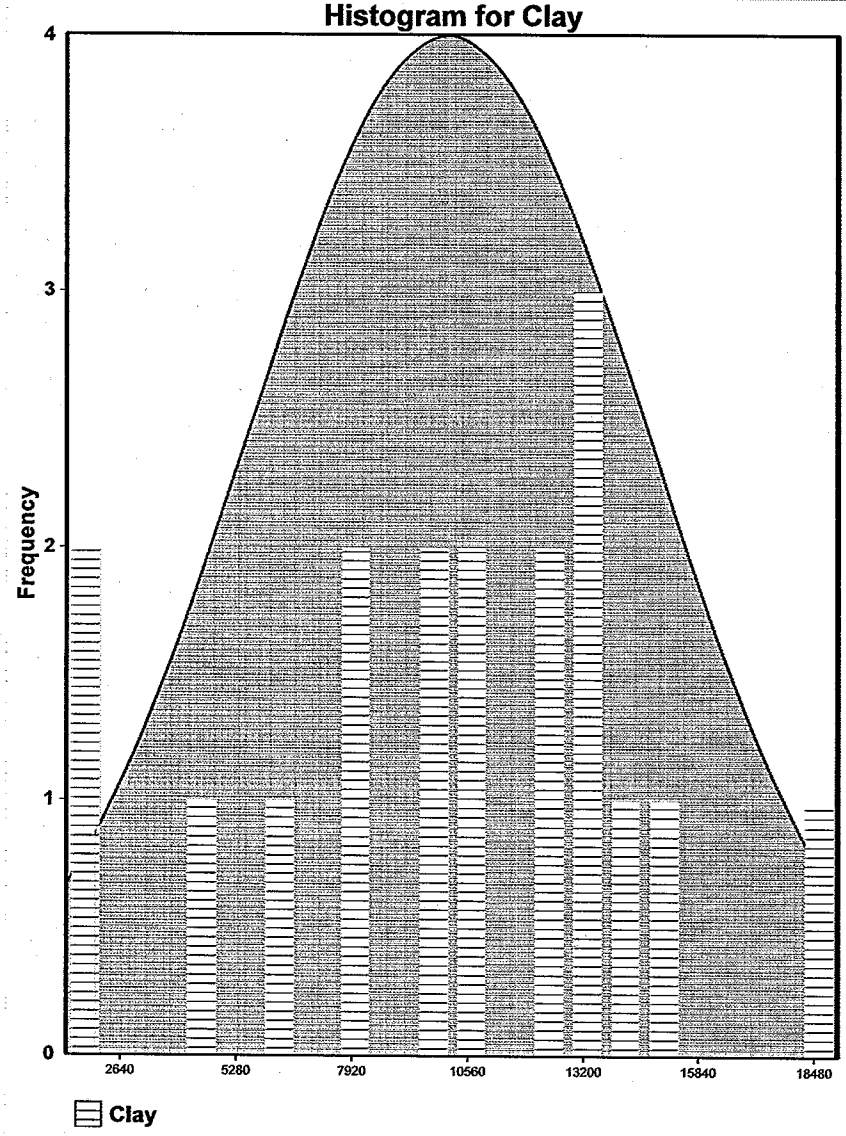

Copper Histogram for Clay
Frequency
0
1
2
3
4
5
2 4 5 6 7 8 10 11 12 13 14 16 17 18 19 20 22 23 24 25
Clay


Copper Histogram for Non-Clay
Frequency
0
1
2
3
4
5
6
7
8
9
2 3 5 7 8 10 12 13 15 17
Non-Clay

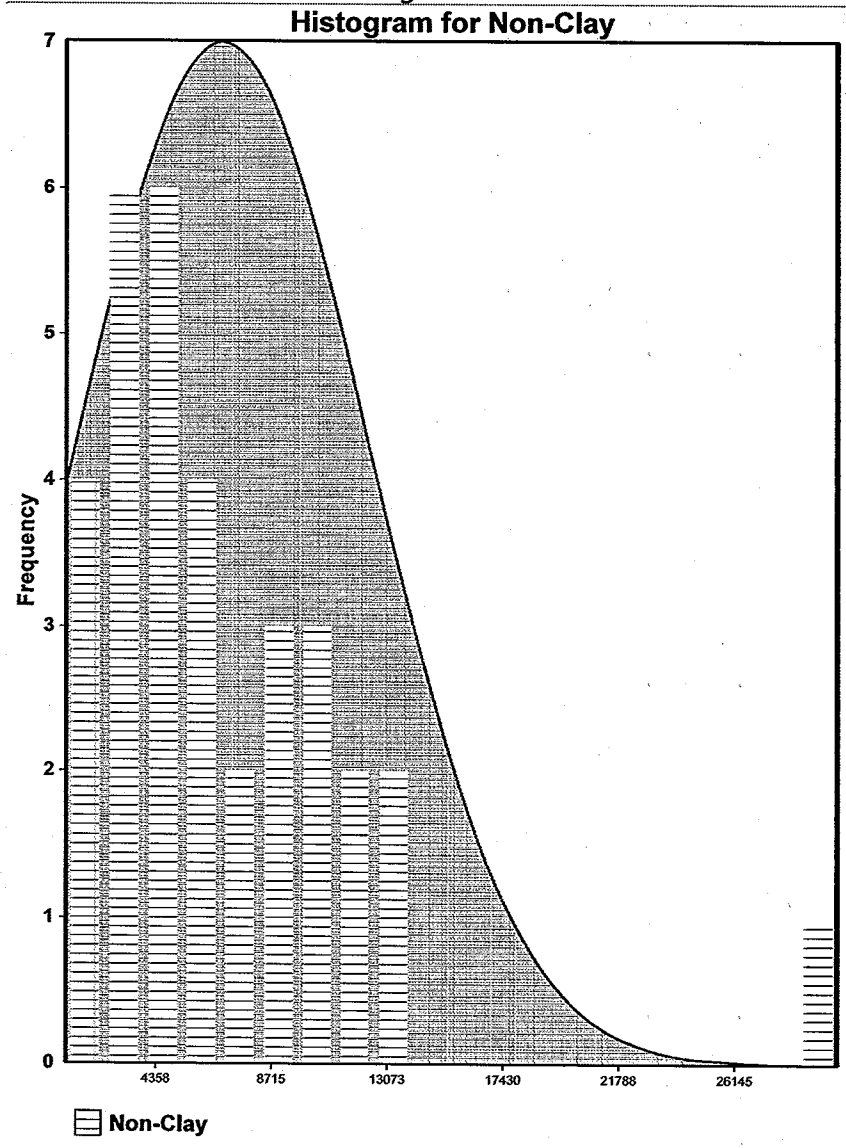

Iron Histogram for Clay
Frequency
0
1
2
3
4
5
4560
6840
9120
11400
13680
15960
18240
20520
22800
25080
Clay


Iron Histogram for Non-Clay
Frequency
0
1
2
3
4
5
6
7
5160
7740
10320
12900
15480
18060
Non-Clay

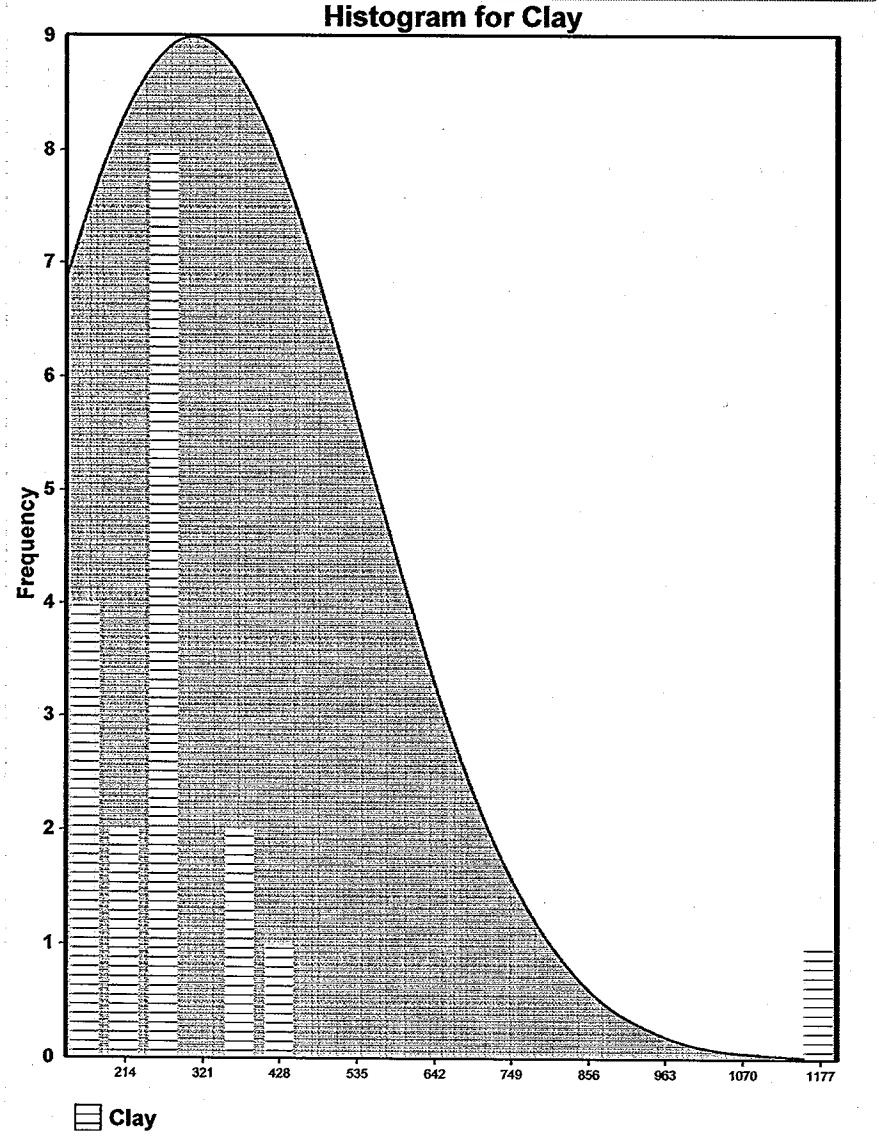
Magnesium



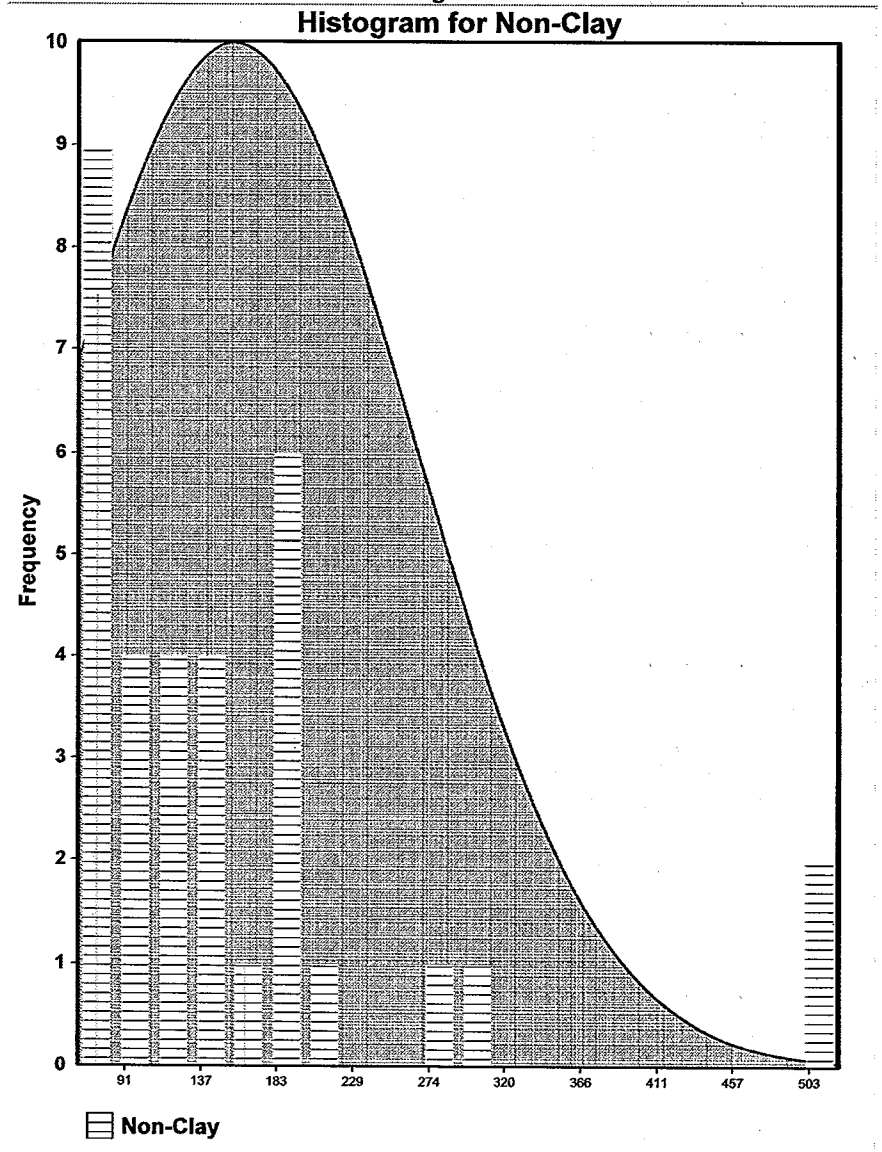
Magnesium

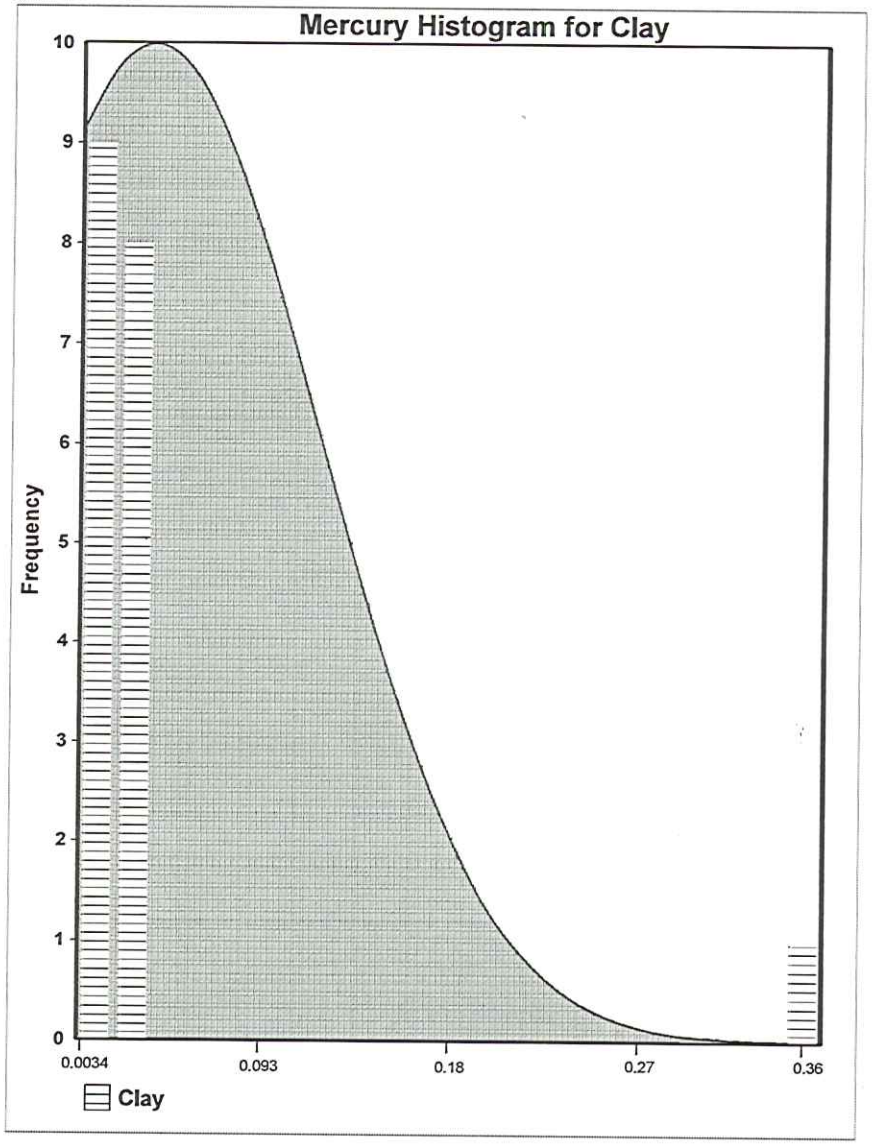


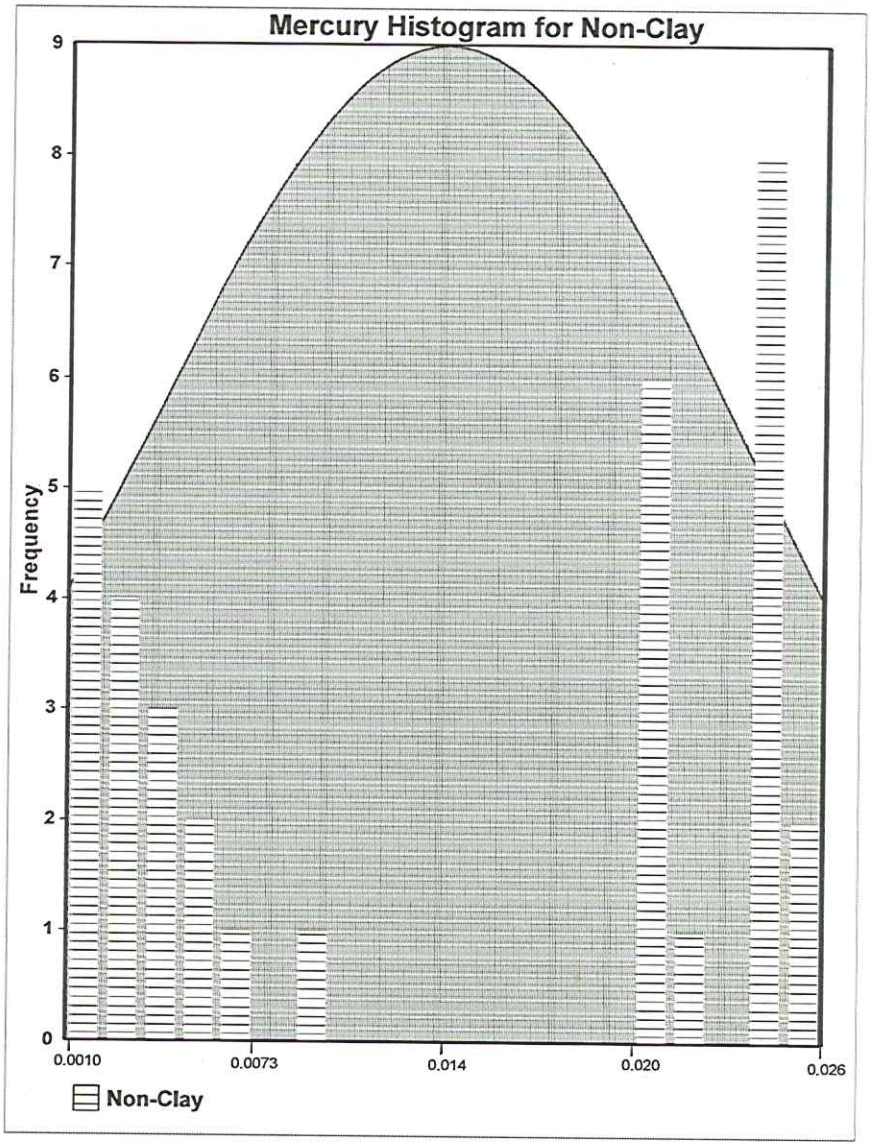
Manganese

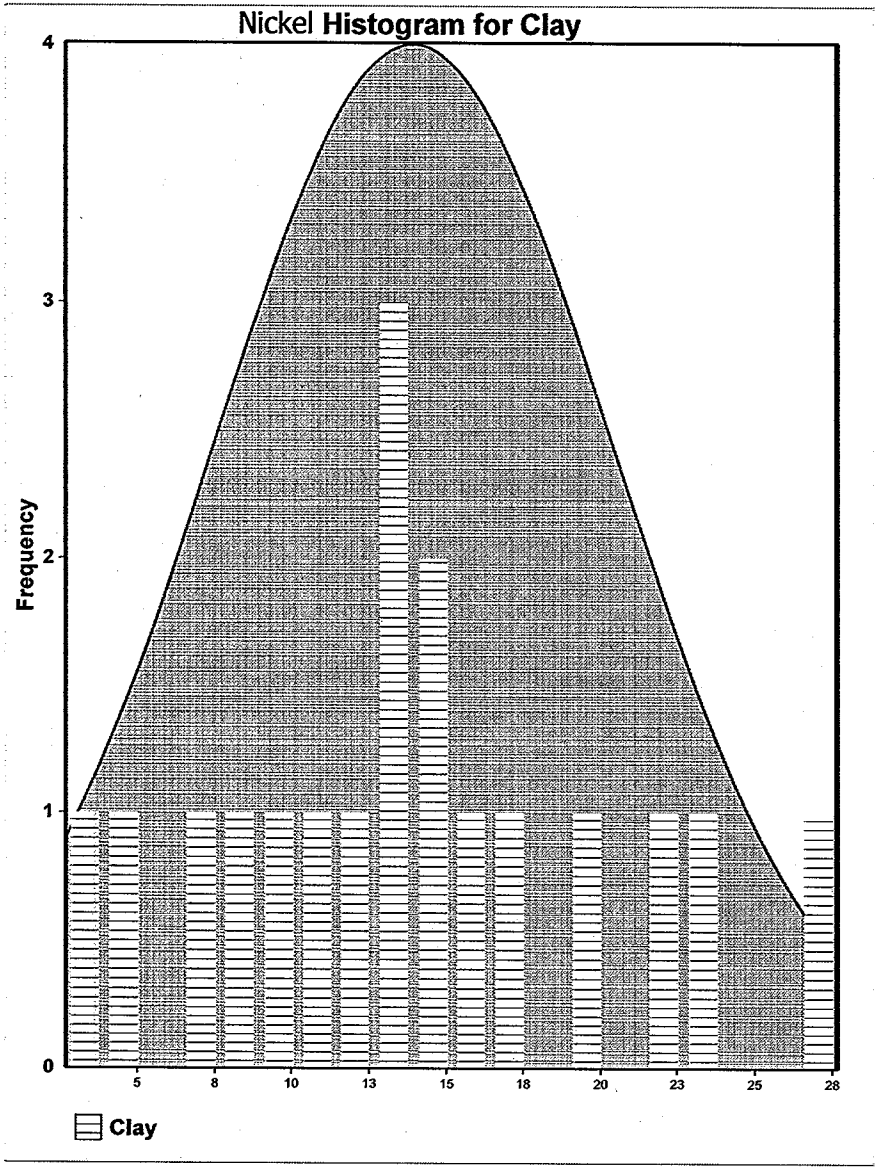


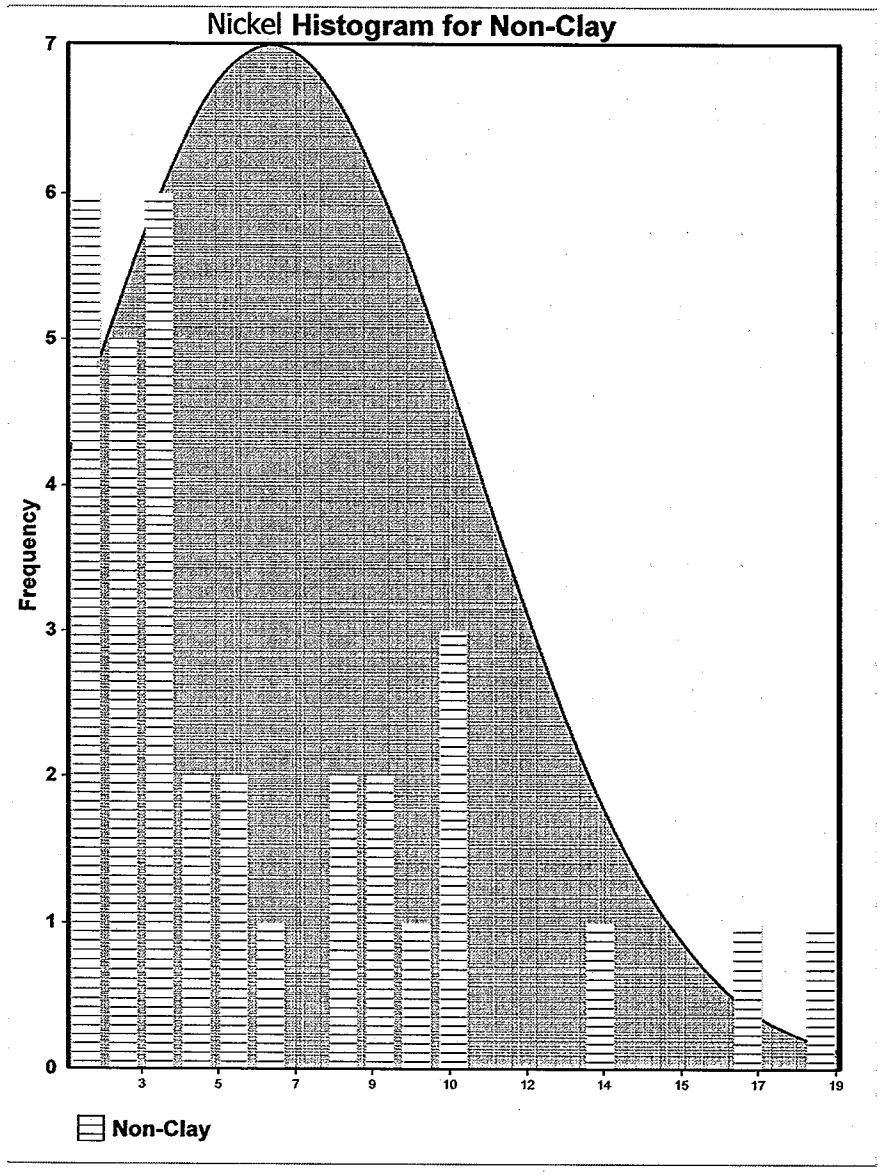
Manganese



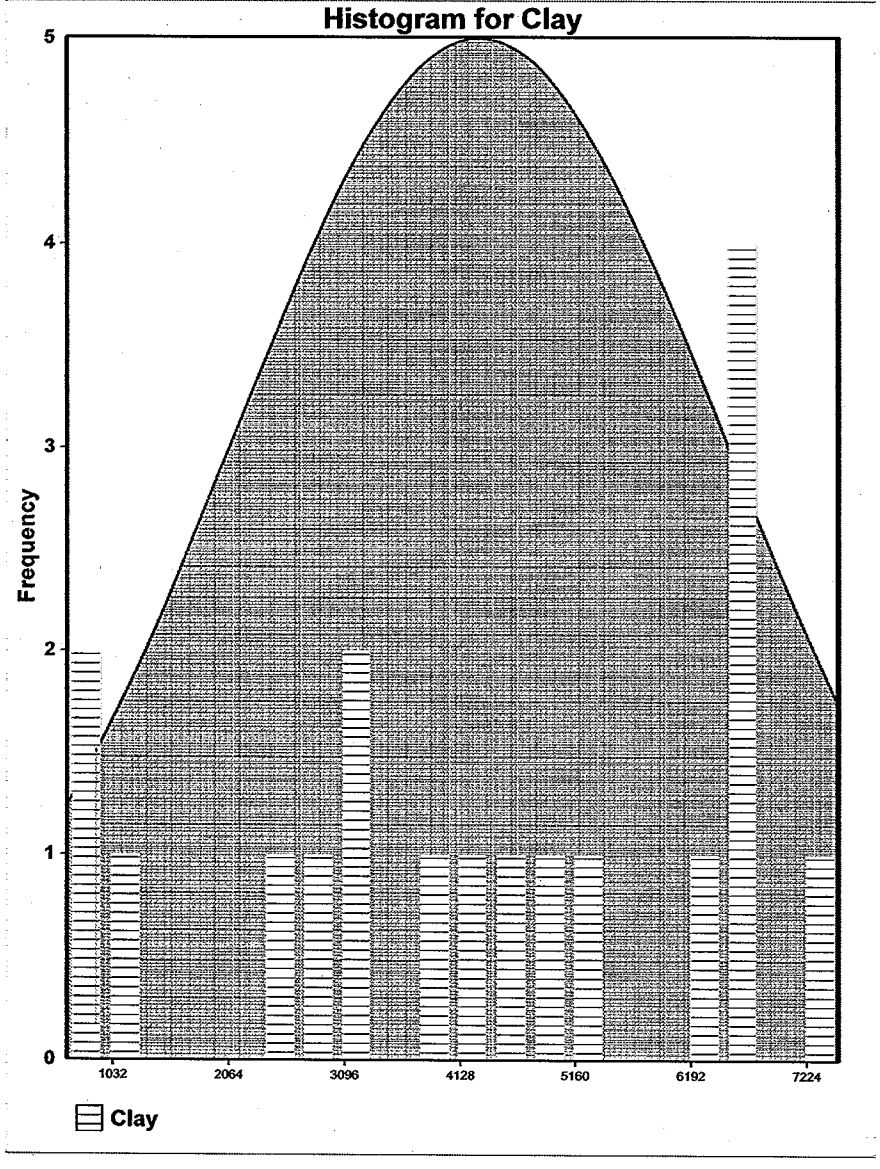

Mercury Histogram for Clay
Frequency
10
9
8
7
6
5
4
3
2
1
0
0.0034
0.093
0.18
0.27
0.36
Clay


Mercury Histogram for Non-Clay
Frequency
9
8
7
6
5
4
3
2
1
0
0.0010
0.0073
0.014
0.020
0.026
Non-Clay

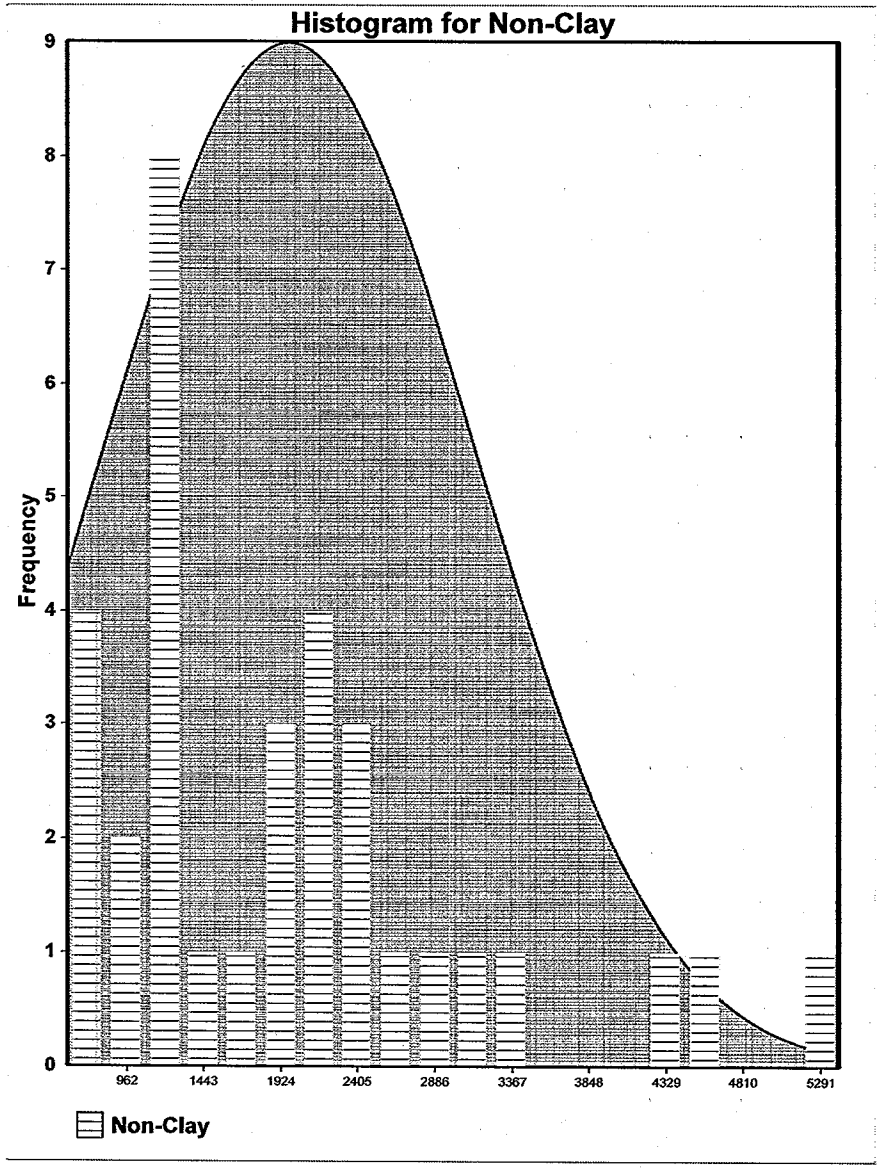

Nickel Histogram for Clay
Frequency
0
1
2
3
4
5
8
10
13
15
18
20
23
25
28
Clay

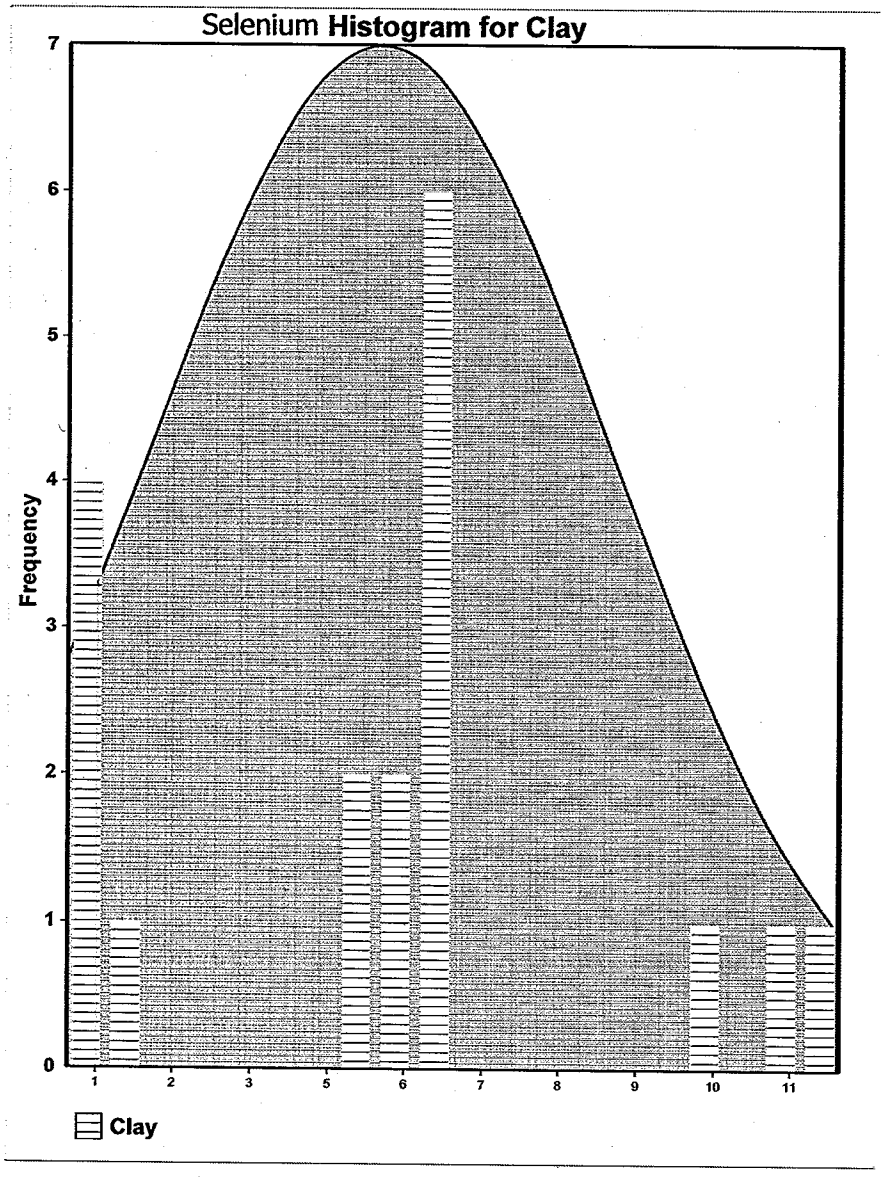

Nickel Histogram for Non-Clay
Frequency
0
1
2
3
4
5
6
7
3
5
7
9
10
12
14
15
17
19
Non-Clay

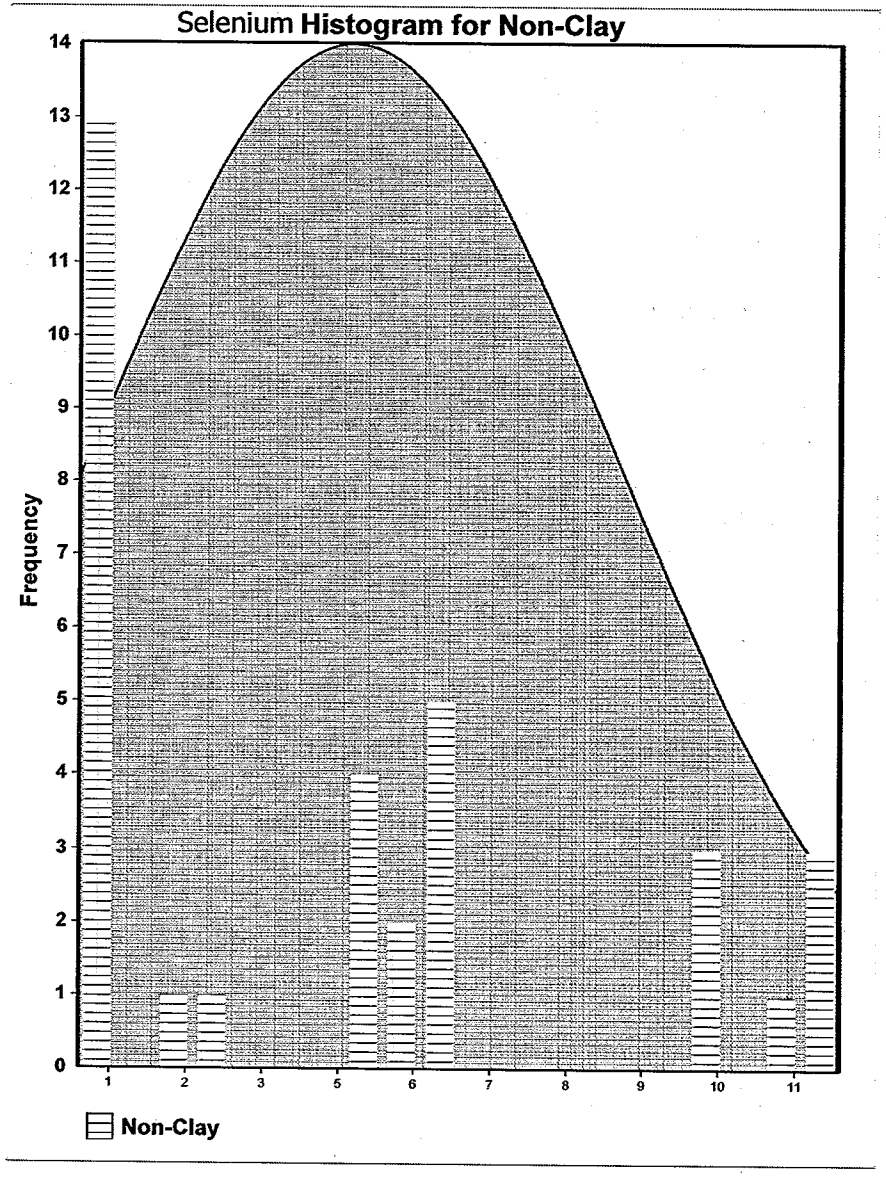
Potassium

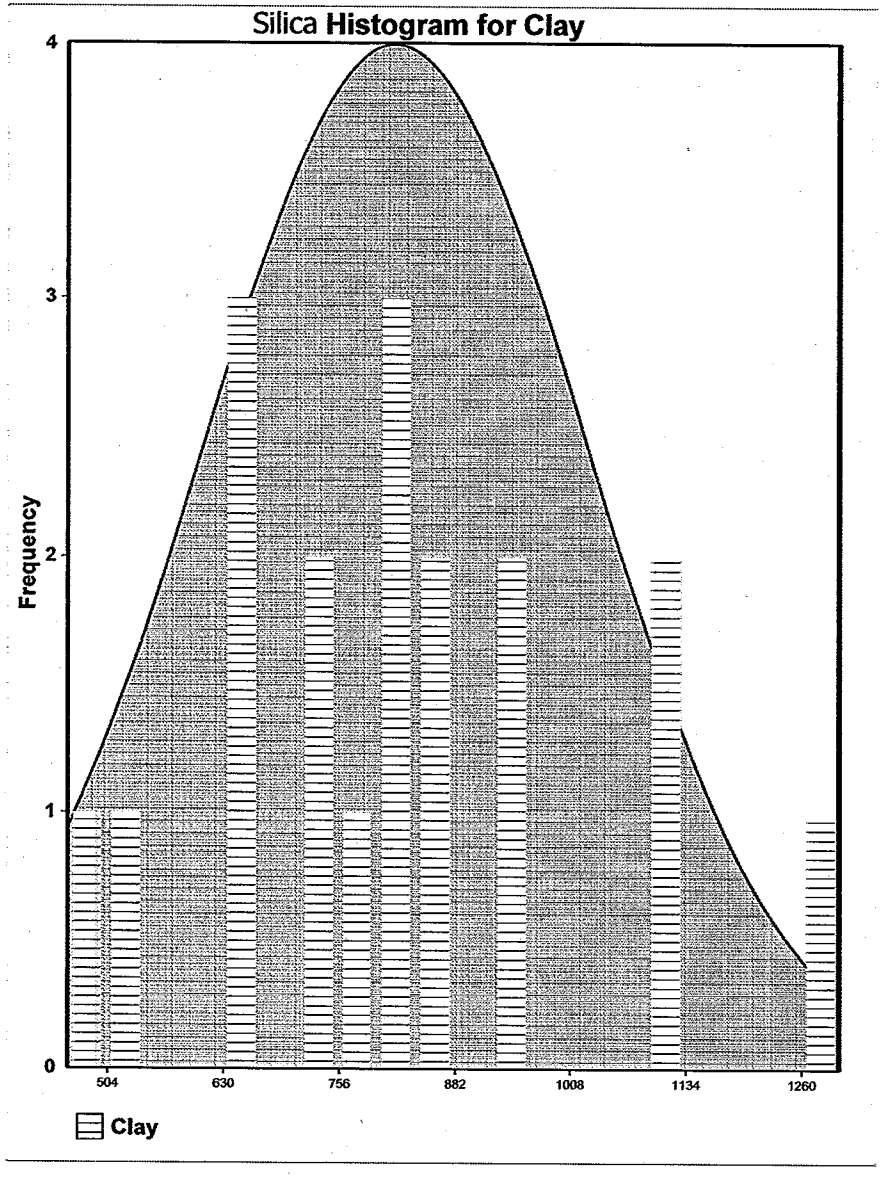


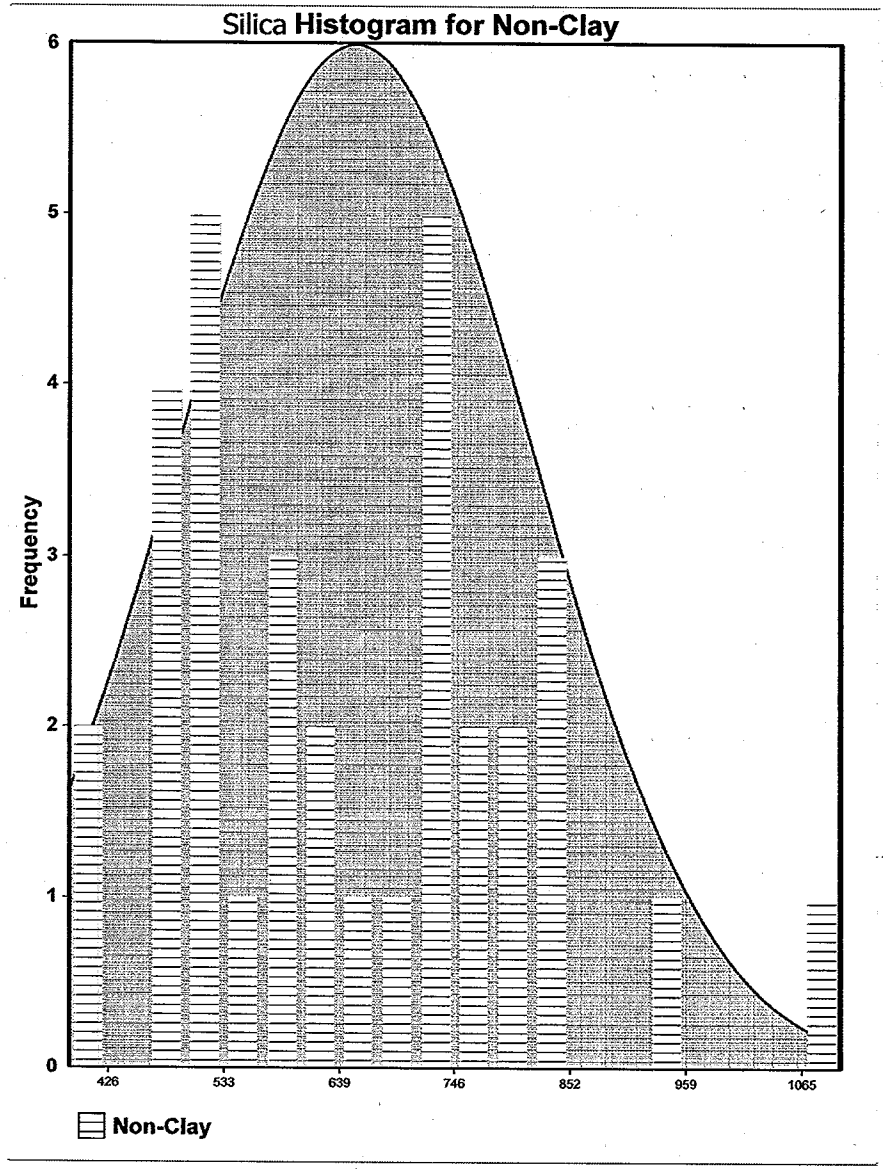
Potassium

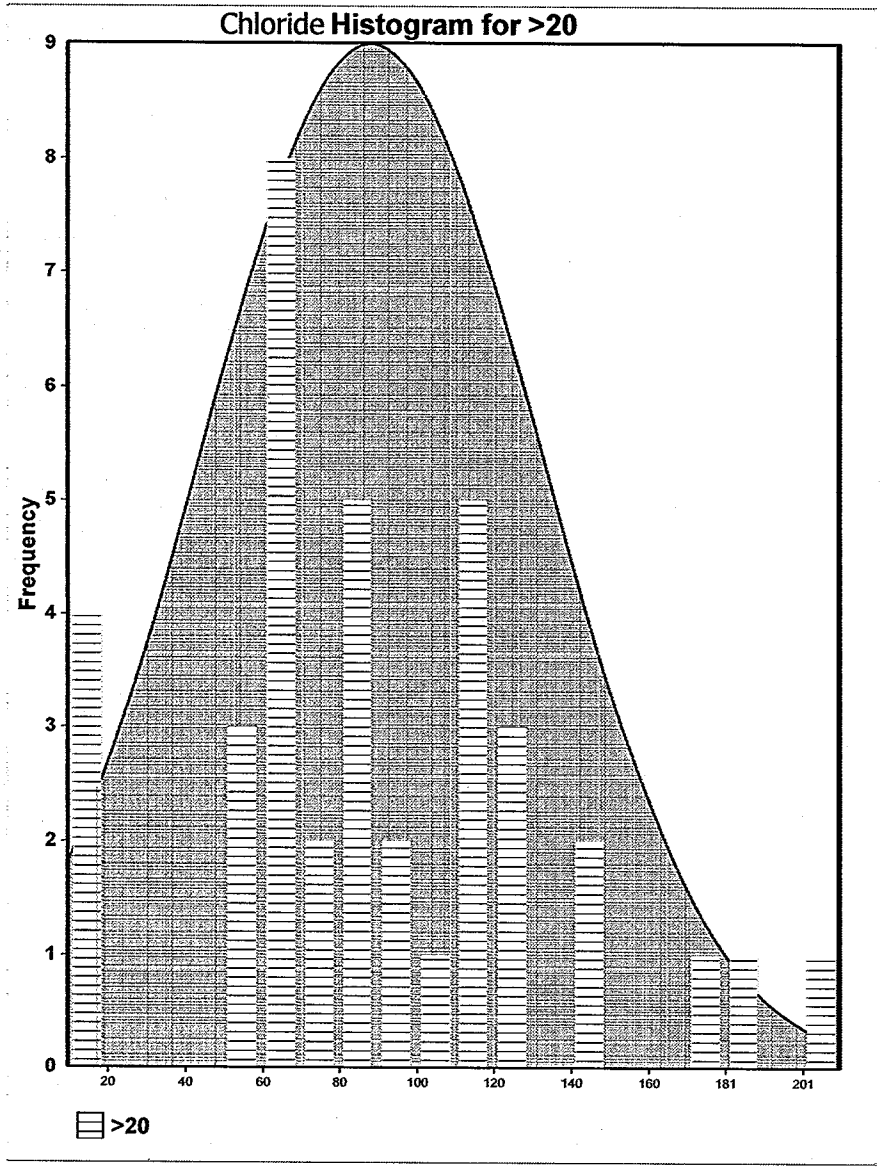


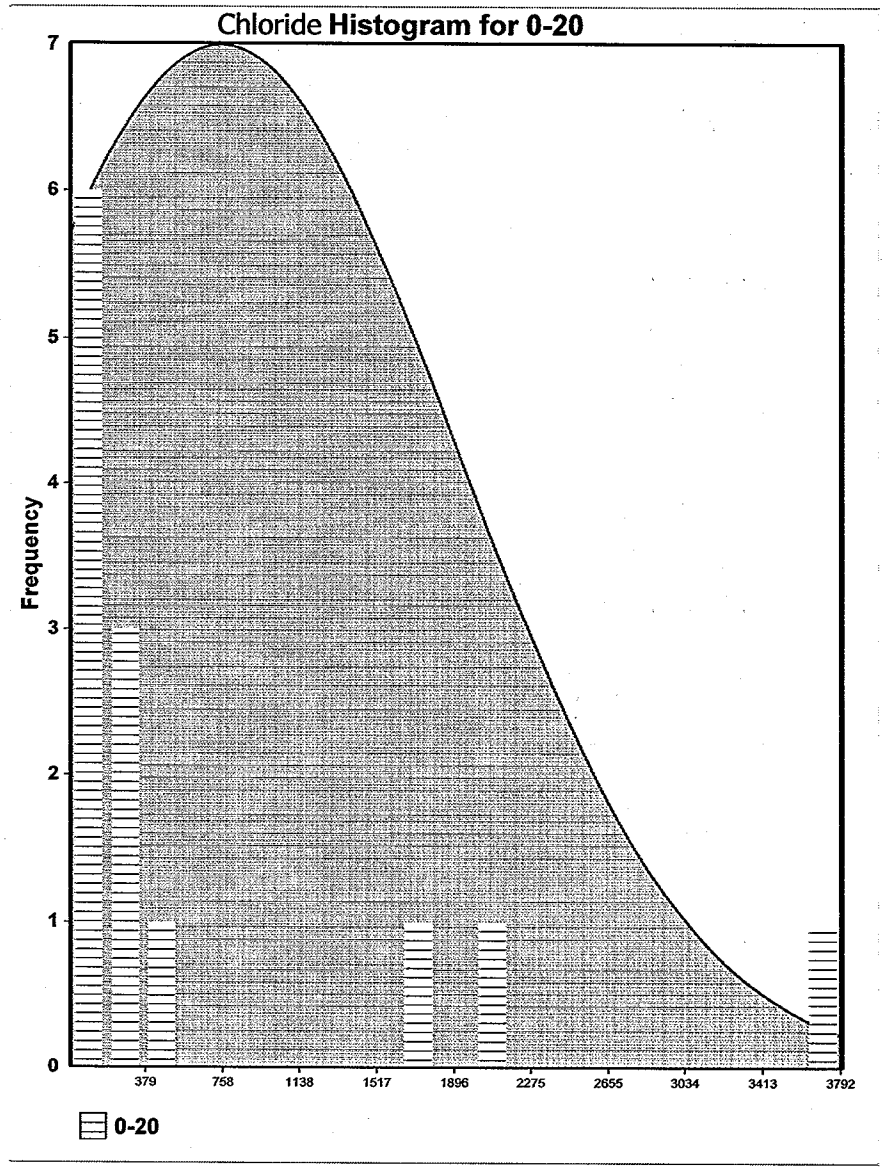

Selenium Histogram for Clay
Frequency
0
1
2
3
4
5
6
7
1
2
3
5
6
7
8
9
10
11
Clay

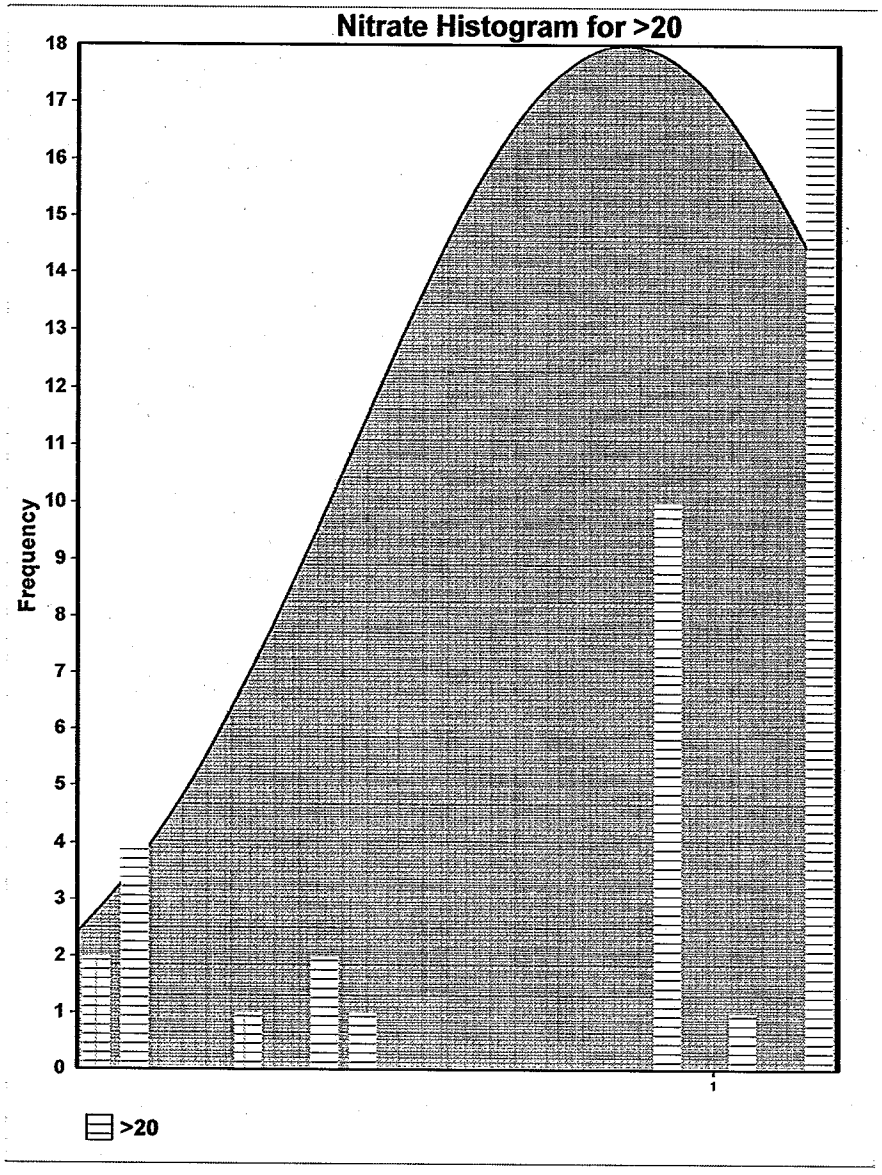

Selenium Histogram for Non-Clay
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
1
2
3
5
6
7
8
9
10
11
Non-Clay

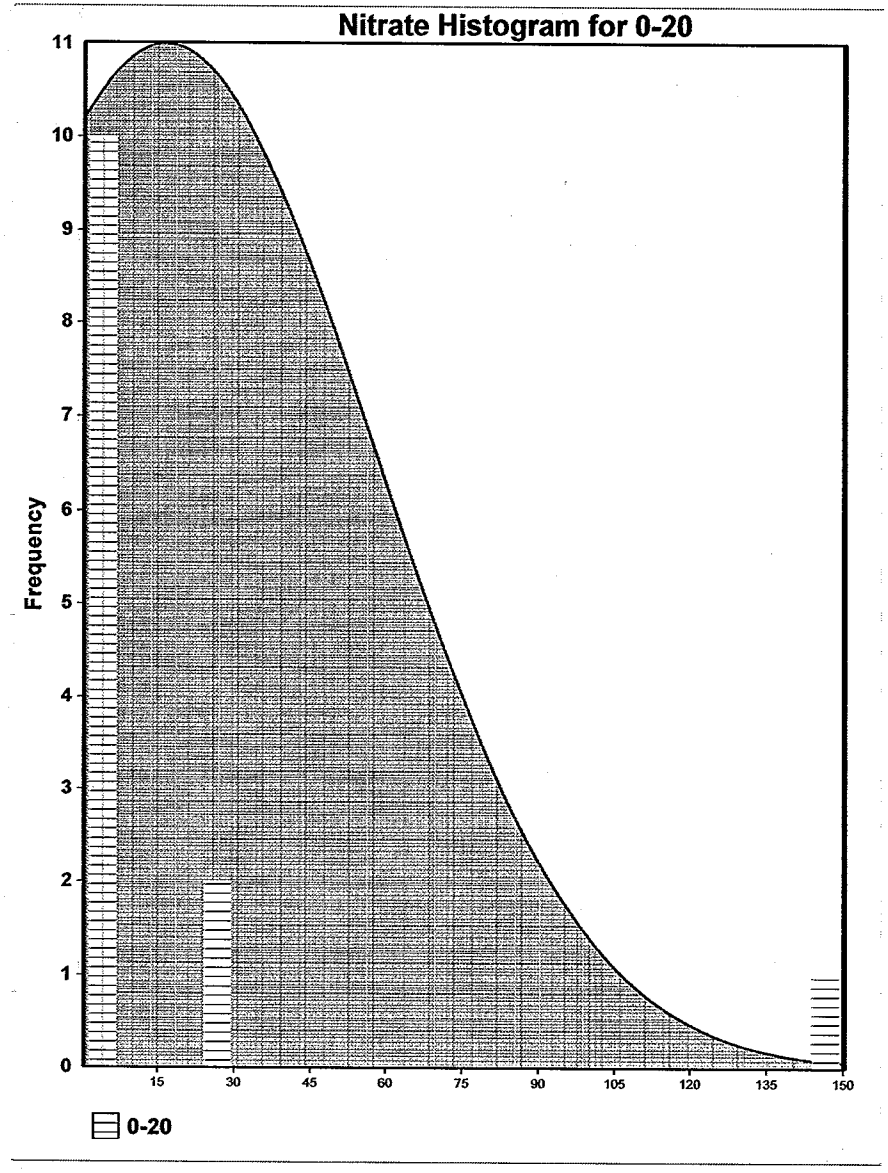

Silica Histogram for Clay
Frequency
0
1
2
3
4
504
630
756
882
1008
1134
1260
Clay

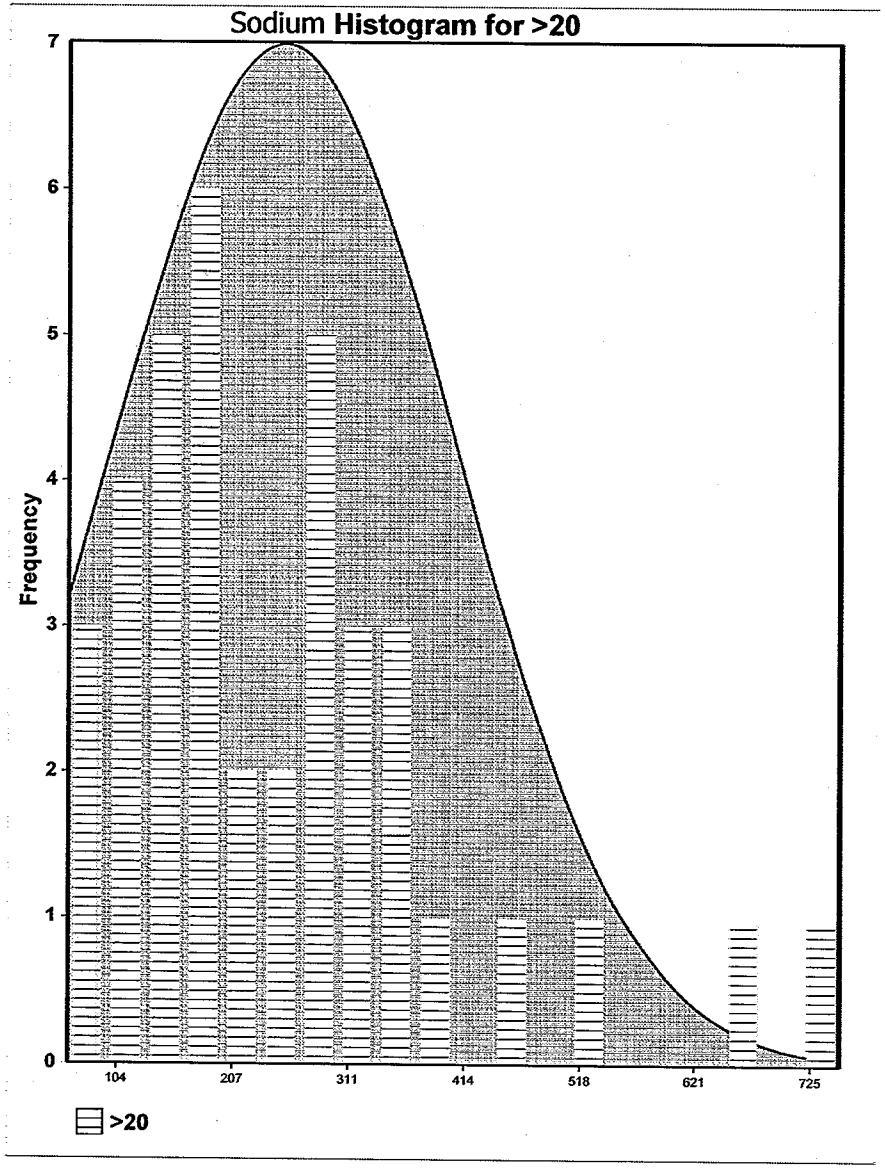

Silica Histogram for Non-Clay
Frequency
0
1
2
3
4
5
6
426
533
639
746
852
959
1065
Non-Clay

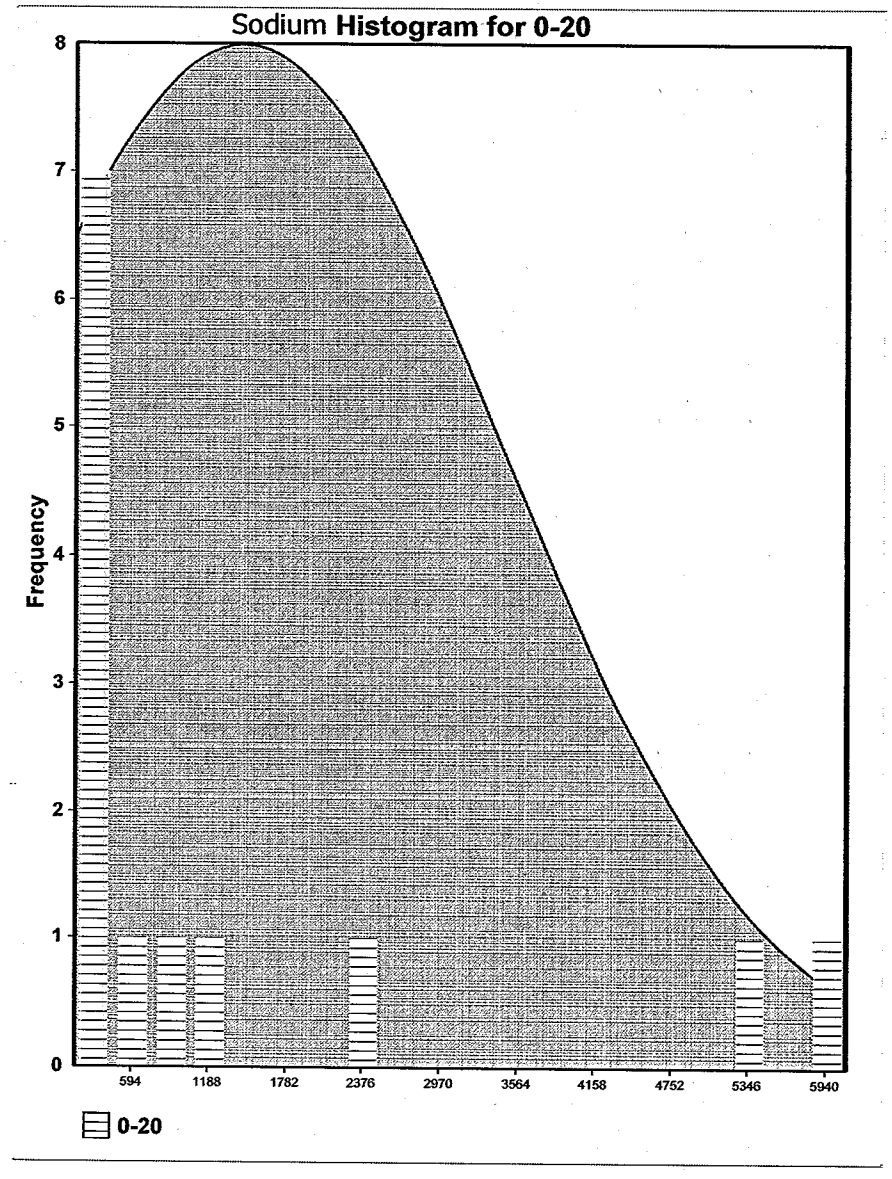

Chloride Histogram for >20
Frequency
0
1
2
3
4
5
6
7
8
9
20
40
60
80
100
120
140
160
181
201
>20

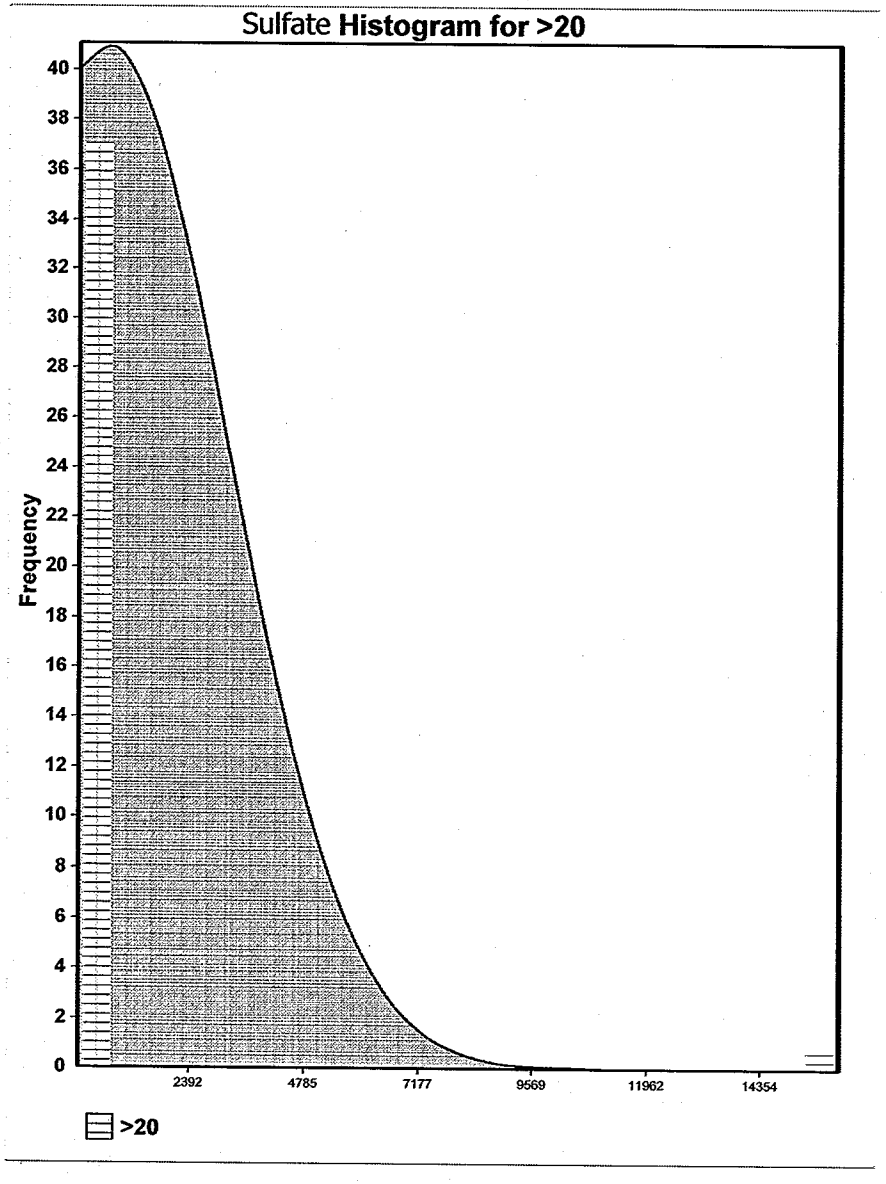

Chloride Histogram for 0-20
Frequency
0
1
2
3
4
5
6
7
379
758
1138
1517
1896
2275
2655
3034
3413
3792
0-20

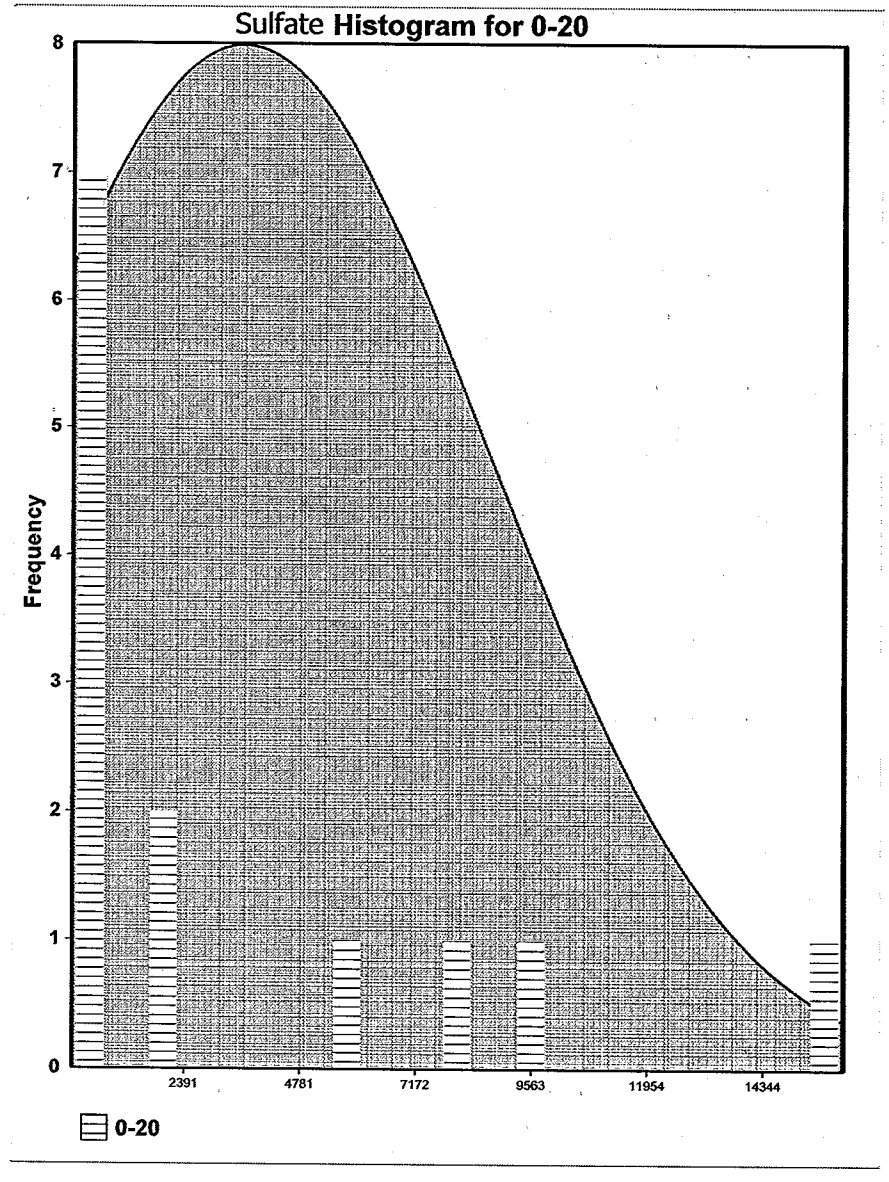

Nitrate Histogram for >20
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
1
>20

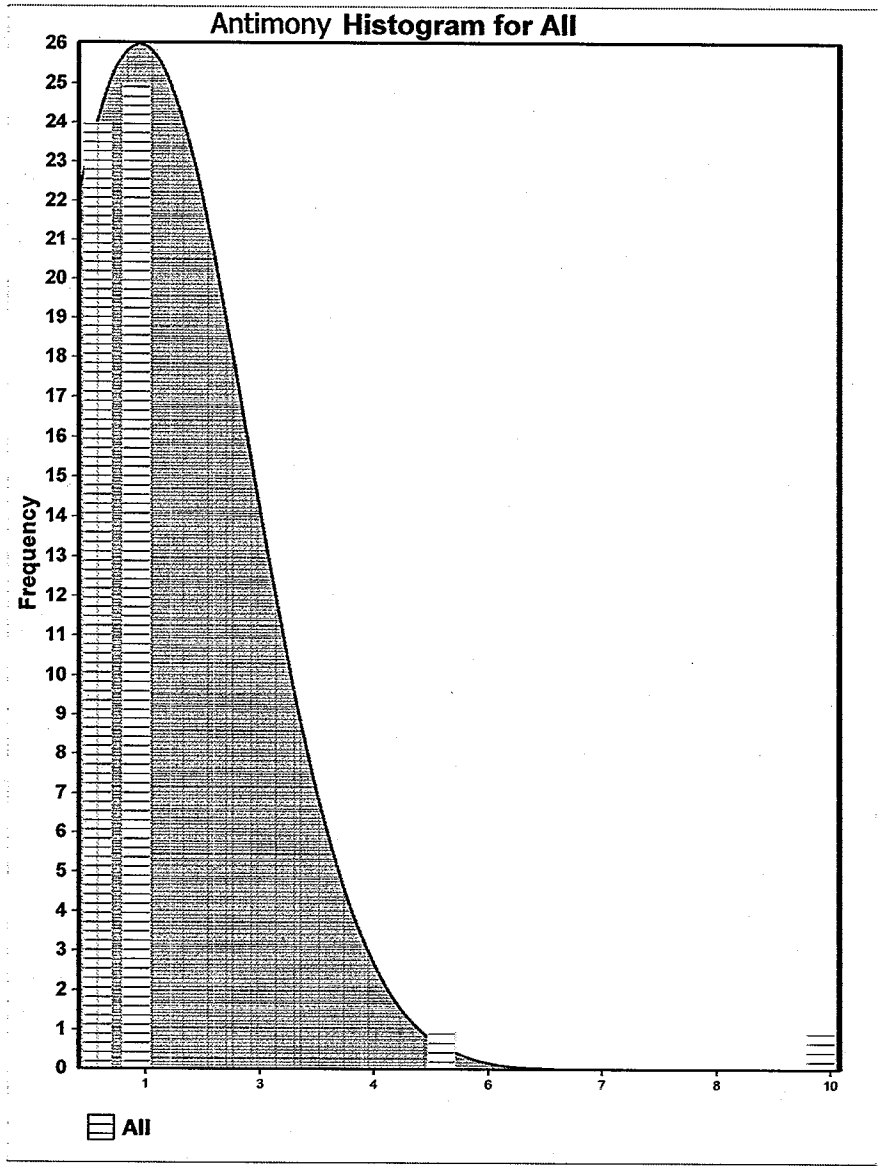

Nitrate Histogram for 0-20
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
15
30
45
60
75
90
105
120
135
150
0-20

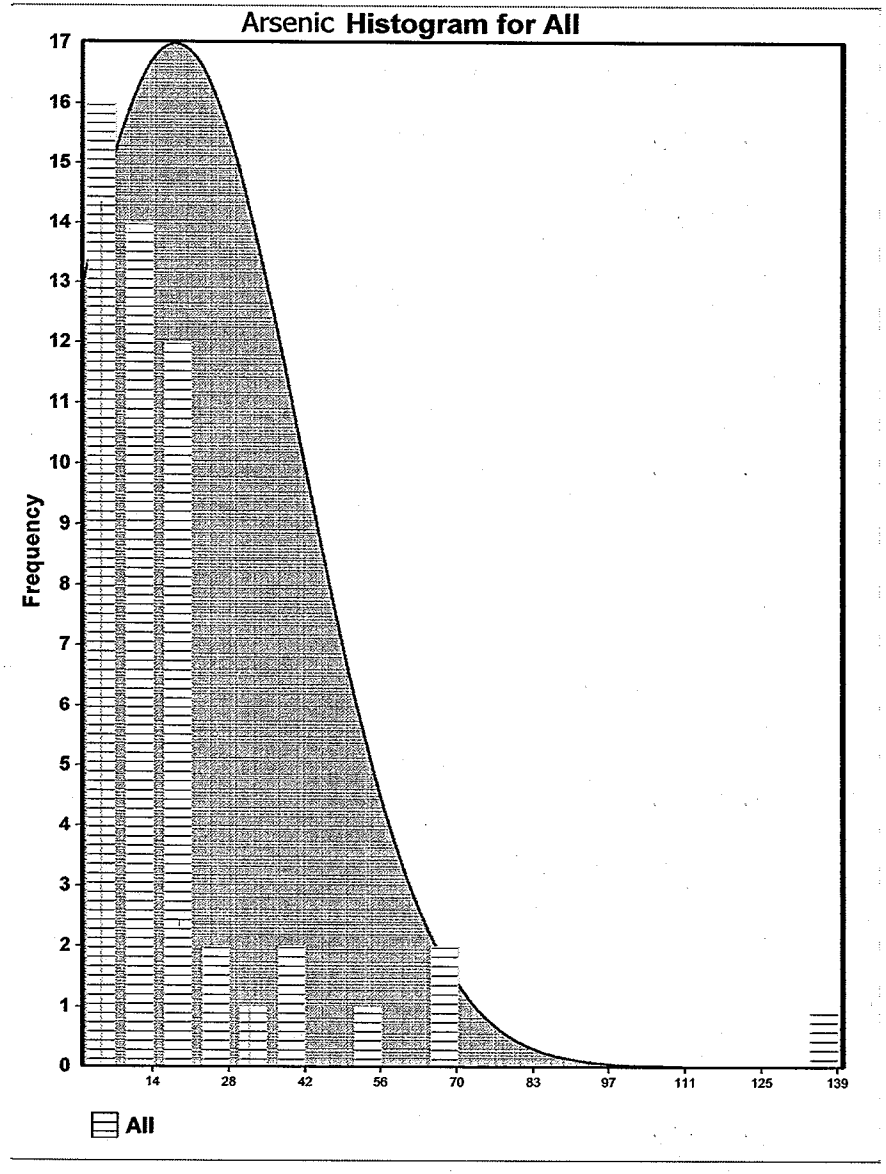

Sodium Histogram for >20
Frequency
0
1
2
3
4
5
6
7
104
207
311
414
518
621
725
>20

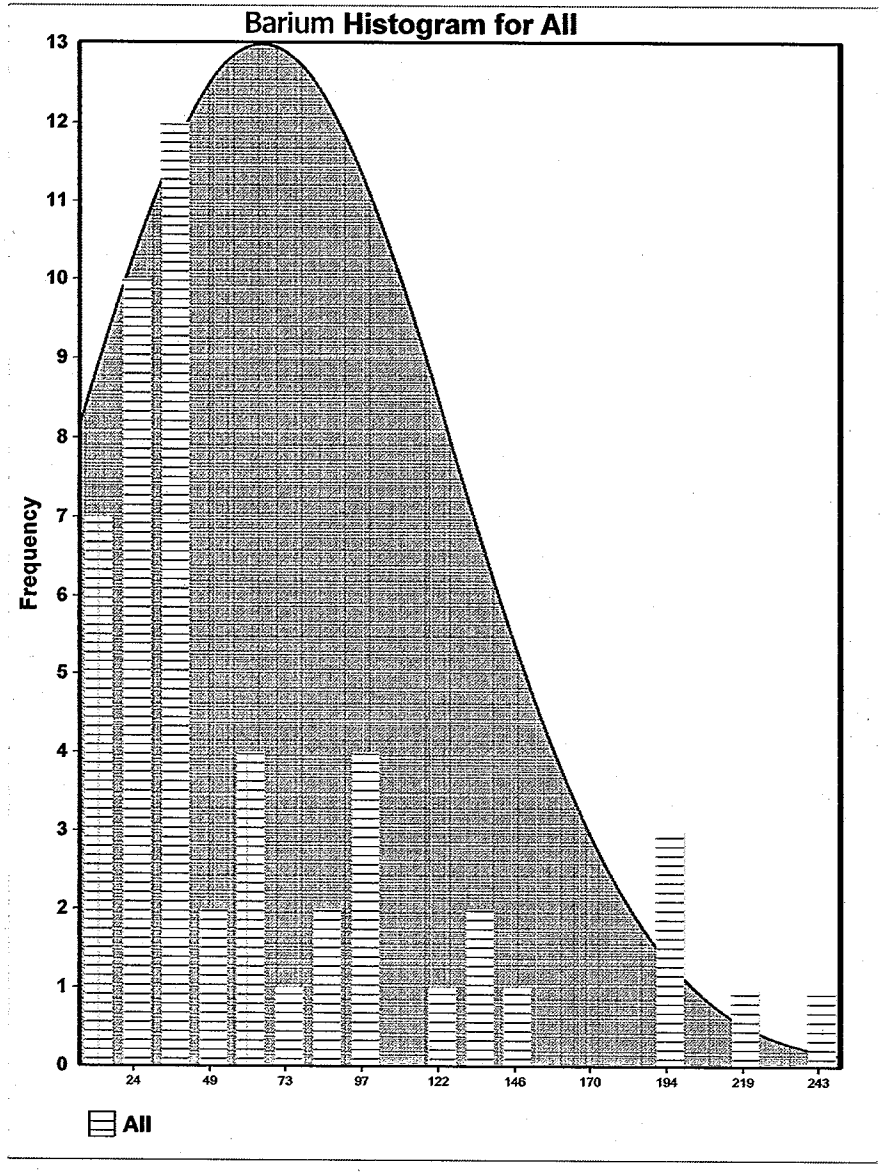

Sodium Histogram for 0-20
Frequency
0
1
2
3
4
5
6
7
8
594
1188
1782
2376
2970
3564
4158
4752
5346
5940
0-20

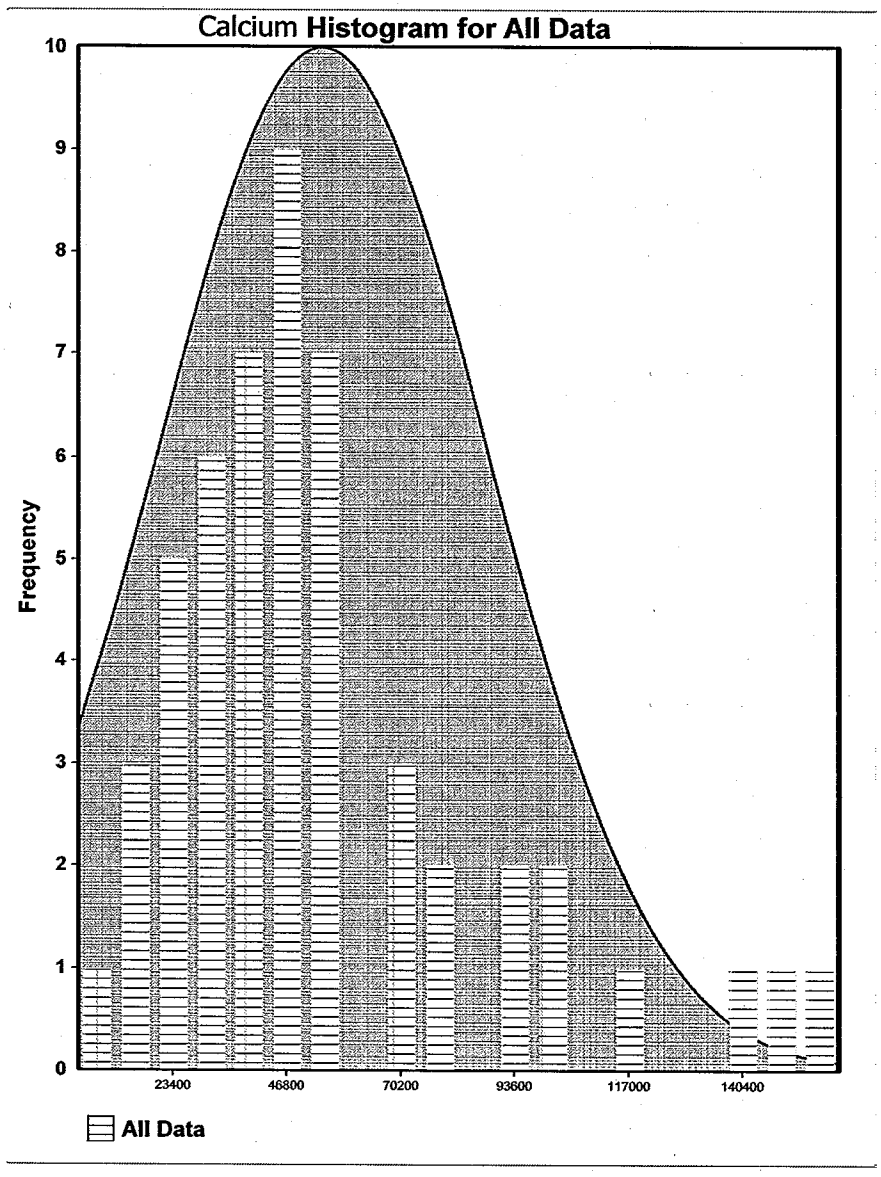

Sulfate Histogram for >20
Frequency
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
2392
4785
7177
9569
11962
14354
>20


Sulfate Histogram for 0-20
Frequency
8
7
6
5
4
3
2
1
0
2391
4781
7172
9563
11954
14344
0-20

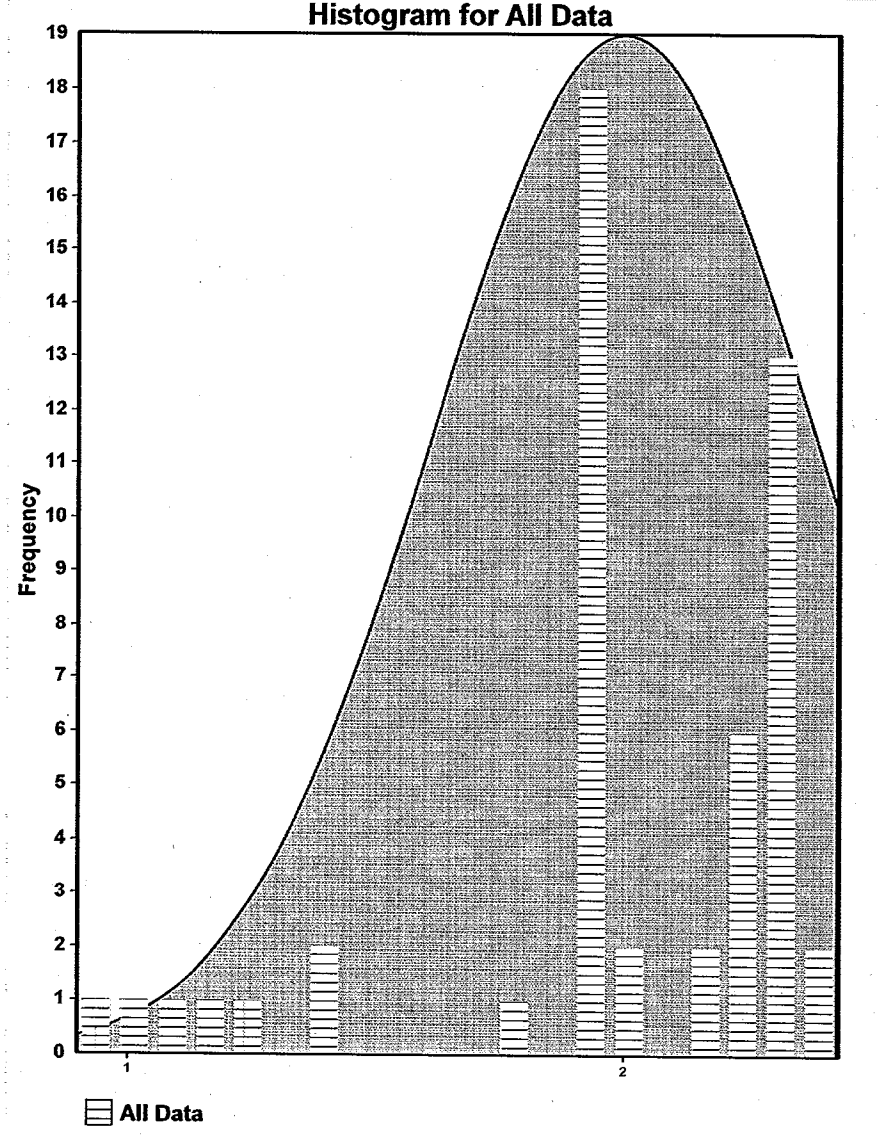

Antimony Histogram for All
Frequency
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1
3
4
6
7
8
10
All


Arsenic Histogram for All
Frequency
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
14
28
42
56
70
83
97
111
125
139
All

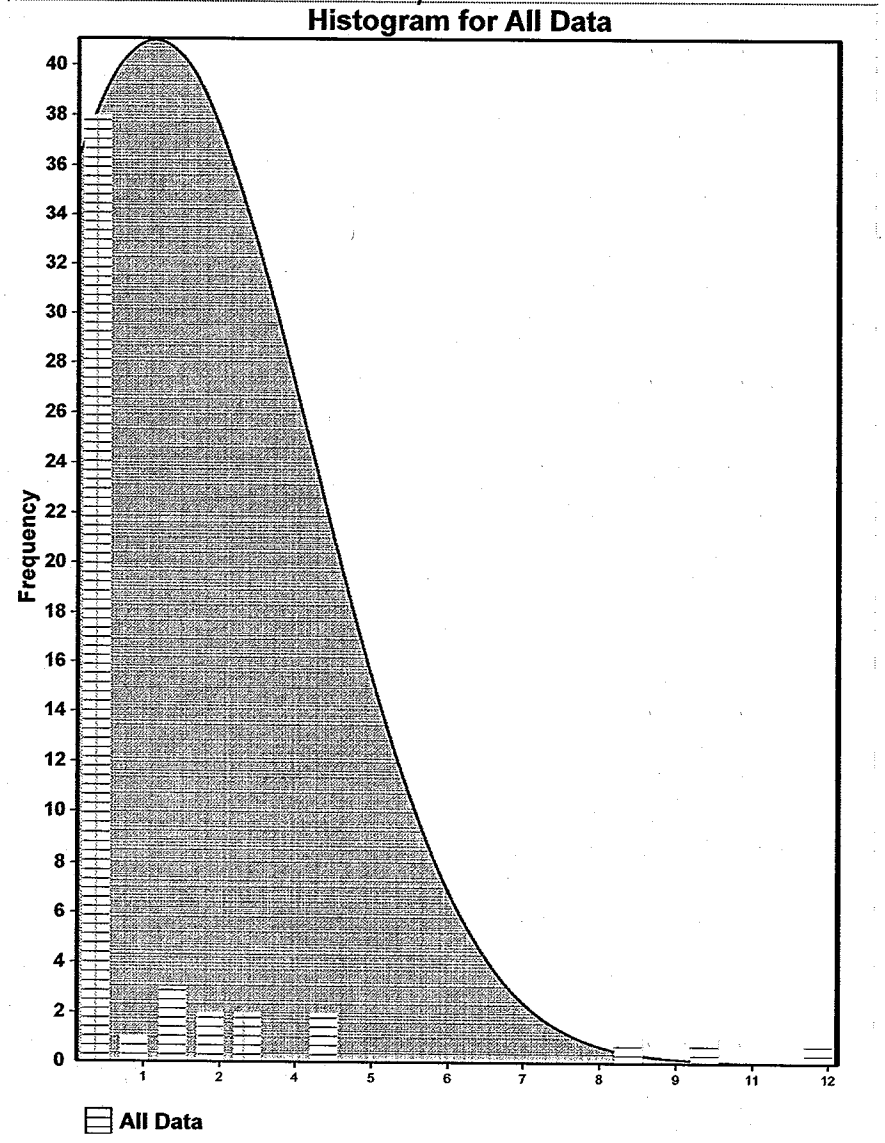

Barium Histogram for All
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
24
49
73
97
122
146
170
194
219
243
All

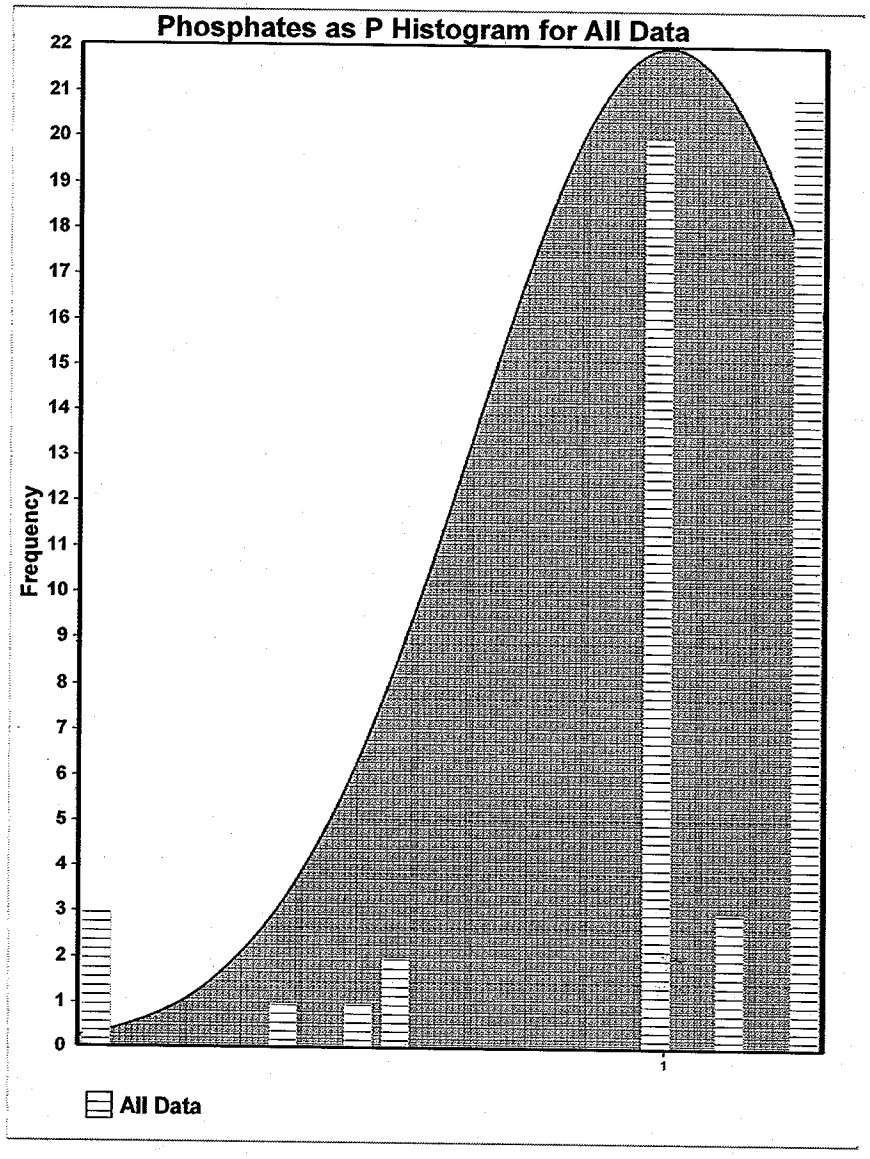

Calcium Histogram for All Data
Frequency
0
1
2
3
4
5
6
7
8
9
10
23400
46800
70200
93600
117000
140400
All Data

Chromium (Hexavalent)

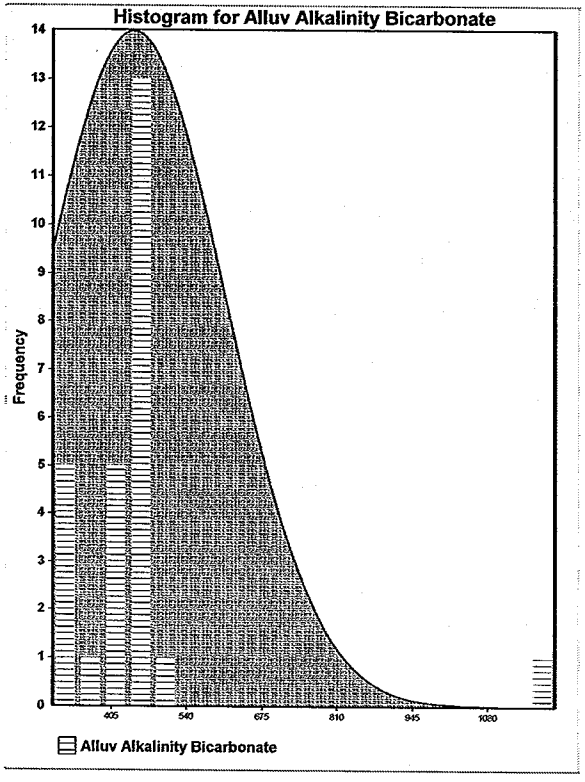


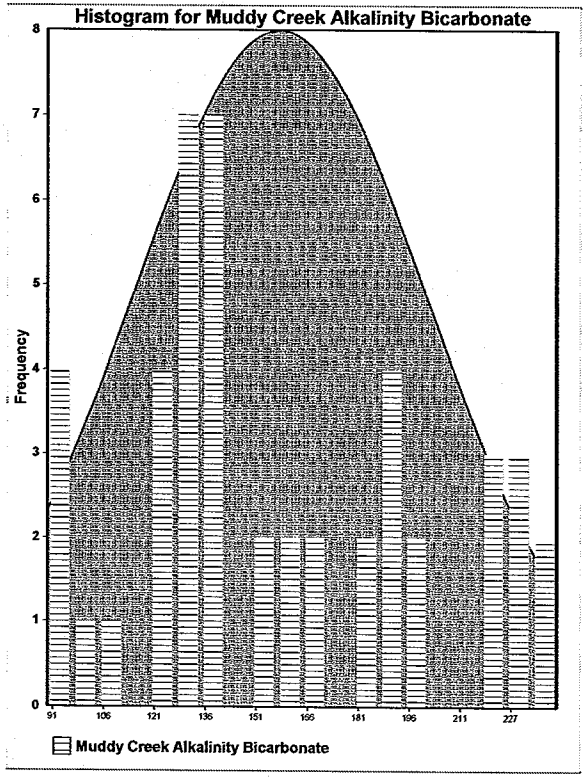
Molybdenum

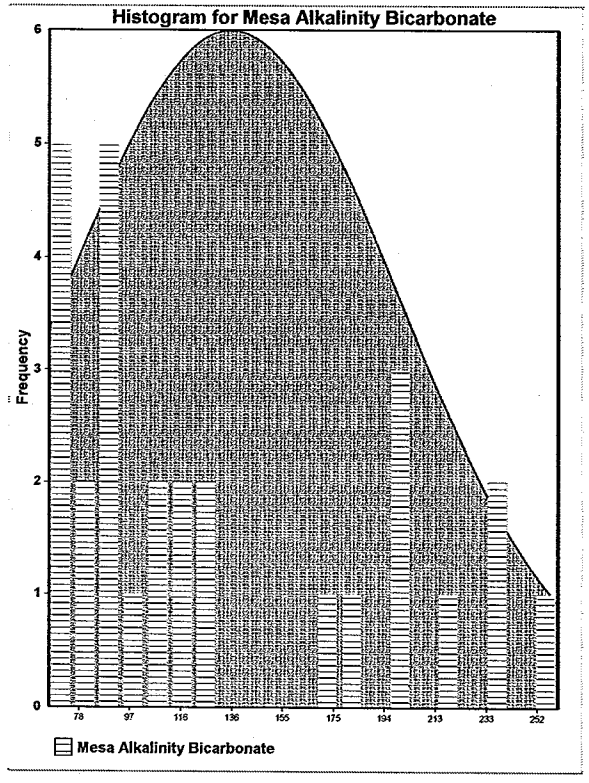


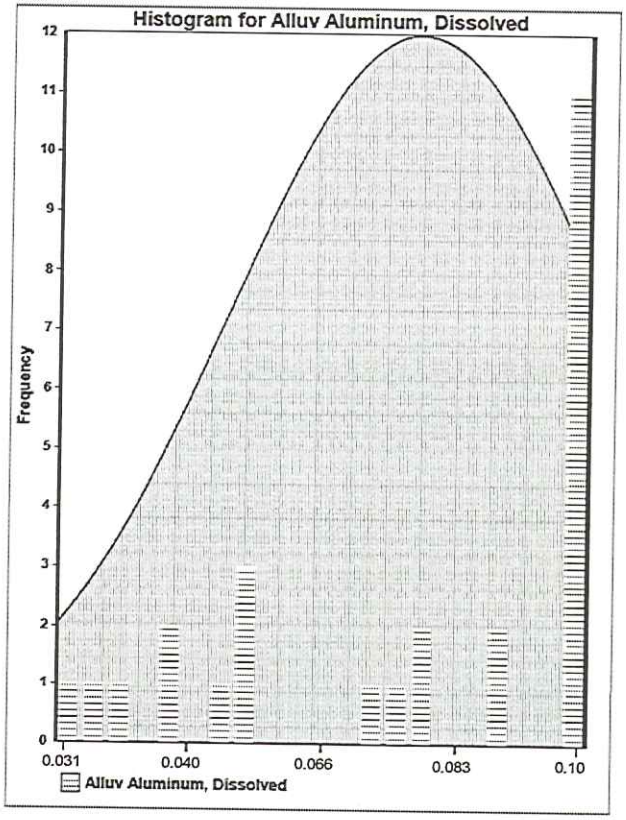

Phosphates as P Histogram for All Data
Frequency
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1
All Data

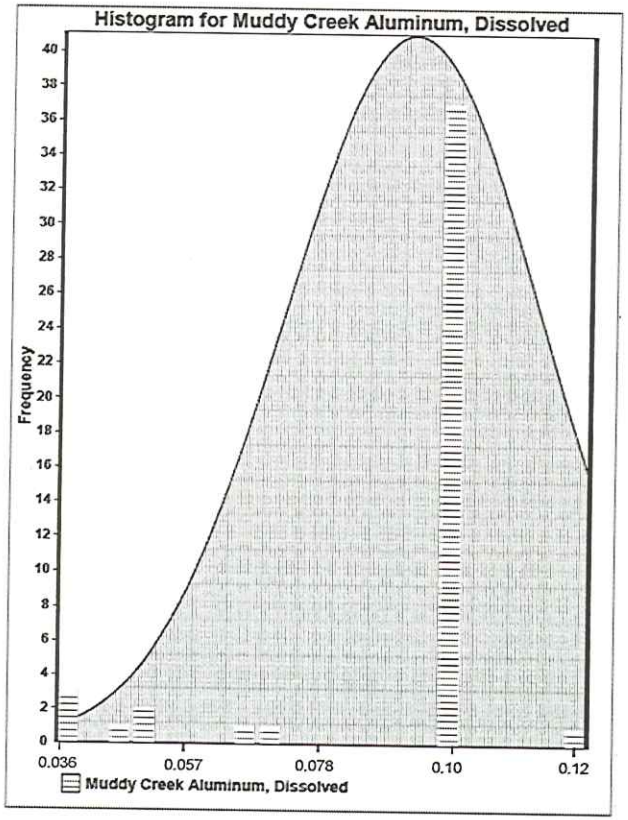
Groundwater

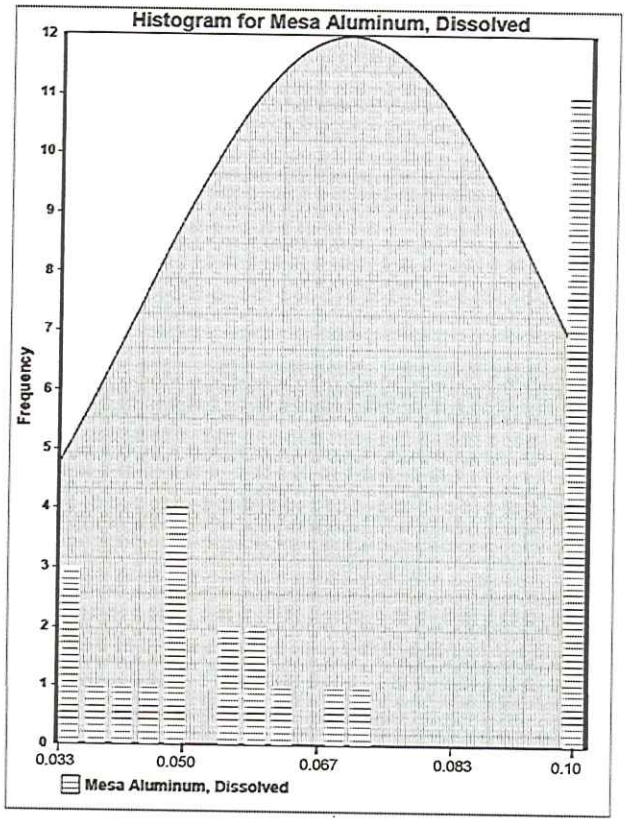

Histogram for Alluv Alkalinity Bicarbonate
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
405
540
675
810
945
1080
Alluv Alkalinity Bicarbonate

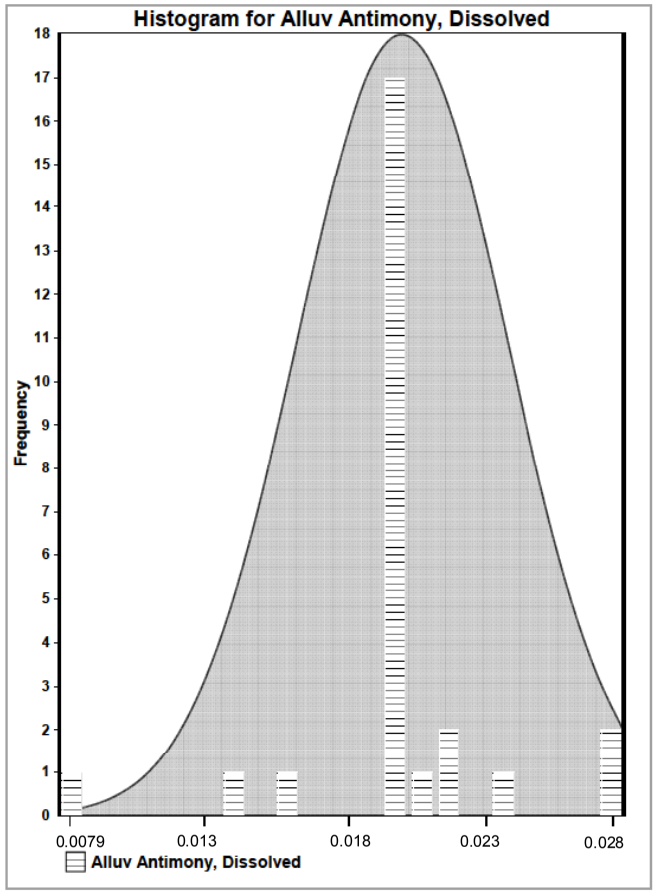

Histogram for Muddy Creek Alkalinity Bicarbonate
Frequency
0
1
2
3
4
5
6
7
8
91
106
121
136
151
166
181
196
211
227
Muddy Creek Alkalinity Bicarbonate

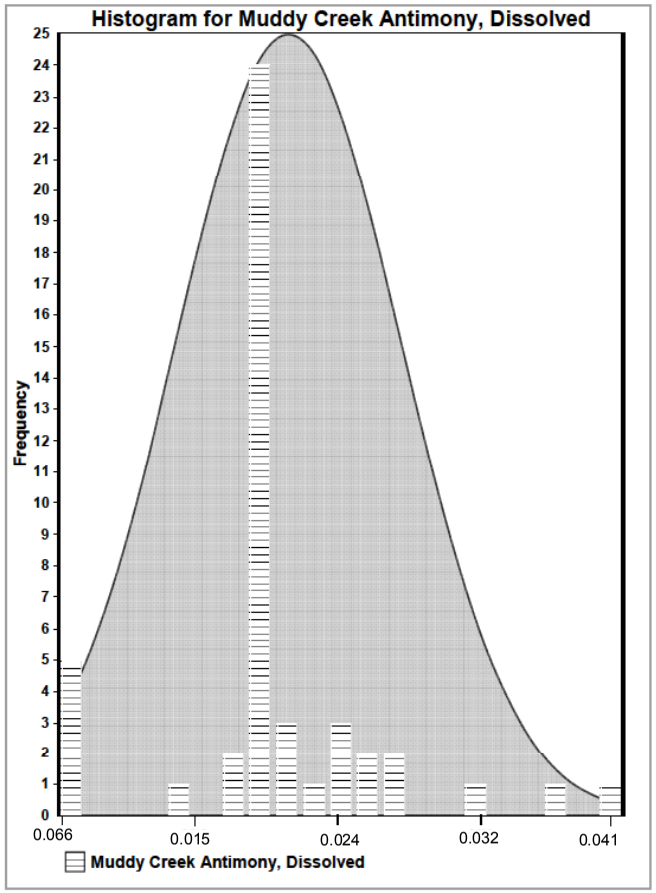

Histogram for Mesa Alkalinity Bicarbonate
Frequency
0
1
2
3
4
5
6
78
97
116
136
155
175
194
213
233
252
Mesa Alkalinity Bicarbonate

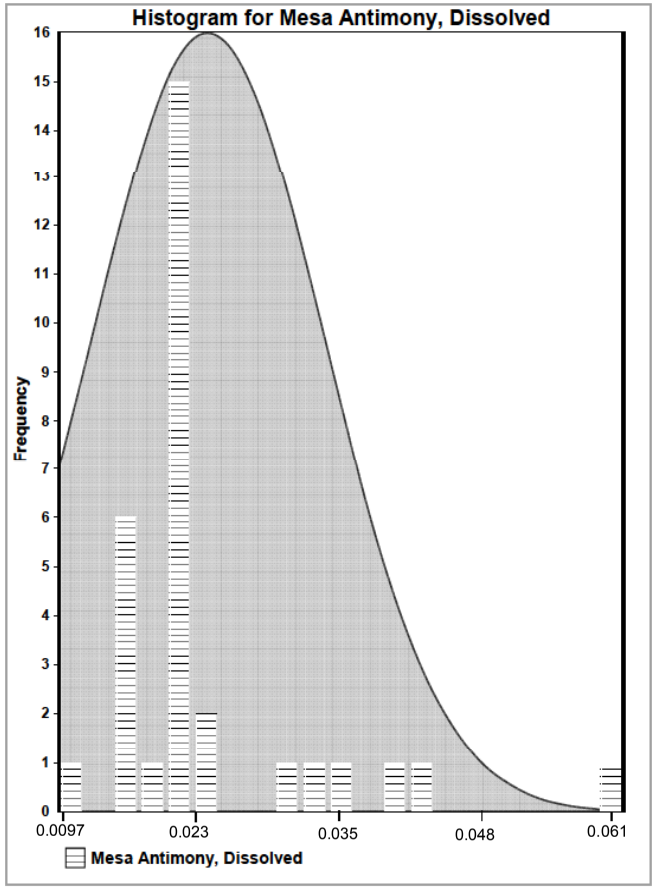

Histogram for Alluv Aluminum, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
0.031
0.040
0.066
0.083
0.10
Alluv Aluminum, Dissolved

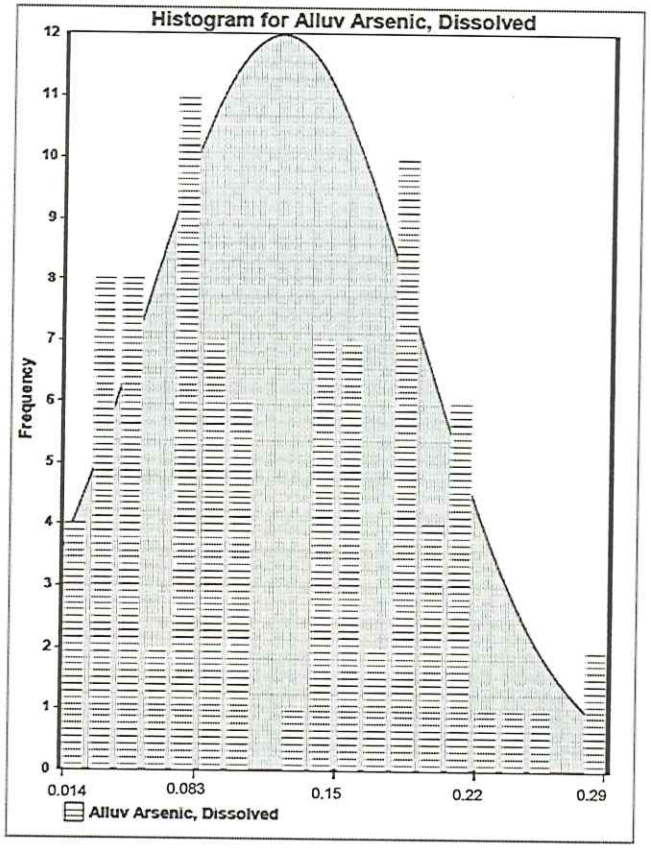

Histogram for Muddy Creek Aluminum, Dissolved
Frequency
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
0.036
0.057
0.078
0.10
0.12
Muddy Creek Aluminum, Dissolved

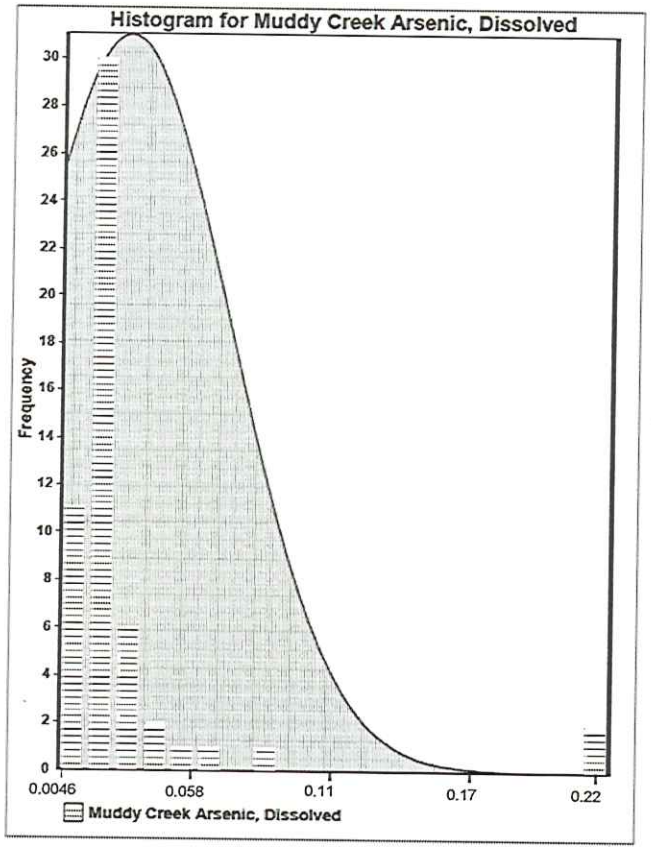

Histogram for Mesa Aluminum, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
0.033
0.050
0.067
0.083
0.10
Mesa Aluminum, Dissolved

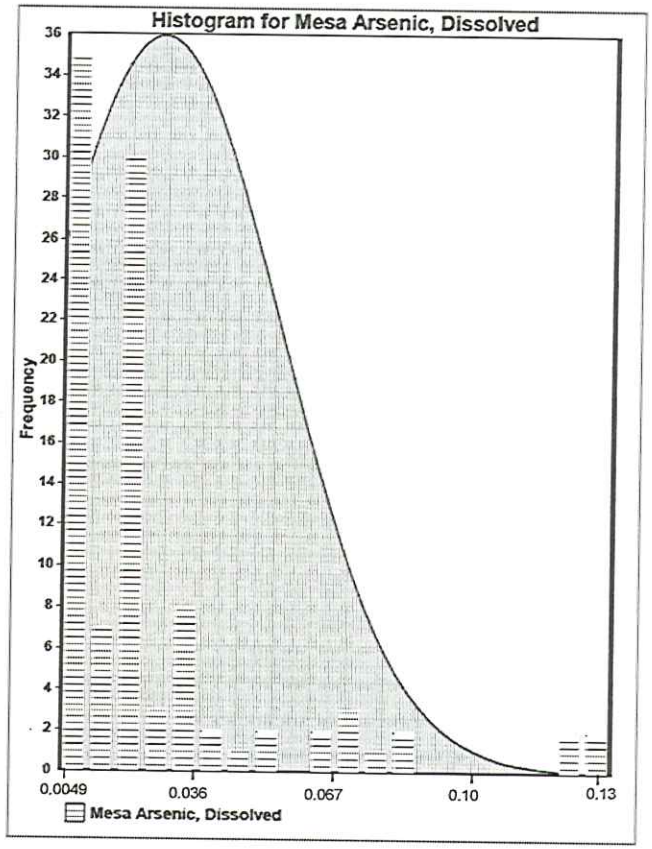

Histogram for Alluv Antimony, Dissolved
Frequency
0.0079
0.013
0.018
0.023
0.028
Alluv Antimony, Dissolved

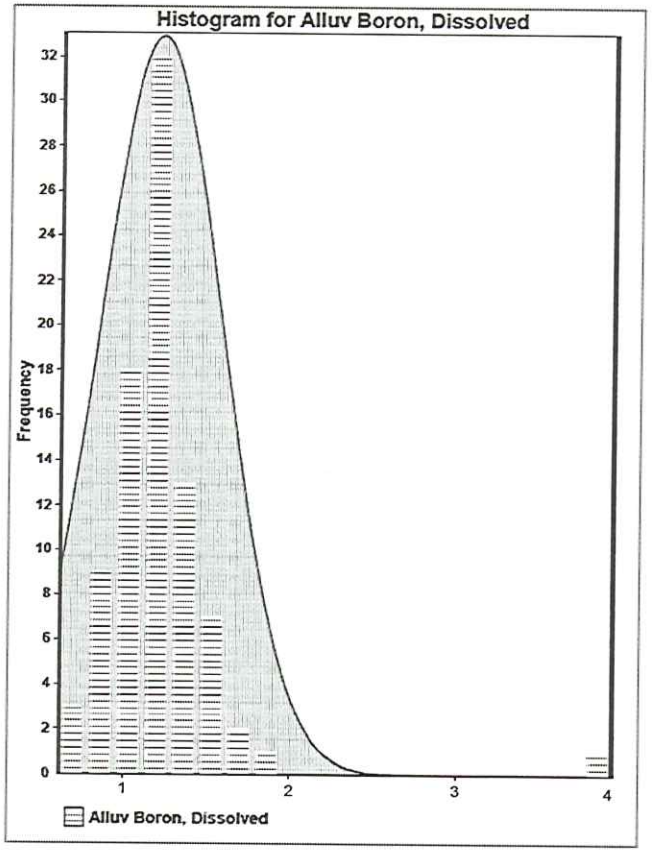

Histogram for Muddy Creek Antimony, Dissolved
Frequency
0.066
0.015
0.024
0.032
0.041
Muddy Creek Antimony, Dissolved

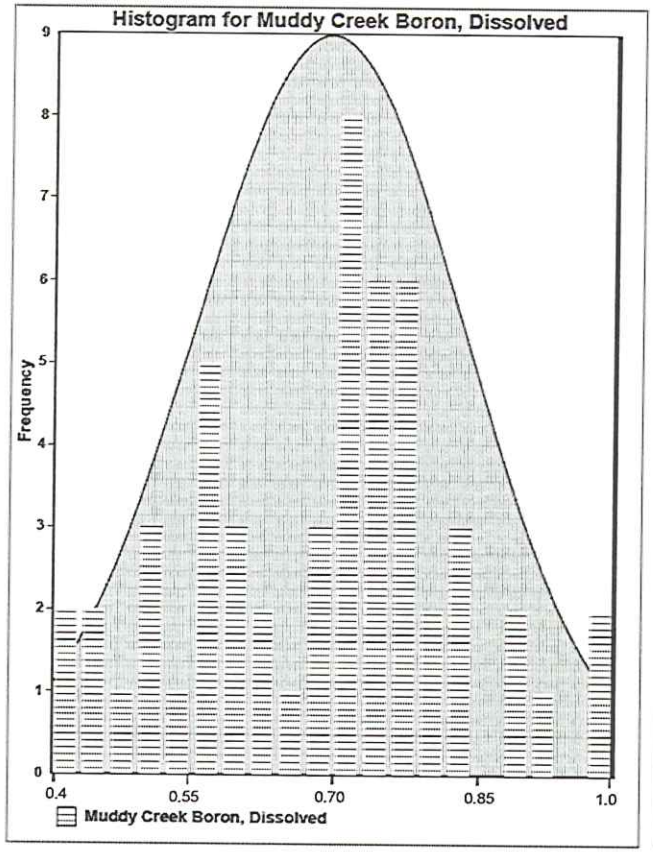

Histogram for Mesa Antimony, Dissolved
Frequency
0.0097
0.023
0.035
0.048
0.061
Mesa Antimony, Dissolved

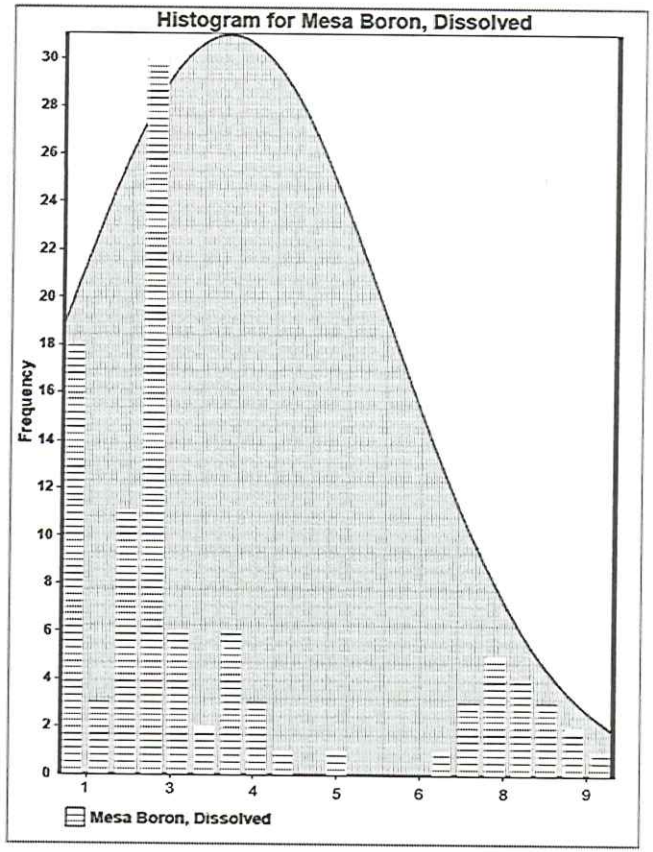

Histogram for Alluv Arsenic, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
0.014
0.083
0.15
0.22
0.29
Alluv Arsenic, Dissolved

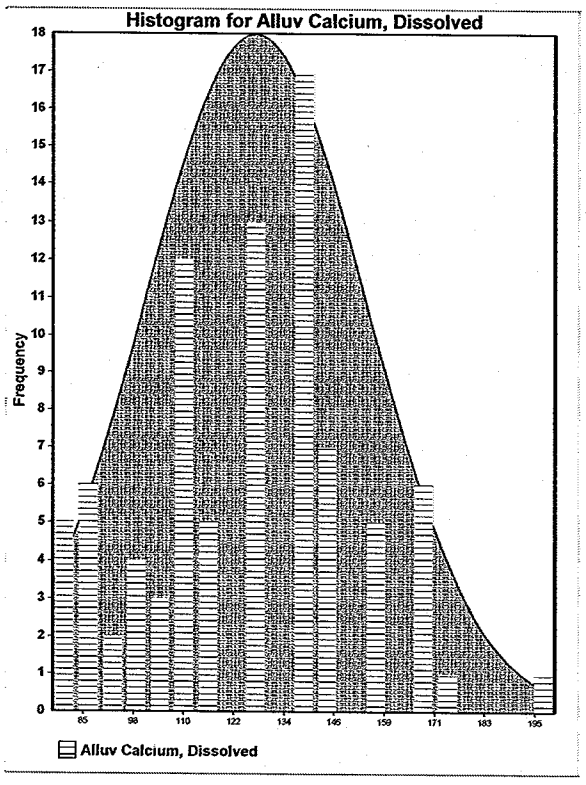

Histogram for Muddy Creek Arsenic, Dissolved
Frequency
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
0.0046
0.058
0.11
0.17
0.22
Muddy Creek Arsenic, Dissolved

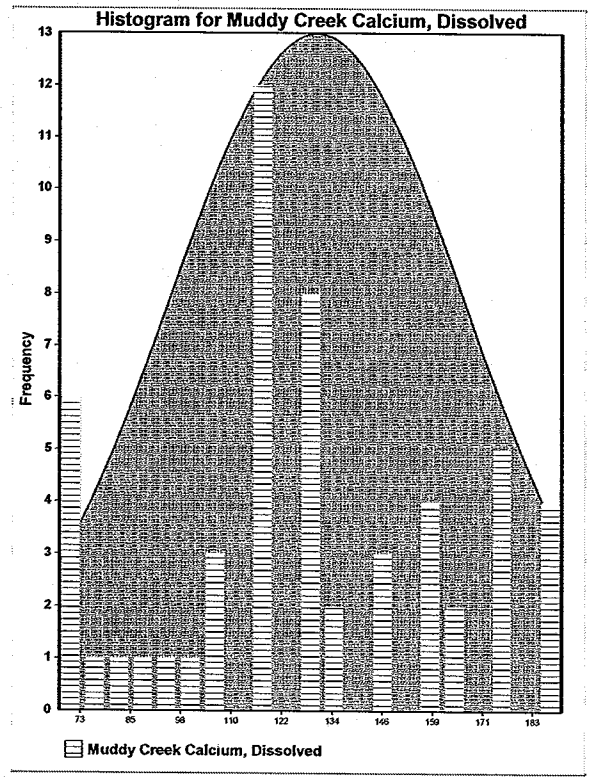

Histogram for Mesa Arsenic, Dissolved
Frequency
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
0.0049
0.036
0.067
0.10
0.13
Mesa Arsenic, Dissolved

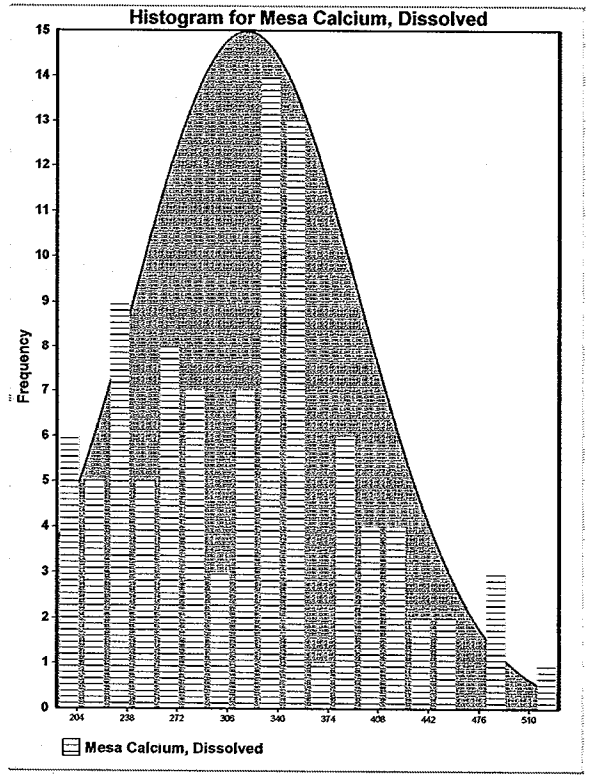

Histogram for Alluv Boron, Dissolved
Frequency
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
1
2
3
4
Alluv Boron, Dissolved

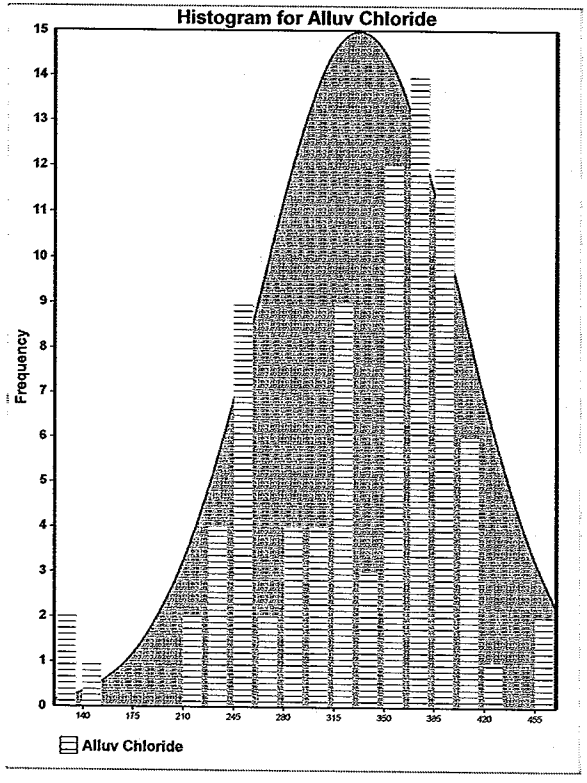

Histogram for Muddy Creek Boron, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
0.4
0.55
0.70
0.85
1.0
Muddy Creek Boron, Dissolved

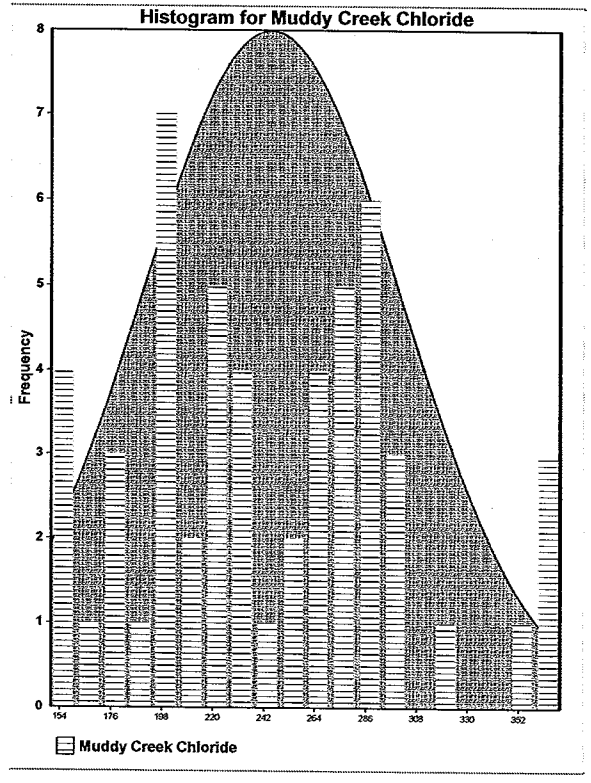

Histogram for Mesa Boron, Dissolved
Frequency
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
1
3
4
5
6
8
9
Mesa Boron, Dissolved

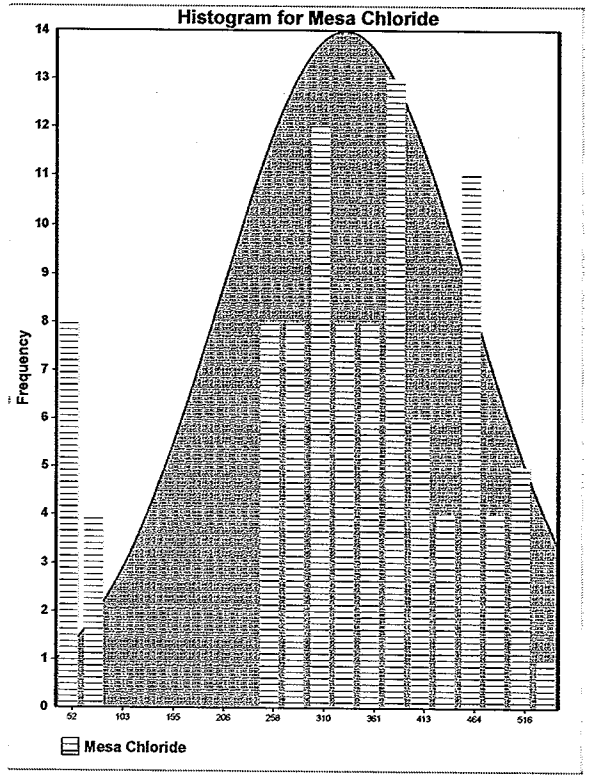

Histogram for Alluv Calcium, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
85
98
110
122
134
146
159
171
183
195
Alluv Calcium, Dissolved

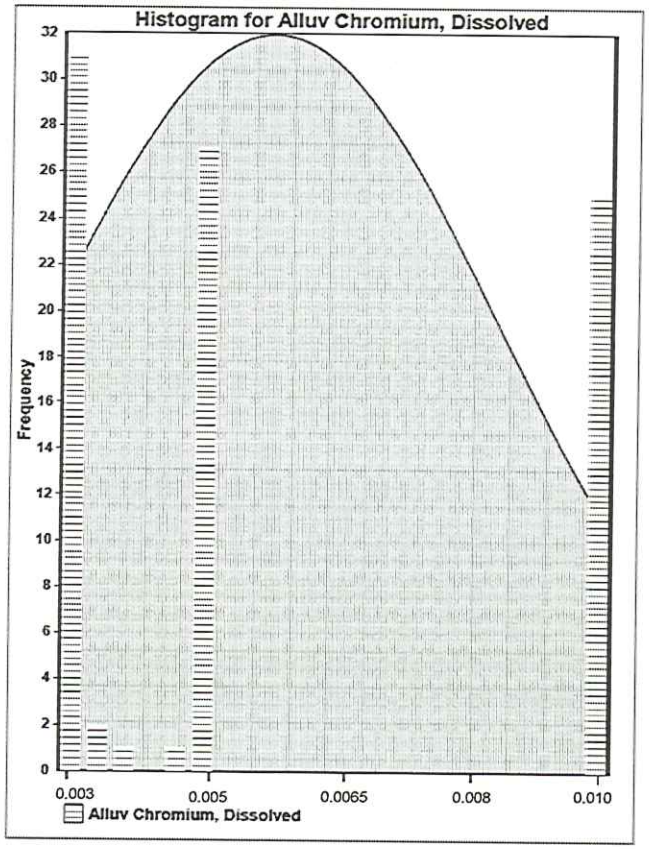

Histogram for Muddy Creek Calcium, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
73
85
98
110
122
134
146
159
171
183
Muddy Creek Calcium, Dissolved

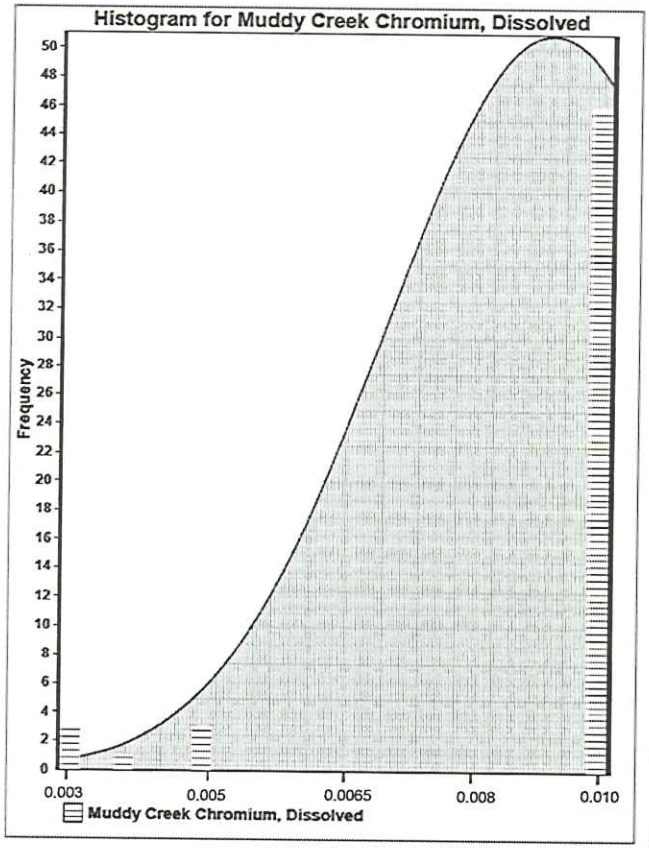

Histogram for Mesa Calcium, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
204
238
272
306
340
374
408
442
476
510
Mesa Calcium, Dissolved

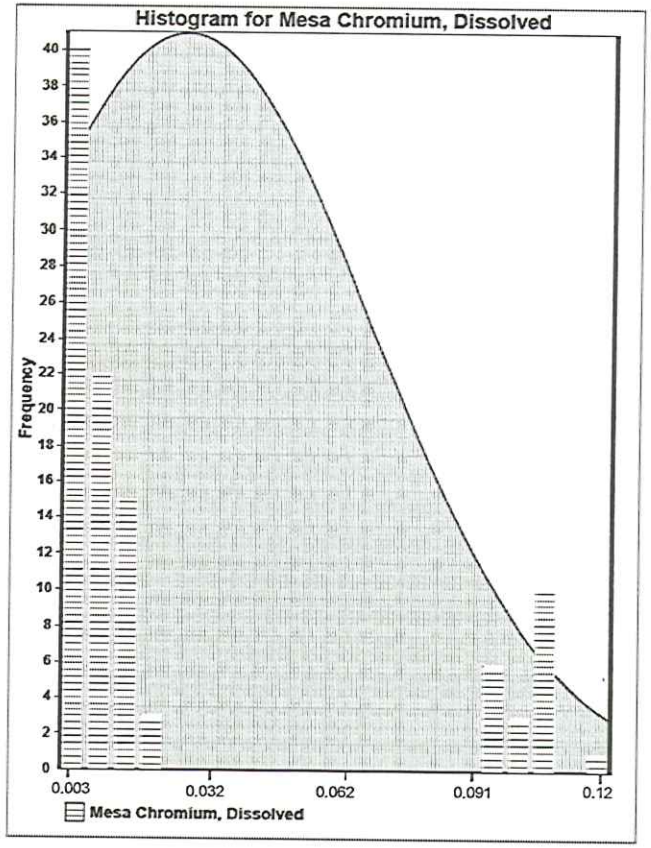

Histogram for Alluv Chloride
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
140
175
210
245
280
315
350
385
420
455
Alluv Chloride

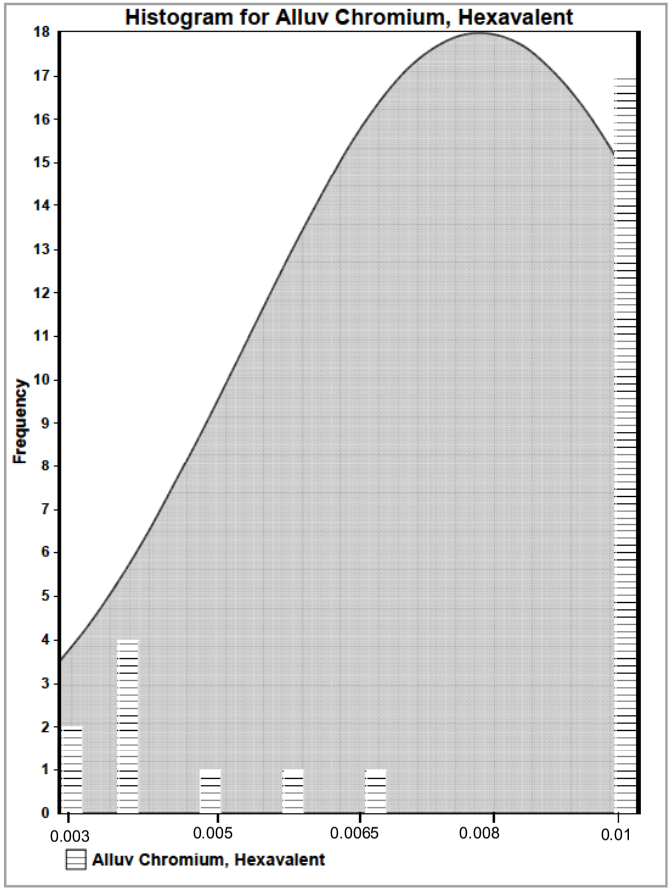

Histogram for Muddy Creek Chloride
Frequency
0
1
2
3
4
5
6
7
8
154
176
198
220
242
264
286
308
330
352
Muddy Creek Chloride

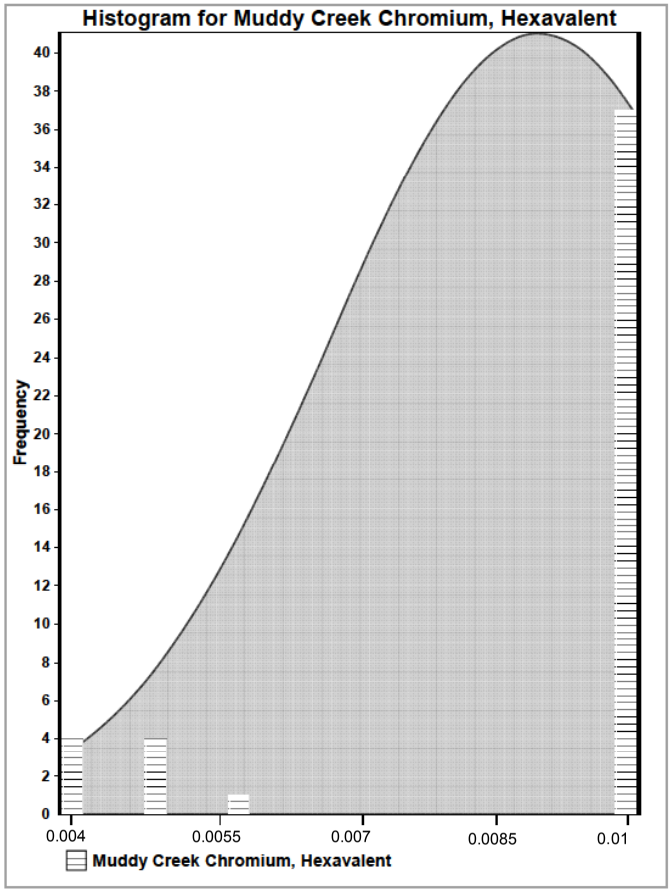

Histogram for Mesa Chloride
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
52
103
155
206
258
310
361
413
464
516
Mesa Chloride

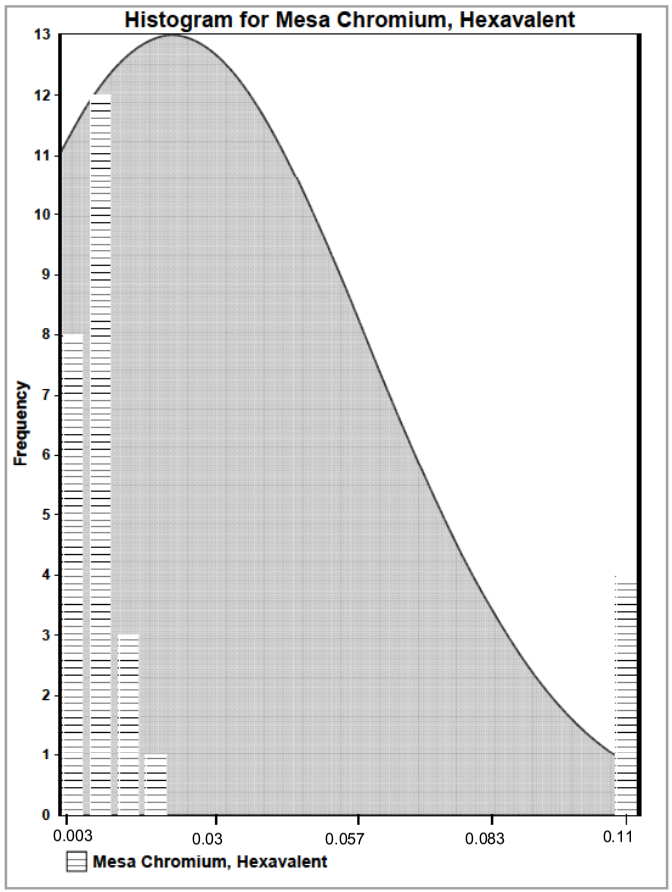

Histogram for Alluv Chromium, Dissolved
Frequency
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
0.003
0.005
0.0065
0.008
0.010
Alluv Chromium, Dissolved

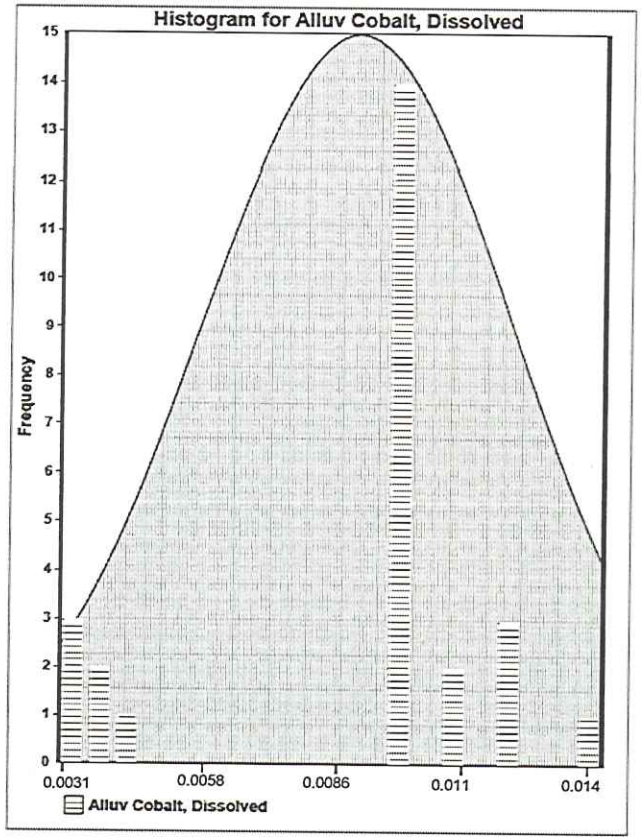

Histogram for Muddy Creek Chromium, Dissolved
Frequency
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
0.003
0.005
0.0065
0.008
0.010
Muddy Creek Chromium, Dissolved

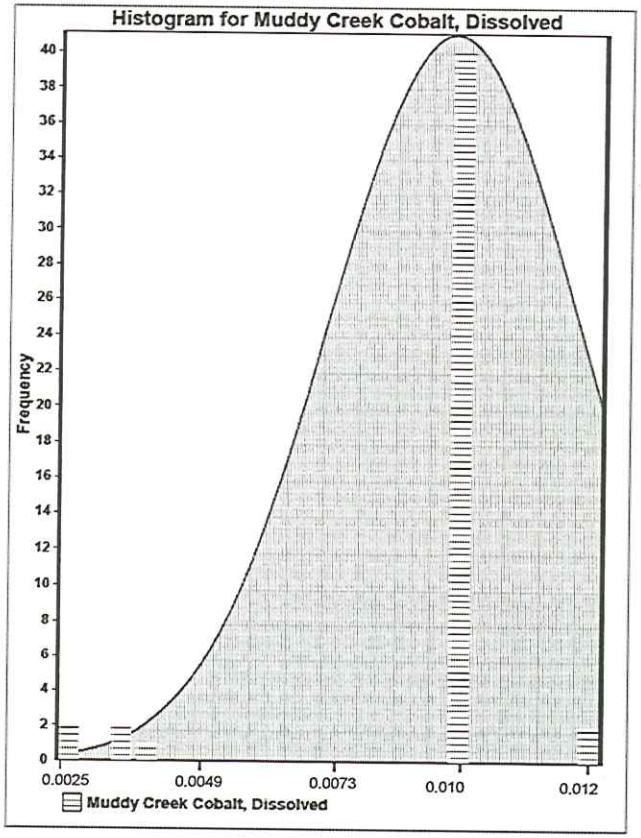

Histogram for Mesa Chromium, Dissolved
Frequency
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
0.003
0.032
0.062
0.091
0.12
Mesa Chromium, Dissolved

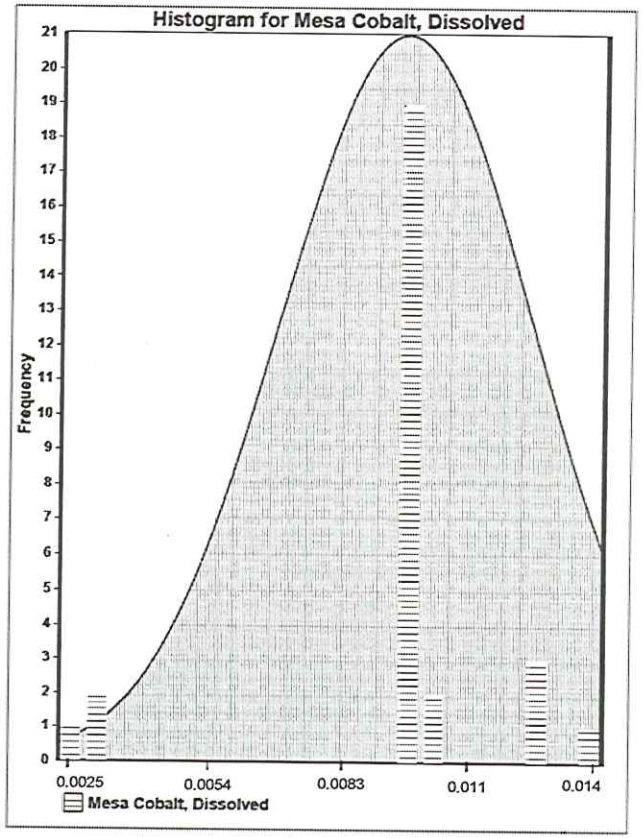

Histogram for Alluv Chromium, Hexavalent
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
0.003
0.005
0.0065
0.008
0.01
Alluv Chromium, Hexavalent

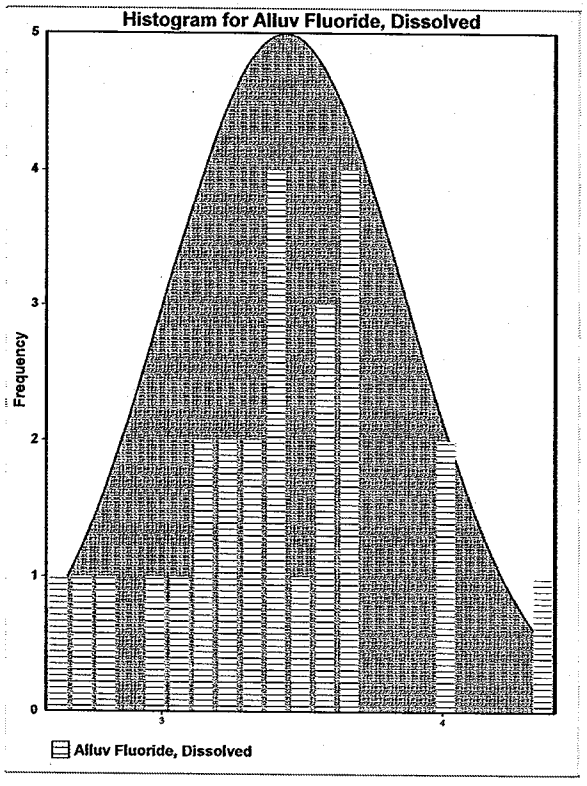

Histogram for Muddy Creek Chromium, Hexavalent
Frequency
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
0.004
0.0055
0.007
0.0085
0.01
Muddy Creek Chromium, Hexavalent

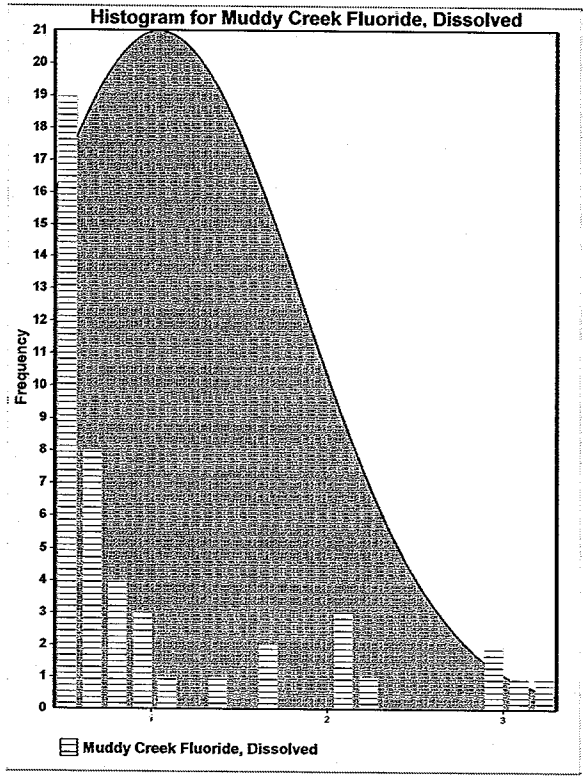

Histogram for Mesa Chromium, Hexavalent
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
0.003
0.03
0.057
0.083
0.11
Mesa Chromium, Hexavalent

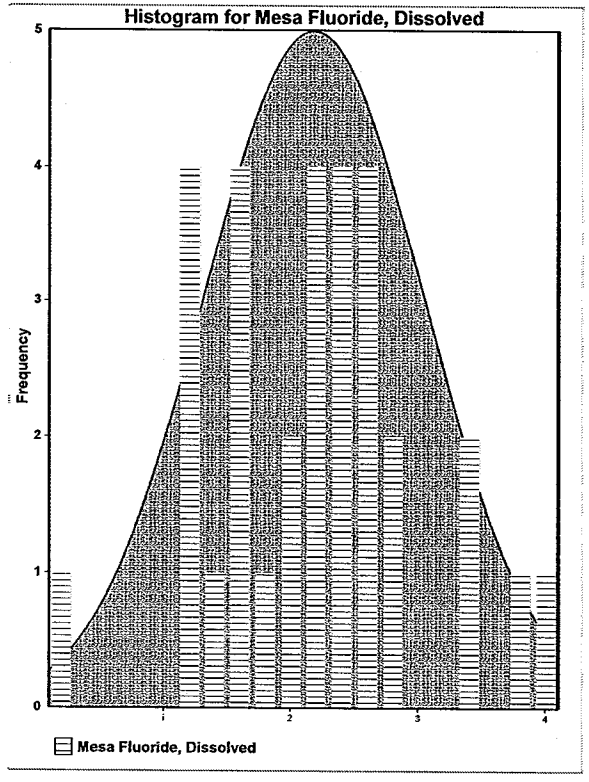

Histogram for Alluv Cobalt, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
0.0031
0.0058
0.0086
0.011
0.014
Alluv Cobalt, Dissolved

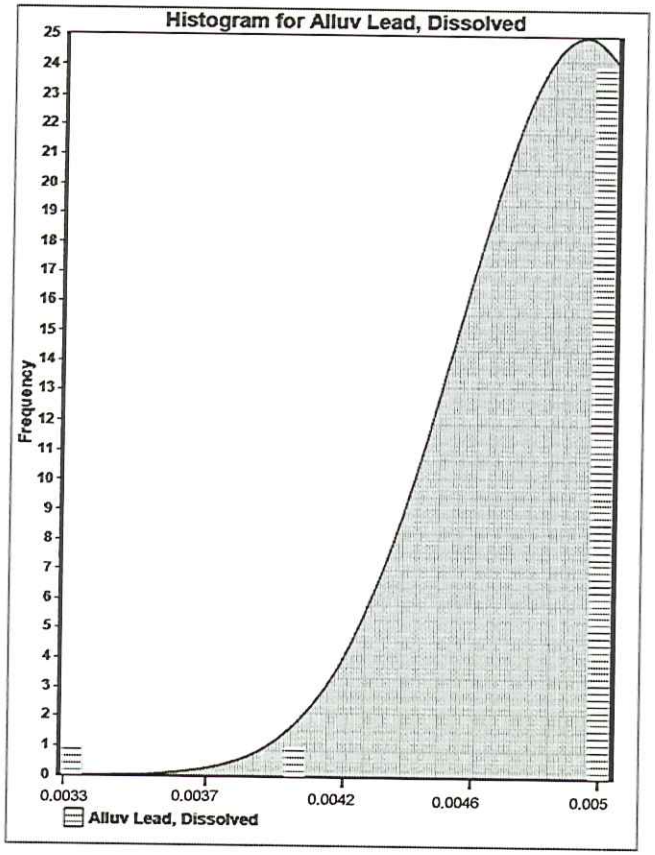

Histogram for Muddy Creek Cobalt, Dissolved
Frequency
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
0.0025
0.0049
0.0073
0.010
0.012
Muddy Creek Cobalt, Dissolved

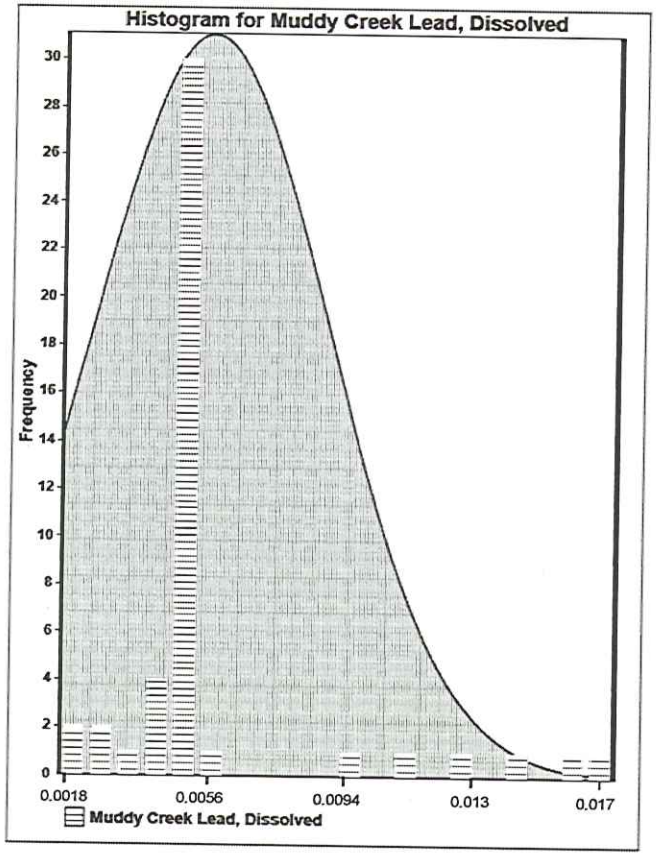

Histogram for Mesa Cobalt, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
0.0025
0.0054
0.0083
0.011
0.014
Mesa Cobalt, Dissolved

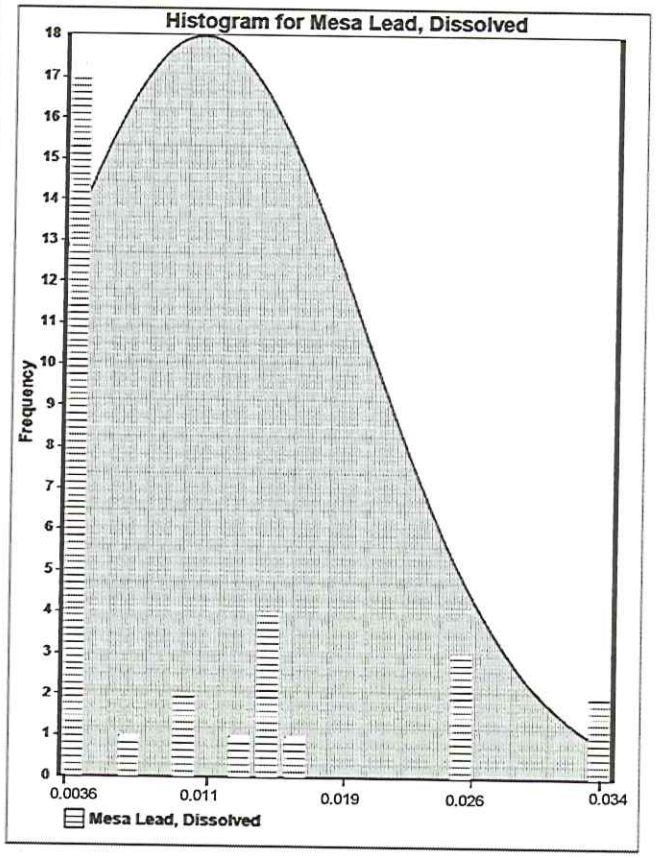

Histogram for Alluv Fluoride, Dissolved
Frequency
0
1
2
3
4
5
3
4
Alluv Fluoride, Dissolved

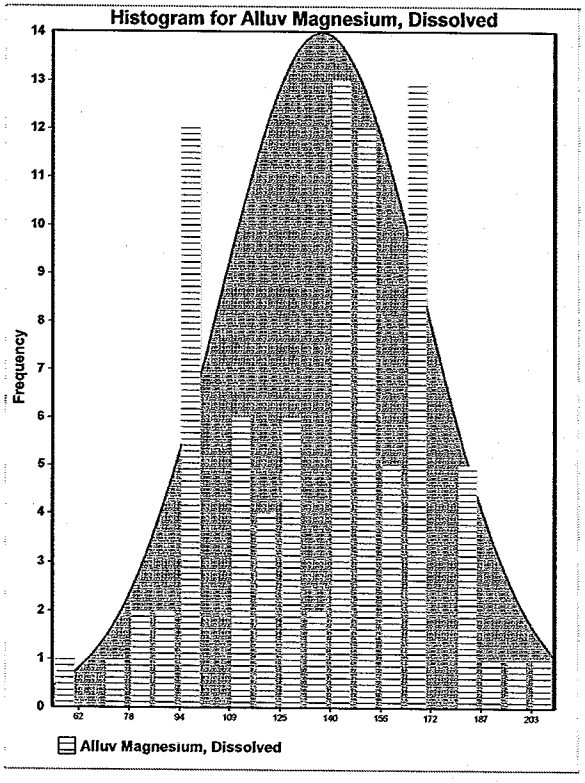

Histogram for Muddy Creek Fluoride, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
1
2
3
Muddy Creek Fluoride, Dissolved

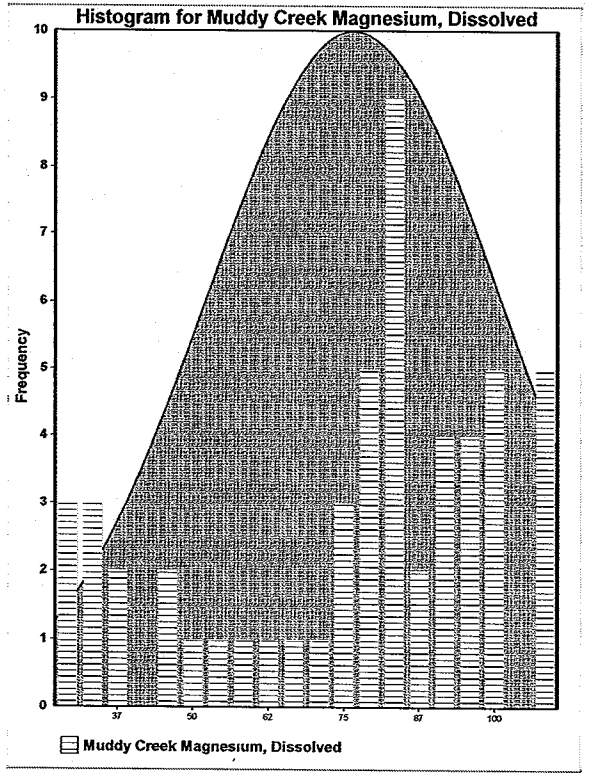

Histogram for Mesa Fluoride, Dissolved
Frequency
0
1
2
3
4
5
1
2
3
4
Mesa Fluoride, Dissolved

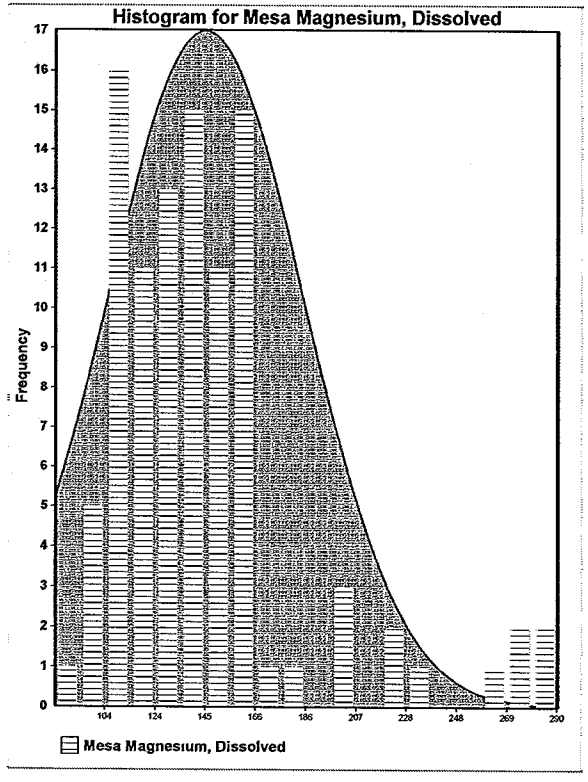

Histogram for Alluv Lead, Dissolved
Frequency
0.0033
0.0037
0.0042
0.0046
0.005
Alluv Lead, Dissolved

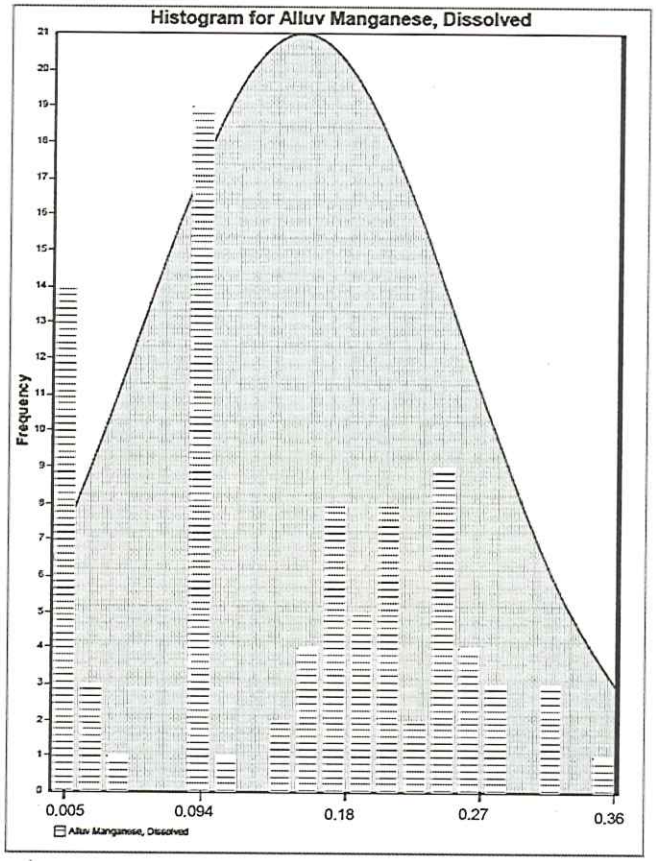

Histogram for Muddy Creek Lead, Dissolved
Frequency
0.0018
0.0056
0.0094
0.013
0.017
Muddy Creek Lead, Dissolved

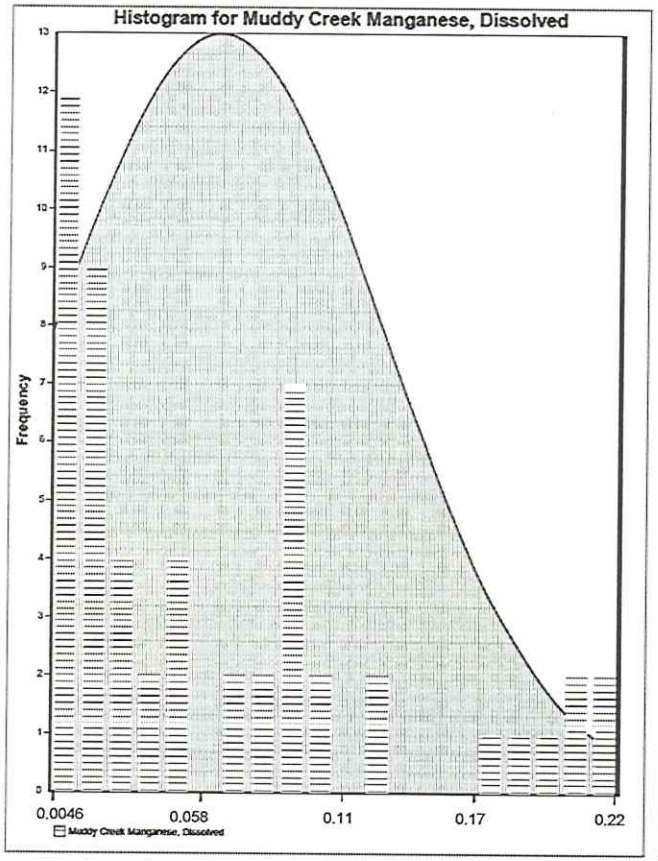

Histogram for Mesa Lead, Dissolved
Frequency
0.0036
0.011
0.019
0.026
0.034
Mesa Lead, Dissolved

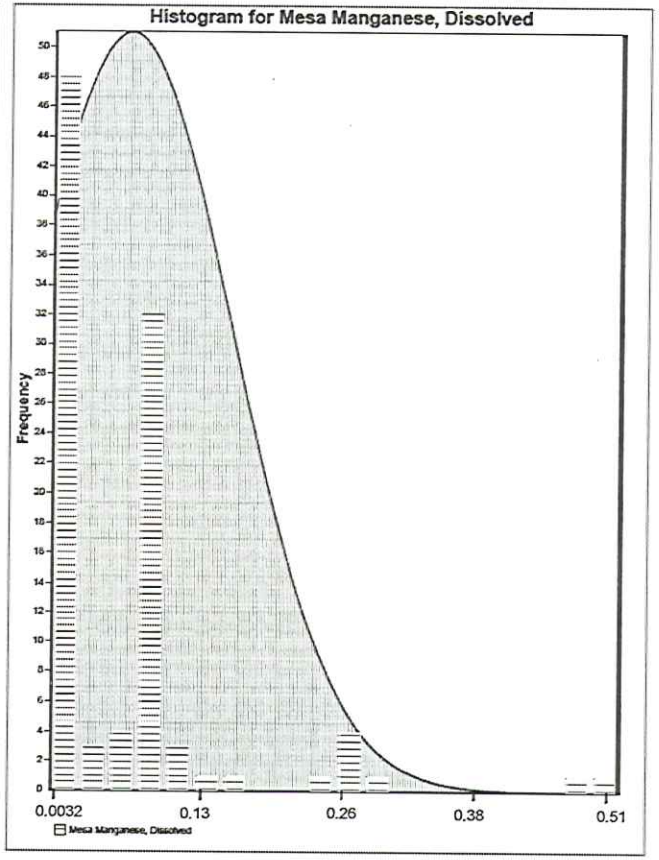

Histogram for Alluv Magnesium, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
62
78
94
109
125
140
156
172
187
203
Alluv Magnesium, Dissolved

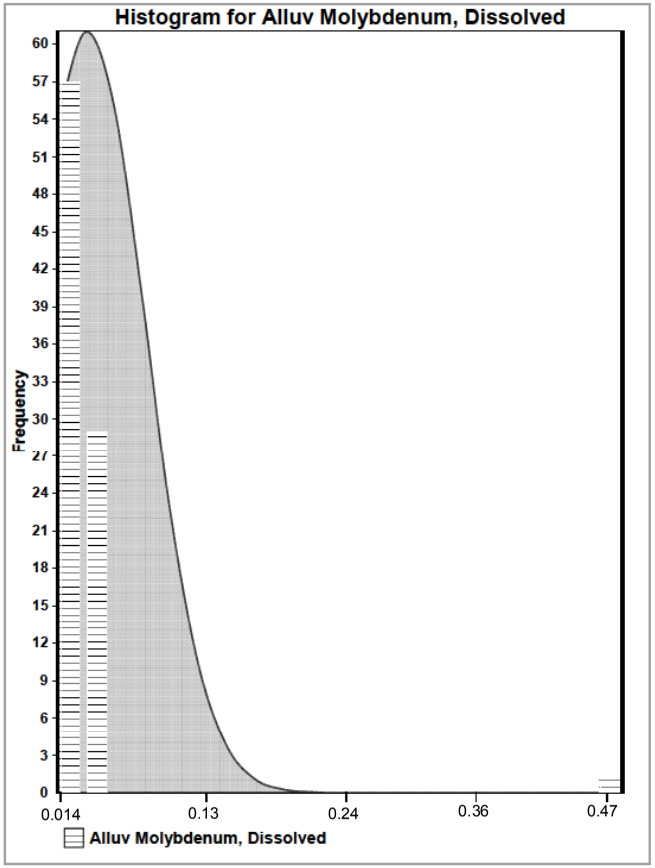

Histogram for Muddy Creek Magnesium, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
10
37
50
62
75
87
100
Muddy Creek Magnesium, Dissolved

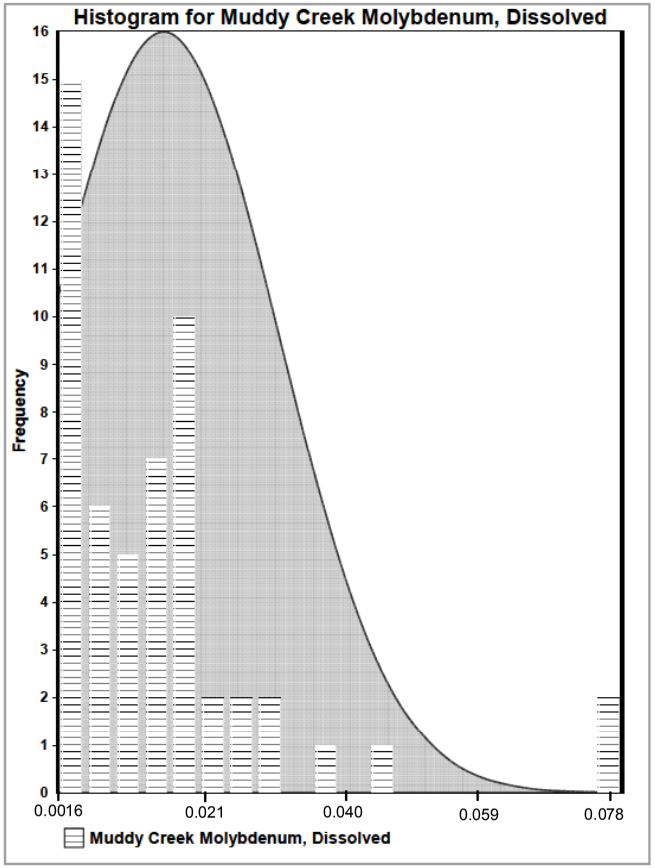

Histogram for Mesa Magnesium, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
104
124
145
165
186
207
228
248
269
290
Mesa Magnesium, Dissolved

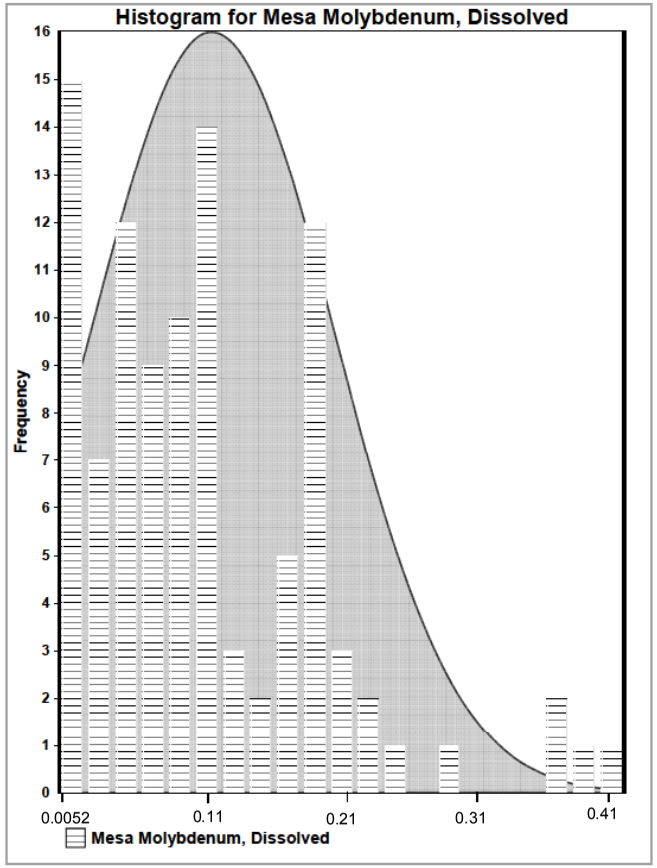

Histogram for Alluv Manganese, Dissolved
Frequency
0.005
0.094
0.18
0.27
0.36
Alluv Manganese, Dissolved

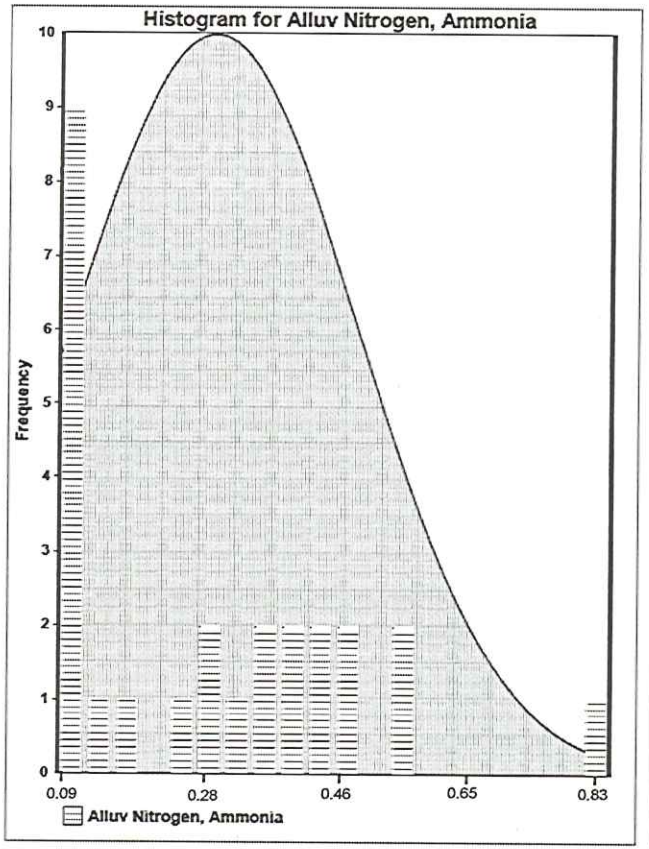

Histogram for Muddy Creek Manganese, Dissolved
Frequency
0.0046
0.058
0.11
0.17
0.22
Muddy Creek Manganese, Dissolved

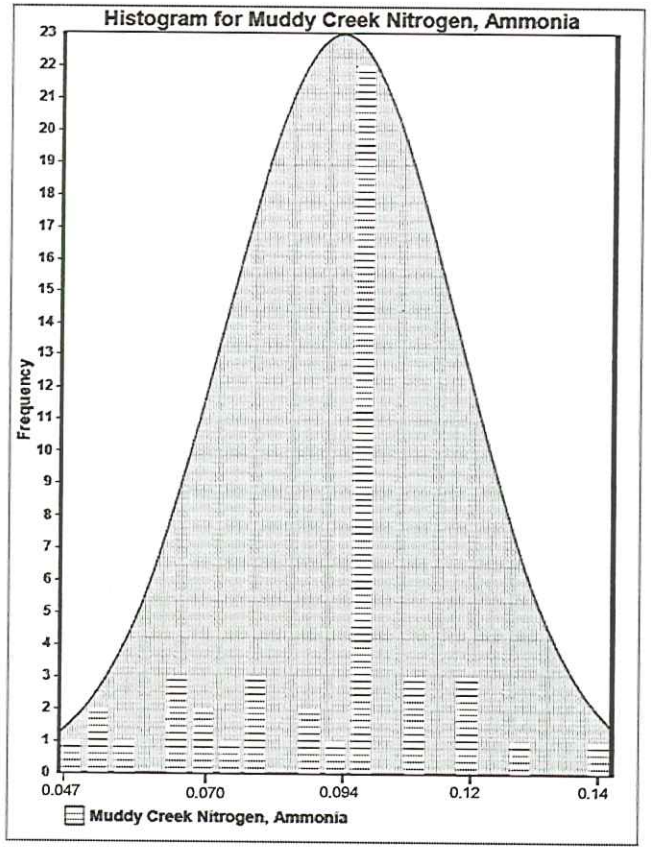

Histogram for Mesa Manganese, Dissolved
Frequency
0.0032
0.13
0.26
0.38
0.51
Mesa Manganese, Dissolved

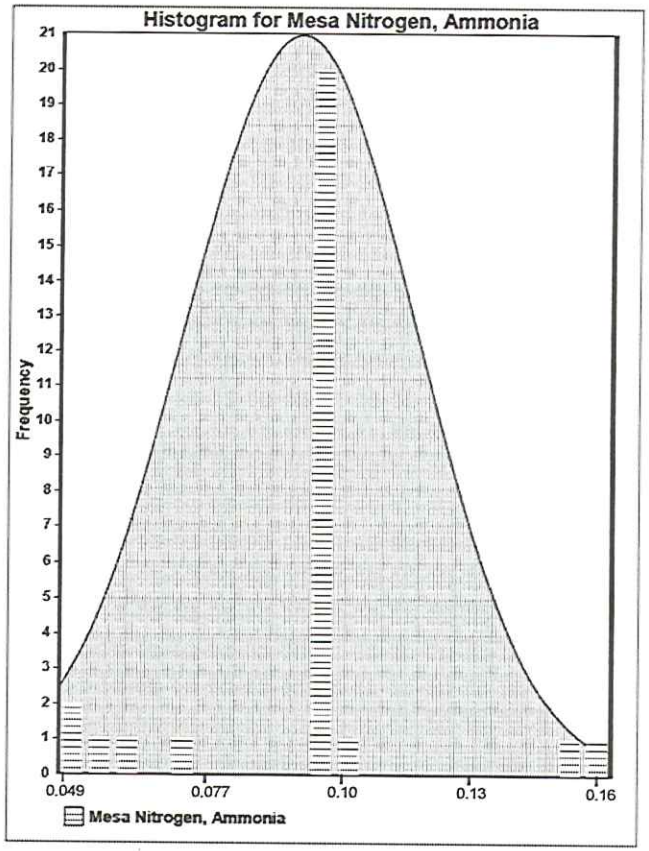

Histogram for Alluv Molybdenum, Dissolved
Frequency
60
57
54
51
48
45
42
39
36
33
30
27
24
21
18
15
12
9
6
3
0
0.014
0.13
0.24
0.36
0.47
Alluv Molybdenum, Dissolved

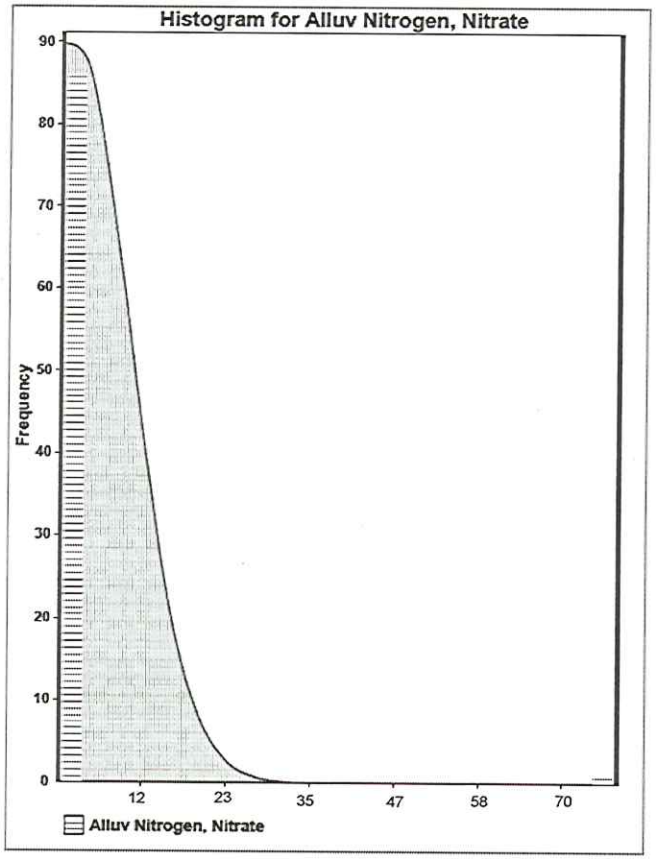

Histogram for Muddy Creek Molybdenum, Dissolved
Frequency
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.0016
0.021
0.040
0.059
0.078
Muddy Creek Molybdenum, Dissolved

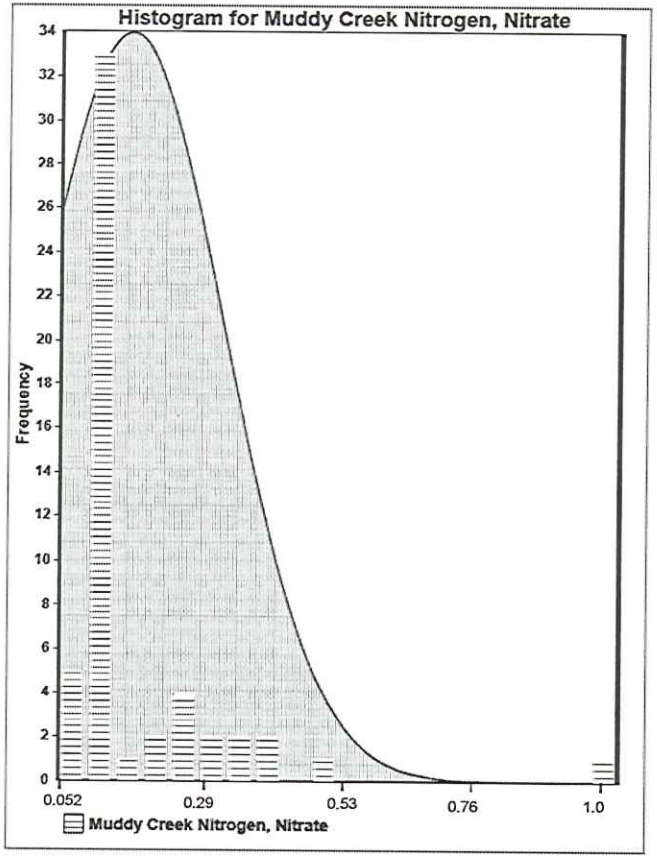

Histogram for Mesa Molybdenum, Dissolved
Frequency
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.0052
0.11
0.21
0.31
0.41
Mesa Molybdenum, Dissolved

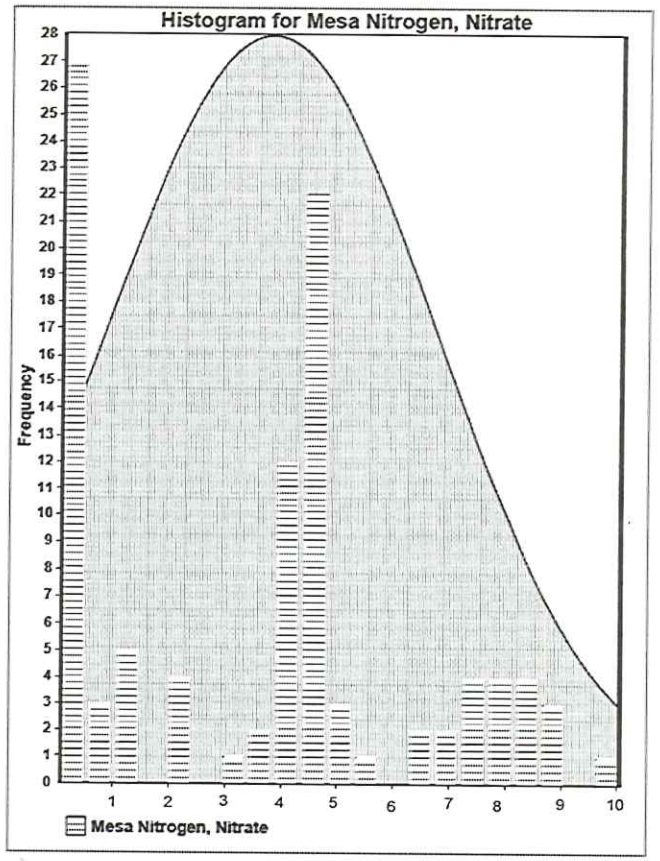

Histogram for Alluv Nitrogen, Ammonia
Frequency
0
1
2
3
4
5
6
7
8
9
10
0.09
0.28
0.46
0.65
0.83
Alluv Nitrogen, Ammonia

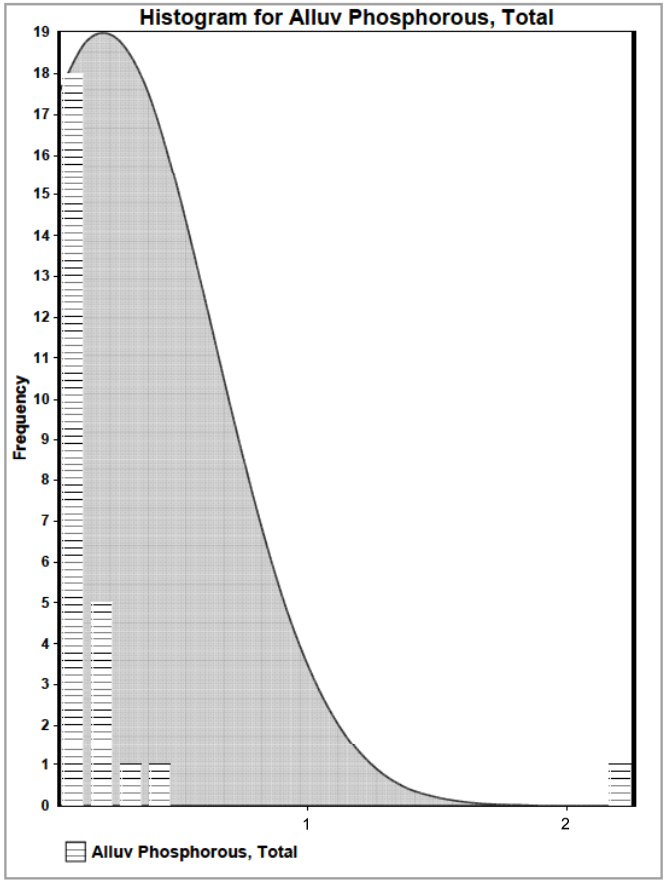

Histogram for Muddy Creek Nitrogen, Ammonia
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
0.047
0.070
0.094
0.12
0.14
Muddy Creek Nitrogen, Ammonia

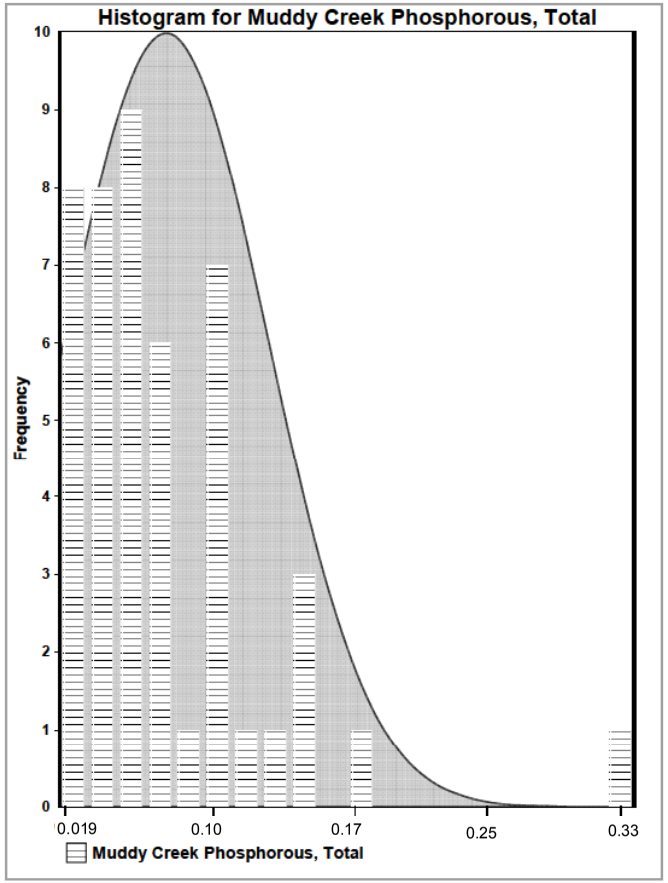

Histogram for Mesa Nitrogen, Ammonia
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
0.049
0.077
0.10
0.13
0.16
Mesa Nitrogen, Ammonia

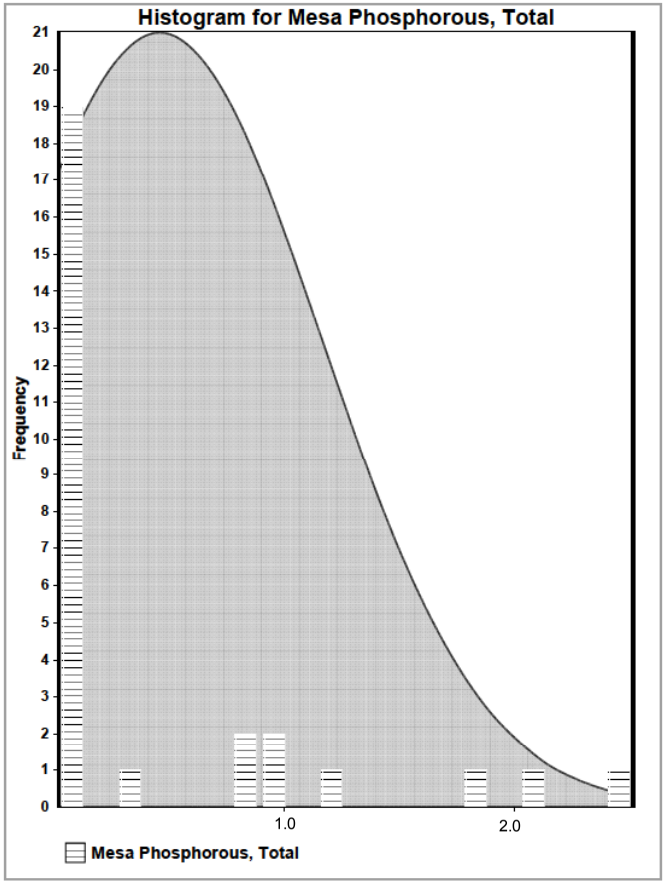

Histogram for Alluv Nitrogen, Nitrate
Frequency
0
10
20
30
40
50
60
70
80
90
12
23
35
47
58
70
Alluv Nitrogen, Nitrate

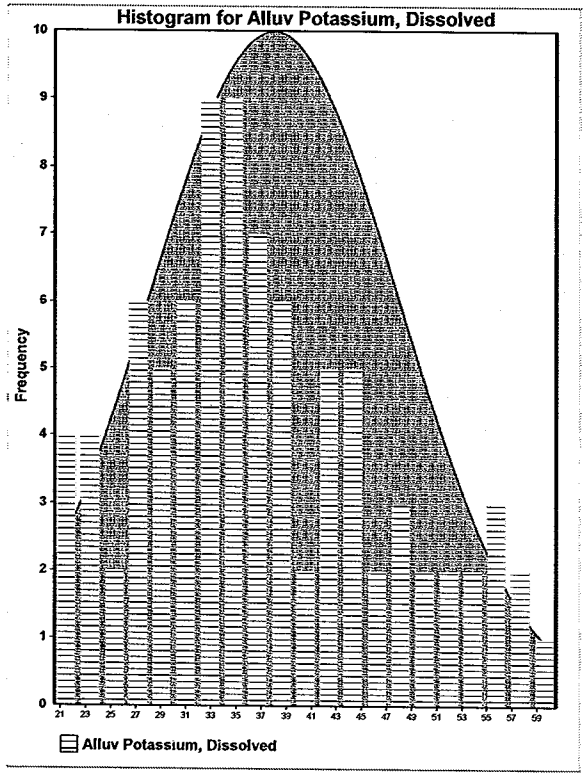

Histogram for Muddy Creek Nitrogen, Nitrate
Frequency
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
0.052
0.29
0.53
0.76
1.0
Muddy Creek Nitrogen, Nitrate

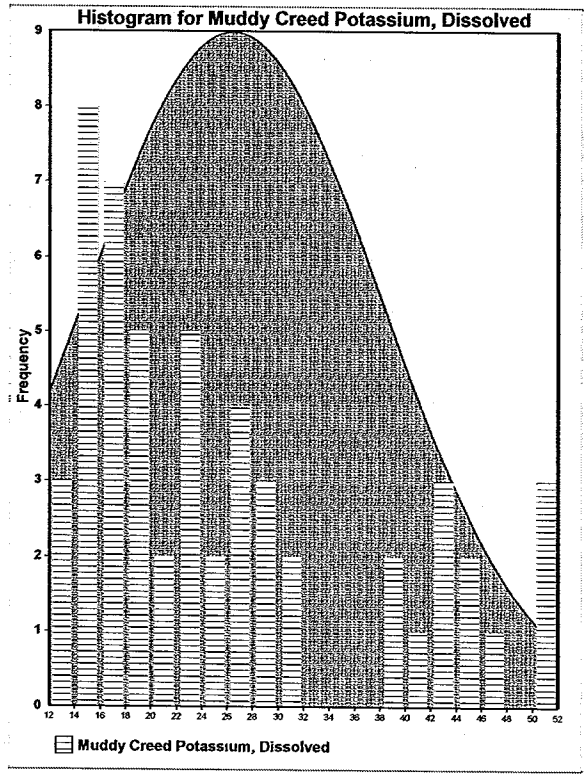

Histogram for Mesa Nitrogen, Nitrate
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
1
2
3
4
5
6
7
8
9
10
Mesa Nitrogen, Nitrate

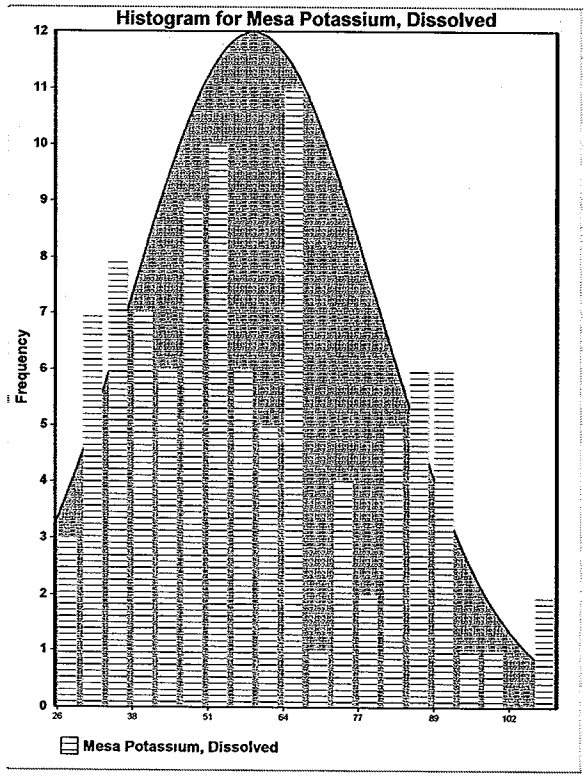

Histogram for Alluv Phosphorous, Total
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
1
2
Alluv Phosphorous, Total

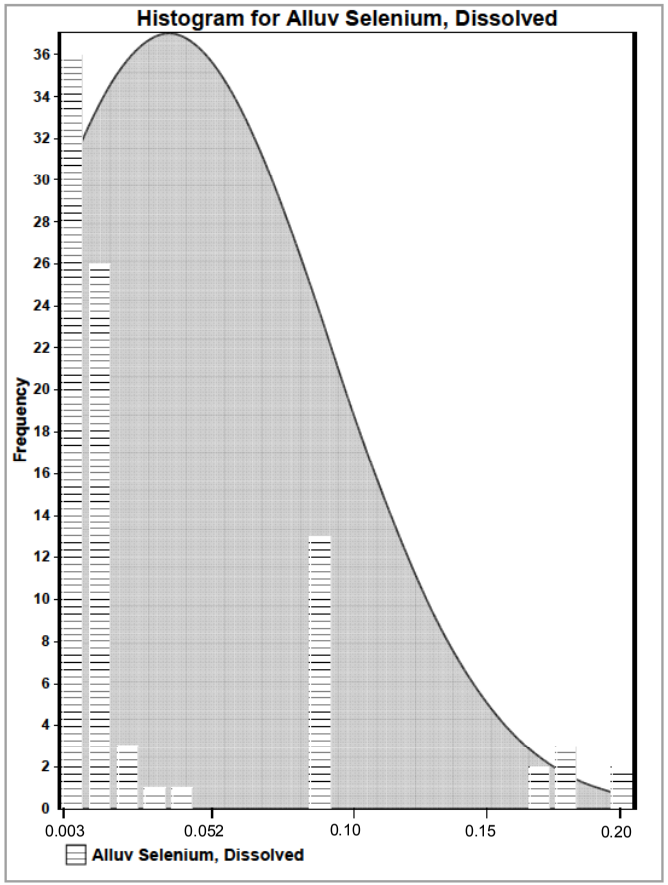

Histogram for Muddy Creek Phosphorous, Total
Frequency
0
1
2
3
4
5
6
7
8
9
10
0.019
0.10
0.17
0.25
0.33
Muddy Creek Phosphorous, Total

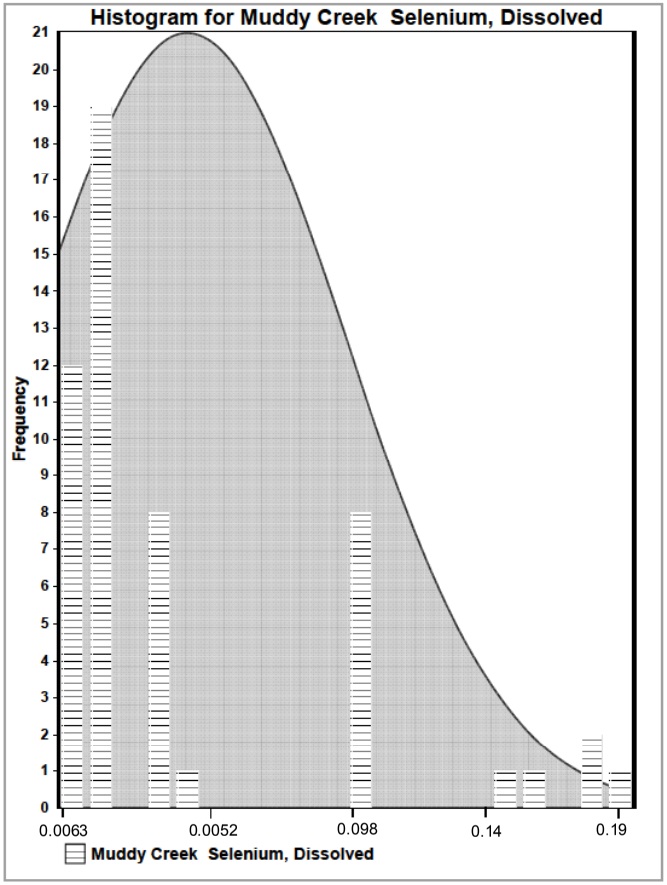

Histogram for Mesa Phosphorous, Total
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
1.0
2.0
Mesa Phosphorous, Total

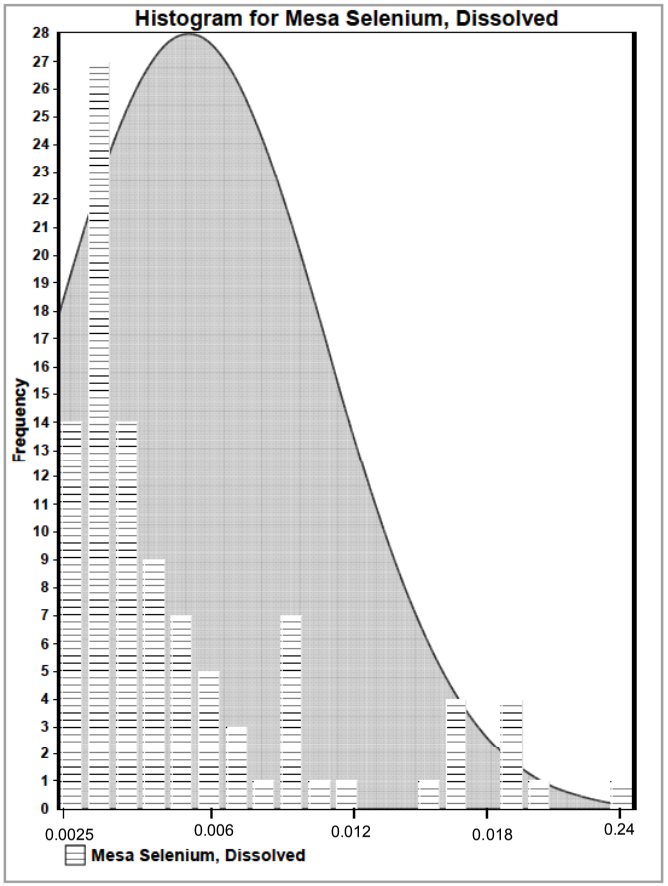

Histogram for Alluv Potassium, Dissolved
Frequency
Alluv Potassium, Dissolved

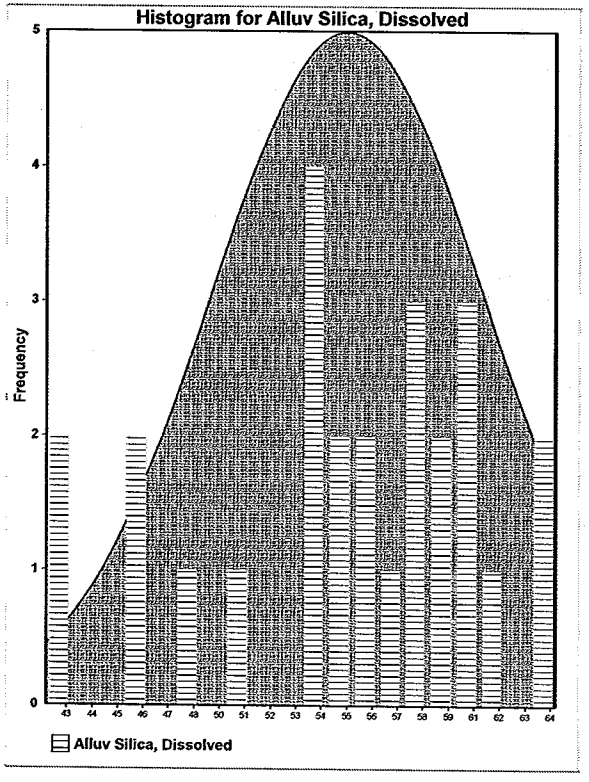

Histogram for Muddy Creed Potassium, Dissolved
Frequency
Muddy Creed Potassium, Dissolved

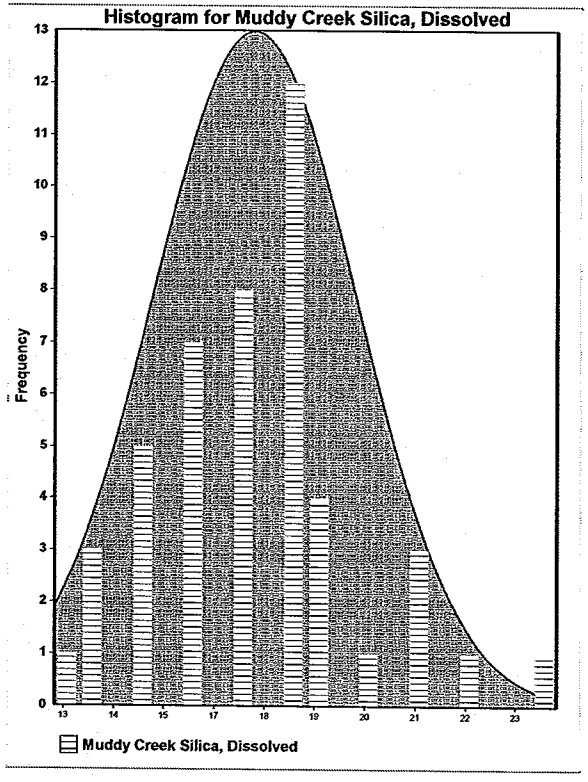

Histogram for Mesa Potassium, Dissolved
Frequency
Mesa Potassium, Dissolved

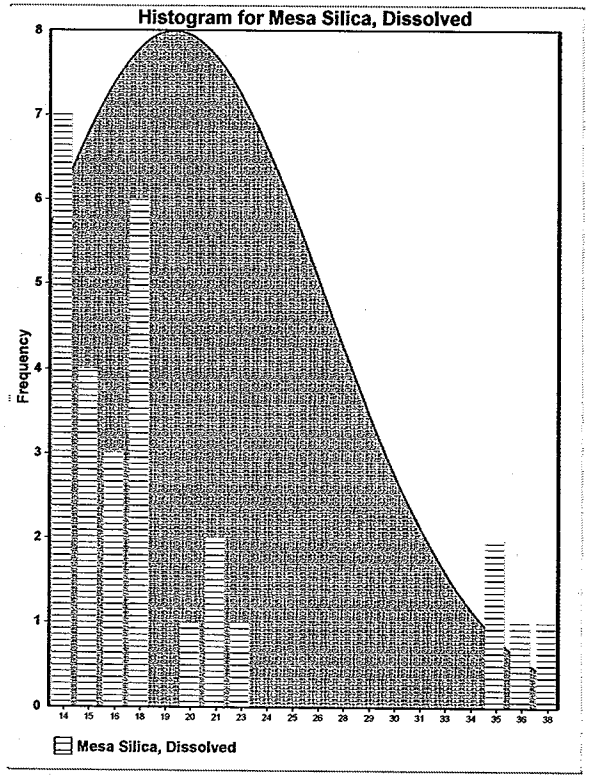

Histogram for Alluv Selenium, Dissolved
Frequency
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
0.003
0.052
0.10
0.15
0.20
Alluv Selenium, Dissolved

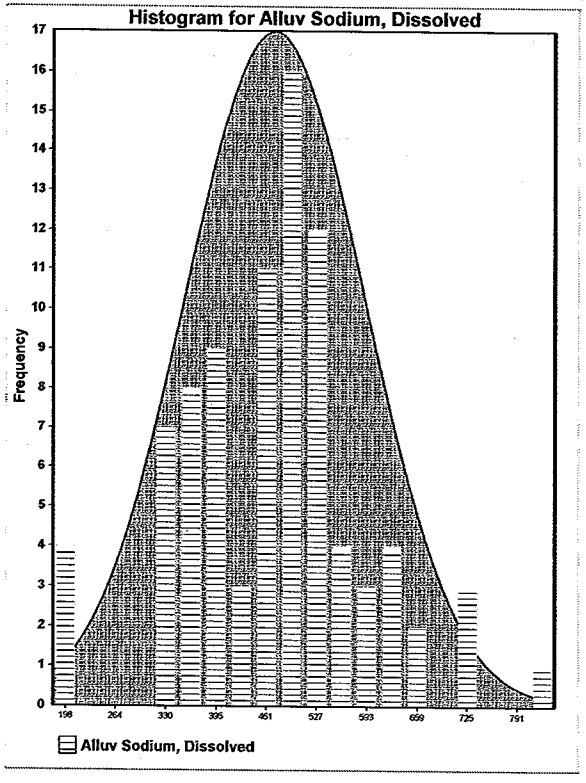

Histogram for Muddy Creek Selenium, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
0.0063
0.0052
0.098
0.14
0.19
Muddy Creek Selenium, Dissolved

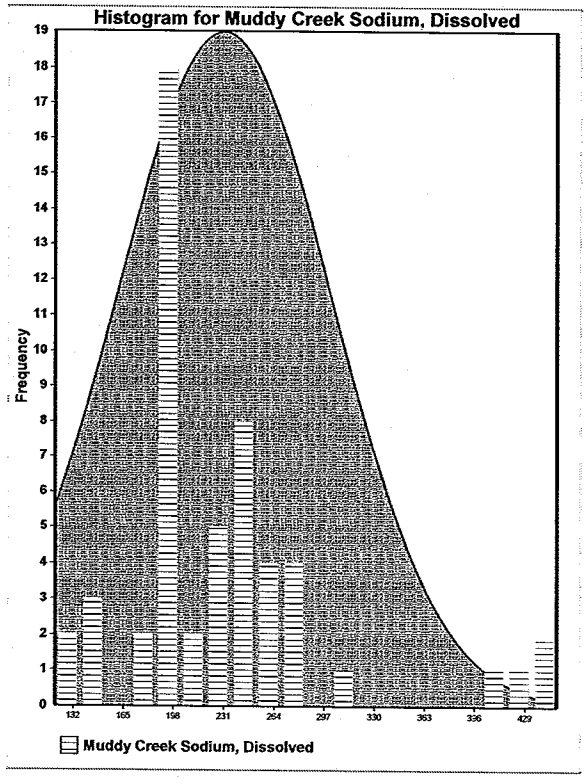

Histogram for Mesa Selenium, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
0.0025
0.006
0.012
0.018
0.24
Mesa Selenium, Dissolved

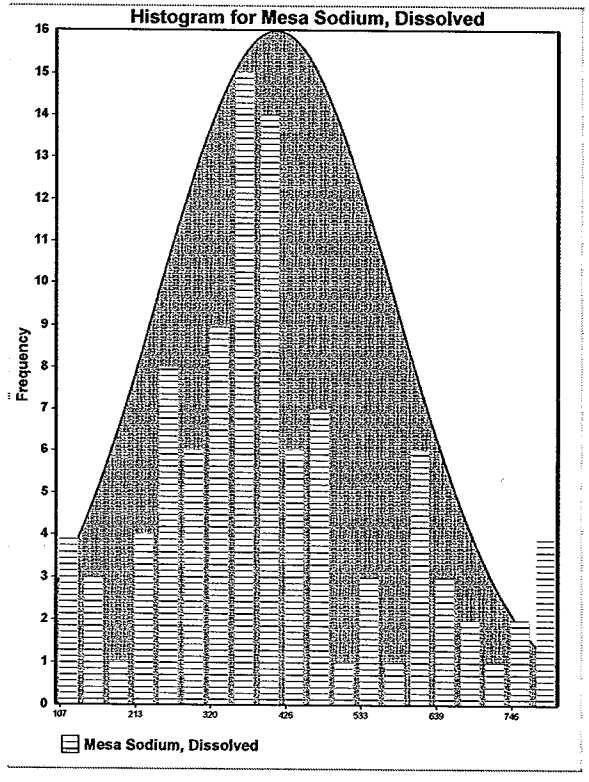

Histogram for Alluv Silica, Dissolved
Frequency
0
1
2
3
4
5
43 44 45 46 47 48 50 51 52 53 54 55 56 57 58 59 61 62 63 64
Alluv Silica, Dissolved

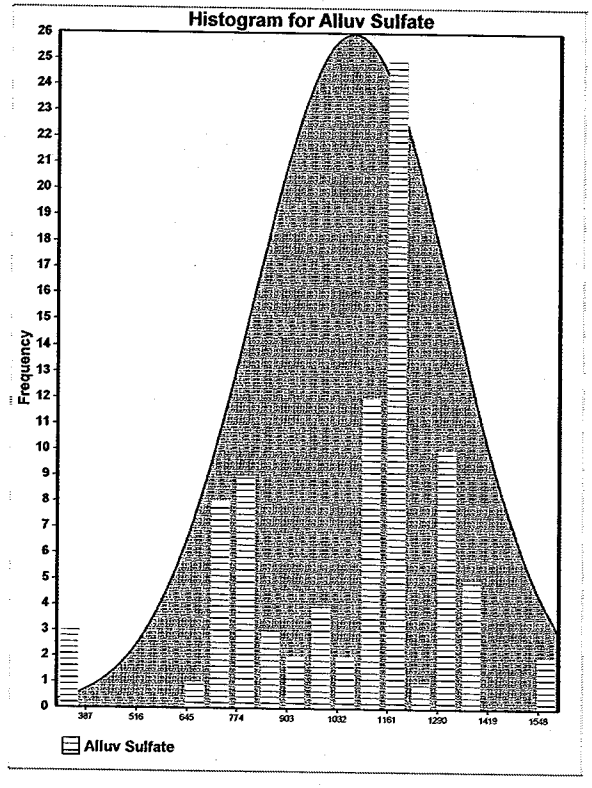

Histogram for Muddy Creek Silica, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
13 14 15 17 18 19 20 21 22 23
Muddy Creek Silica, Dissolved

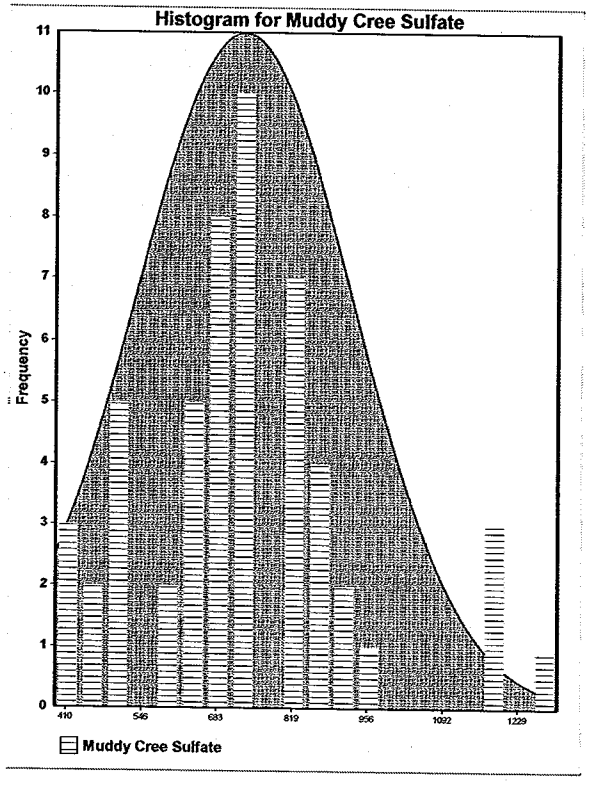

Histogram for Mesa Silica, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
14 15 16 18 19 20 21 23 24 25 26 28 29 30 31 33 34 35 36 38
Mesa Silica, Dissolved

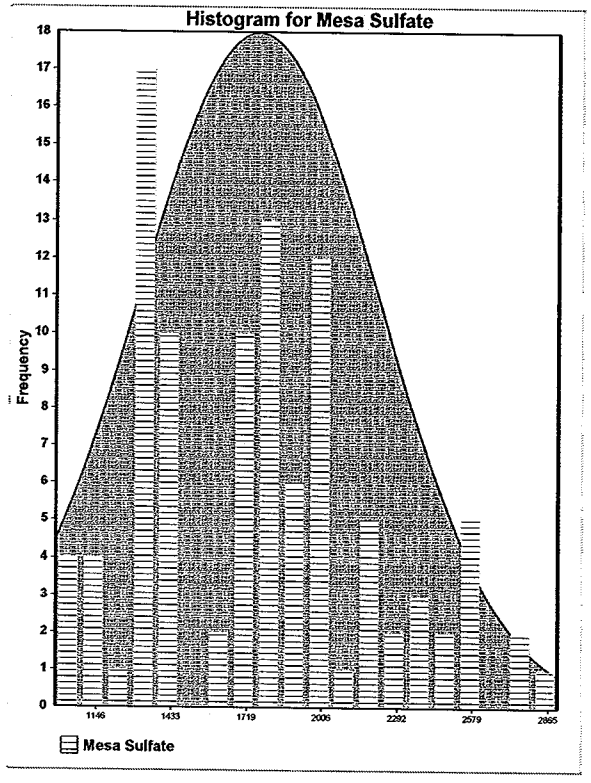

Histogram for Alluv Sodium, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
198
264
330
395
461
527
593
659
725
791
Alluv Sodium, Dissolved

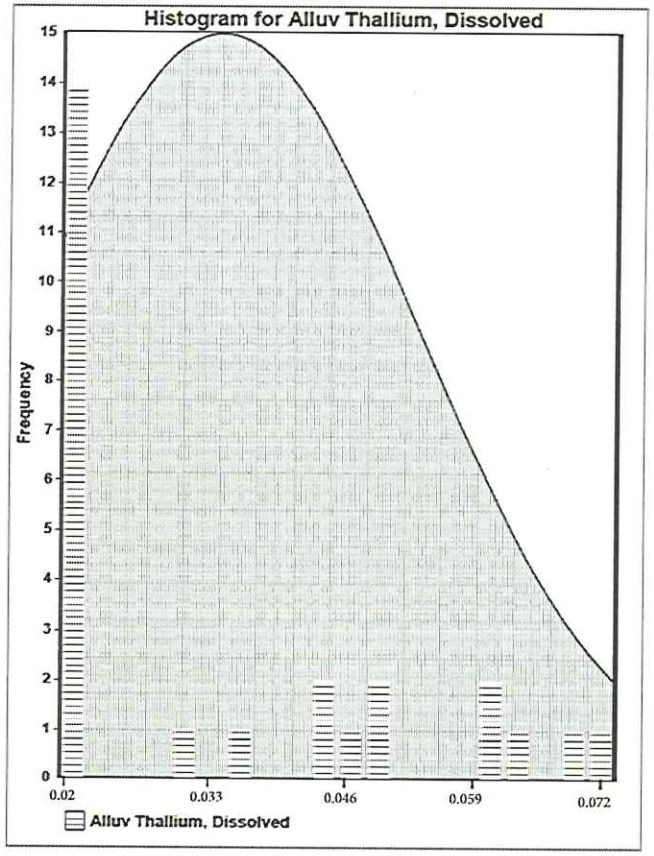

Histogram for Muddy Creek Sodium, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
132
165
198
231
264
297
330
363
396
429
Muddy Creek Sodium, Dissolved

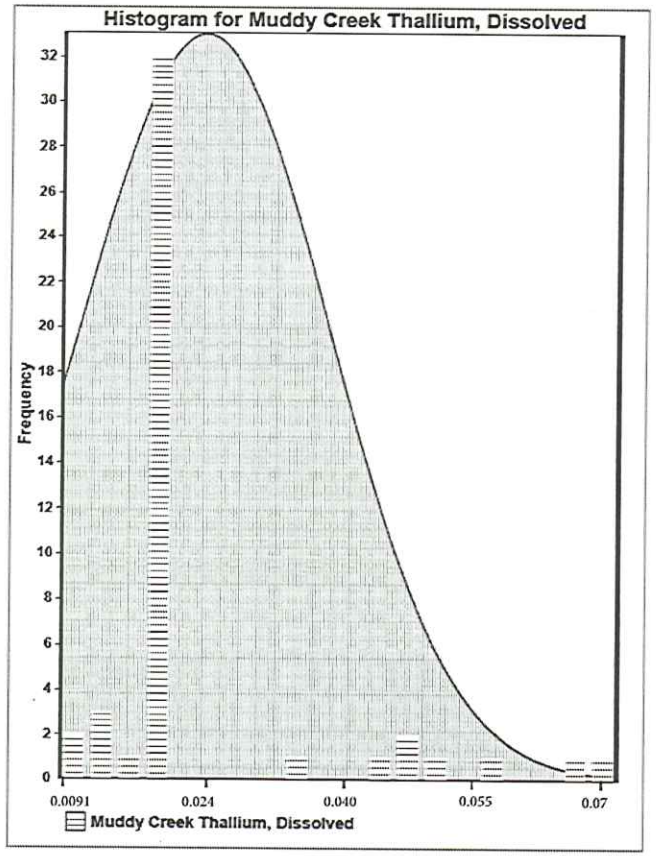

Histogram for Mesa Sodium, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
107
213
320
426
533
639
746
Mesa Sodium, Dissolved

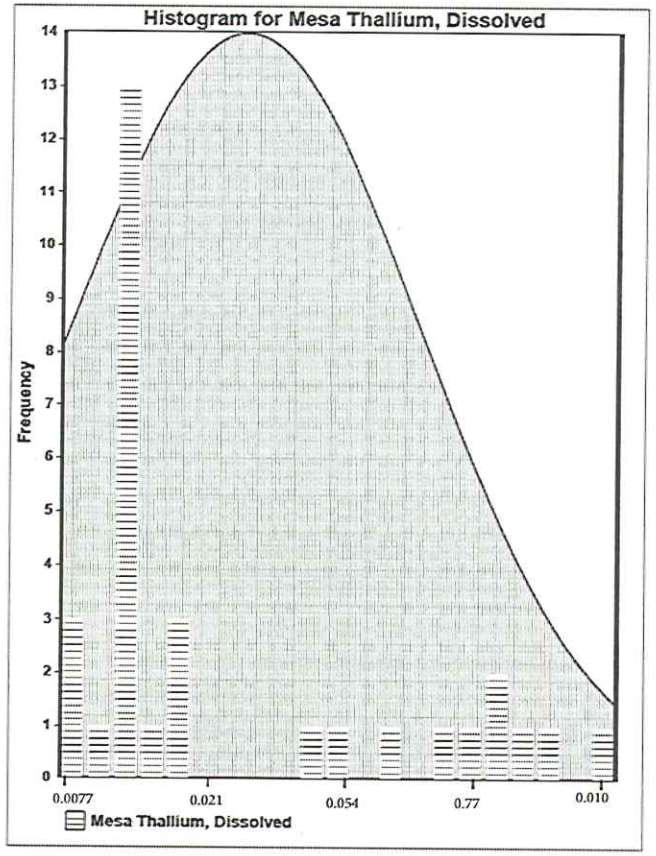

Histogram for Alluv Sulfate
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
387
516
645
774
903
1032
1161
1290
1419
1548
Alluv Sulfate

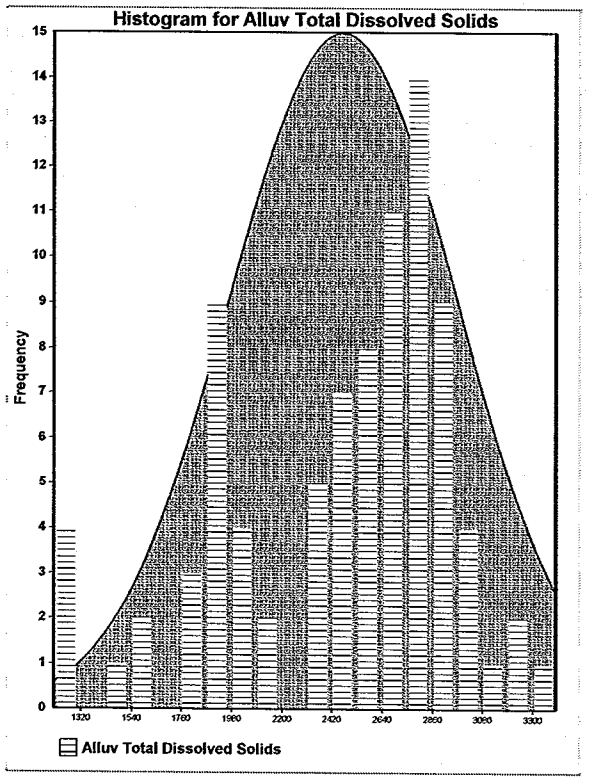

Histogram for Muddy Cree Sulfate
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
410
546
683
819
956
1092
1229
Muddy Cree Sulfate

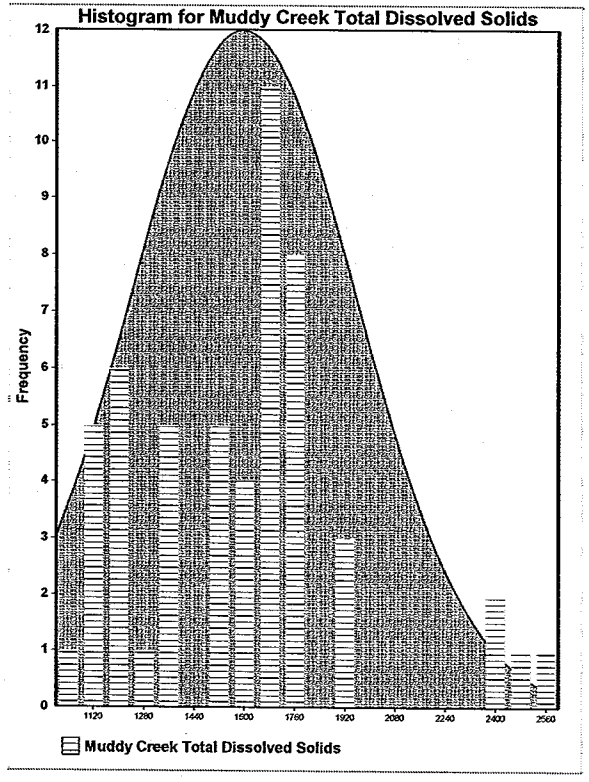

Histogram for Mesa Sulfate
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
1146
1433
1719
2006
2292
2579
2865
Mesa Sulfate

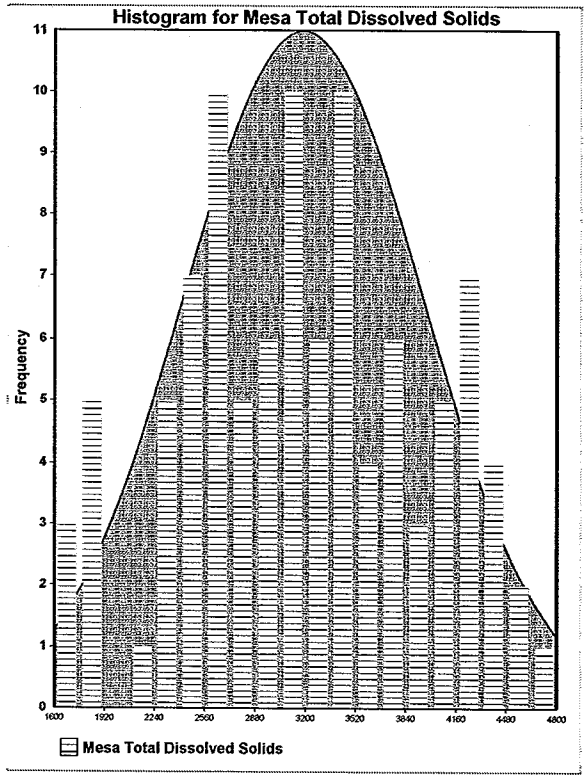

Histogram for Alluv Thallium, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
0.02
0.033
0.046
0.059
0.072
Alluv Thallium, Dissolved

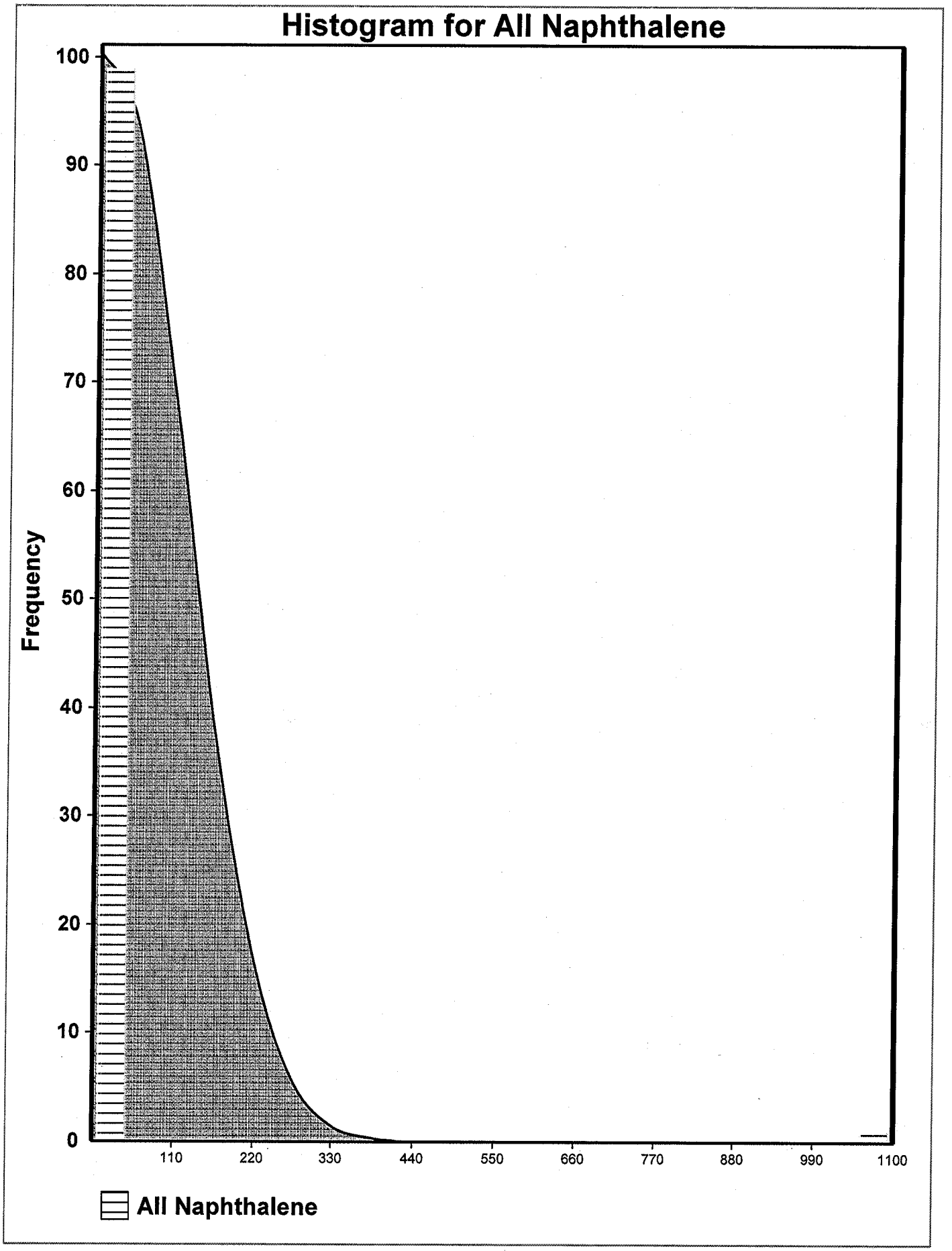

Histogram for Muddy Creek Thallium, Dissolved
Frequency
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
0.0091
0.024
0.040
0.055
0.07
Muddy Creek Thallium, Dissolved

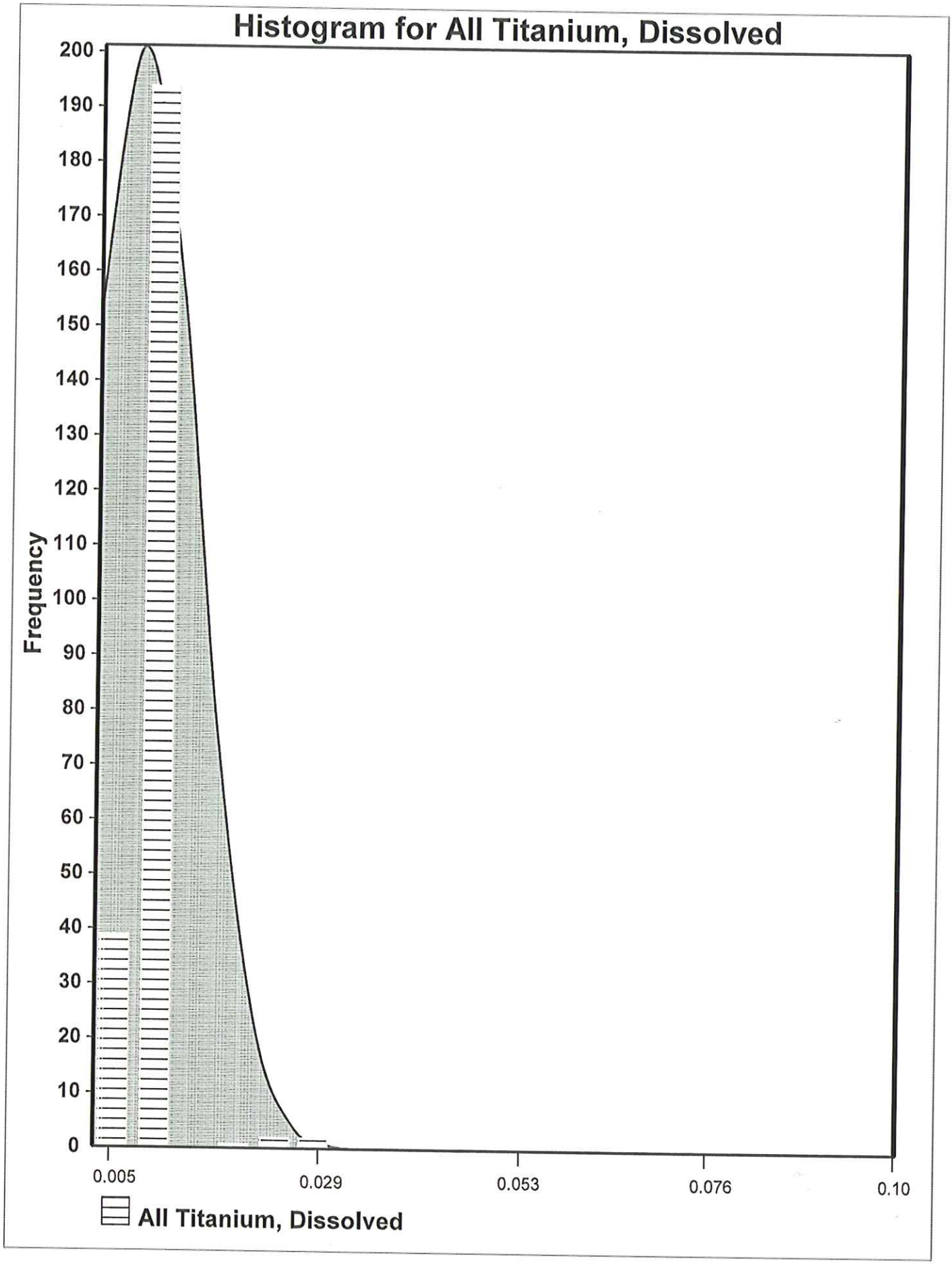

Histogram for Mesa Thallium, Dissolved
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
0.0077
0.021
0.054
0.77
0.010
Mesa Thallium, Dissolved

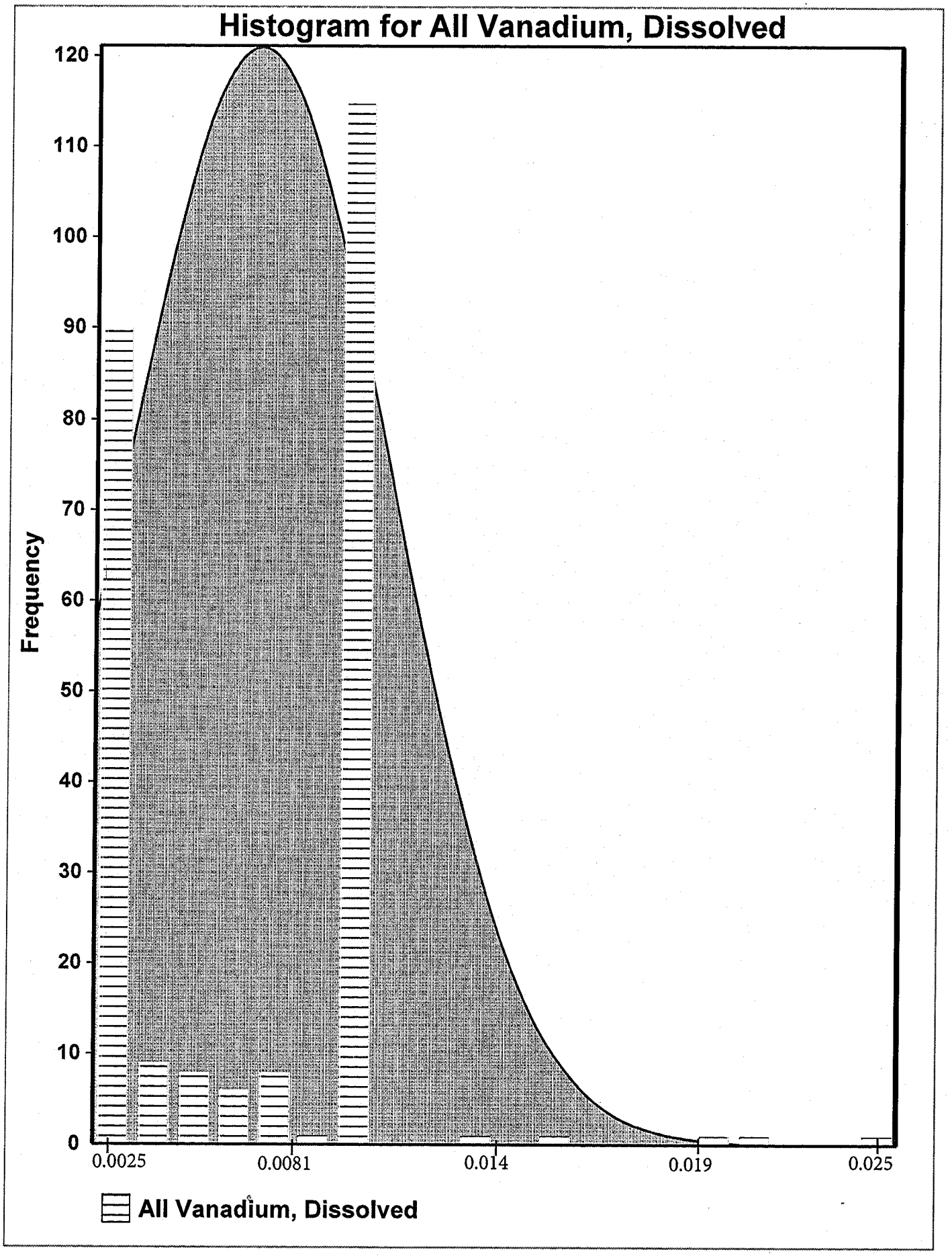

Histogram for Alluv Total Dissolved Solids
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
1320
1540
1760
1980
2200
2420
2640
2860
3080
3300
Alluv Total Dissolved Solids


Histogram for Muddy Creek Total Dissolved Solids
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
1120
1280
1440
1600
1760
1920
2080
2240
2400
2560
Muddy Creek Total Dissolved Solids


Histogram for Mesa Total Dissolved Solids
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
1600
1920
2240
2560
2880
3200
3520
3840
4160
4480
4800
Mesa Total Dissolved Solids


Histogram for All Naphthalene
Frequency
100
90
80
70
60
50
40
30
20
10
0
110
220
330
440
550
660
770
880
990
1100
All Naphthalene


Histogram for All Titanium, Dissolved
Frequency
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0.005
0.029
0.053
0.076
0.10
All Titanium, Dissolved


Histogram for All Vanadium, Dissolved
Frequency
120
110
100
90
80
70
60
50
40
30
20
10
0
0.0025
0.0081
0.014
0.019
0.025
All Vanadium, Dissolved

Appendix G

AqQA Data

KMW-2S

Water Type	$Na\text{-}SO_4$		
Dissolved Solids	3002.1 mg/kg	3000 mg/L	Measured
Density	0.99929 g/cm^3		Calculated
Conductivity	3940 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	1050.4 mg/kg	1049.6 mg/L	Calculated
Carbonate	722.54	722.03	
Non-Carbonate	327.84	327.61	

Primary Tests

Anion-Cation Balance		
Anions	44.7	
Cations	41.5	
% Difference	3.665	OK
Measured TDS = Calculated TDS		
Measured	3002.126	
Calculated	2935.029	
Ratio	1.023	OK
Measured EC = Calculated EC		
Measured	3940.000	
Calculated	3508.269	
Ratio	1.123	Not within range 0.9 to 1.1

Secondary Tests

Measured EC and Ion Sums:		
Anions (0.9-1.1)	1.134718	Not within preferred range
Cations	1.054485	Within preferred range (0.9-1.1)
Calculated TDS to EC ratio (0.55-0.7)	0.745	Not within preferred range
Measured TDS to EC ratio (0.55-0.7)	0.762	Not within preferred range

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

KMW-2S

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.3972	Supersaturated
Aragonite	0.2329	Supersaturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	6.04
Exchangeable Sodium Ratio	0.933
Magnesium Hazard	66.7
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer

Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	205.01°C
Na-K-Ca Geothermometer	172.94°C
Na-K-Ca-Mg Geothermometer	Not determined: relative Mg too high
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

KMW-2M

Water Type	Na-SO_4		
Dissolved Solids	3102 mg/kg	3100 mg/L	Measured
Density	0.99937 g/cm^3		Calculated
Conductivity	3990 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	1125.3 mg/kg	1124.6 mg/L	Calculated
Carbonate	738.9	738.43	
Non-Carbonate	386.36	386.12	

Primary Tests

Anion-Cation Balance		
Anions	44.2	
Cations	45.2	
% Difference	1.047	OK
Measured TDS = Calculated TDS		
Measured	3101.964	
Calculated	3002.351	
Ratio	1.033	OK
Measured EC = Calculated EC		
Measured	3990.000	
Calculated	3586.010	
Ratio	1.113	Not within range 0.9 to 1.1

Secondary Tests

Measured EC and Ion Sums:		
Anions (0.9-1.1)	1.108563	Not within preferred range
Cations (0.9-1.1)	1.132018	Not within preferred range
Calculated TDS to EC ratio (0.55-0.7)	0.752	Not within preferred range
Measured TDS to EC ratio (0.55-0.7)	0.777	Not within preferred range

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

KMW-2M

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.4641	Supersaturated
Aragonite	0.2998	Supersaturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	6.49
Exchangeable Sodium Ratio	0.968
Magnesium Hazard	62.2
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer

Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	192.46°C
Na-K-Ca Geothermometer	164.94°C
Na-K-Ca-Mg Geothermometer	Not determined: relative Mg too high
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

KMW-2D

Water Type	Na-SO_4		
Dissolved Solids	2802.4 mg/kg	2800 mg/L	Measured
Density	0.99914 g/cm^3		Calculated
Conductivity	3810 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	943.12 mg/kg	942.31 mg/L	Calculated
Carbonate	788.32	787.64	
Non-Carbonate	154.8	154.67	

Primary Tests

Anion-Cation Balance		
Anions	42.3	
Cations	41.7	
% Difference	0.676	OK
Measured TDS = Calculated TDS		
Measured	2802.405	
Calculated	2863.908	
Ratio	0.979	Not within range 1.0 to 1.2
Measured EC = Calculated EC		
Measured	3810.000	
Calculated	3399.282	
Ratio	1.121	Not within range 0.9 to 1.1

Secondary Tests

Measured EC and Ion Sums:		
Anions (0.9-1.1)	1.110203	Not within preferred range
Cations (0.9-1.1)	1.095288	Within preferred range
Calculated TDS to EC ratio (0.55-0.7)	0.752	Not within preferred range
Measured TDS to EC ratio (0.55-0.7)	0.736	Not within preferred range

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

KMW-2D

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.3877	Supersaturated
Aragonite	0.2234	Supersaturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	7.23
Exchangeable Sodium Ratio	1.178
Magnesium Hazard	65.5
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer

Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	170.46°C
Na-K-Ca Geothermometer	152.78°C
Na-K-Ca-Mg Geothermometer	Not determined: relative Mg too high
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

IMW-2.5S

Water Type	Na-SO_4		
Dissolved Solids	2702.5 mg/kg	2700 mg/L	Measured
Density	0.99907 g/cm^3		Calculated
Conductivity	3940 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	802 mg/kg	801.25 mg/L	Calculated
Carbonate	802	801.25	
Non-Carbonate	0.0	0.0	

Primary Tests

Anion-Cation Balance		
Anions	43.7	
Cations	41.6	
% Difference	2.379	OK
Measured TDS = Calculated TDS		
Measured	2702.522	
Calculated	2929.084	
Ratio	0.923	Not within range 1.0 to 1.2
Measured EC = Calculated EC		
Measured	3940.000	
Calculated	3435.824	
Ratio	1.147	Not within range 0.9 to 1.1

Secondary Tests

Measured EC and Ion Sums:		
Anions	1.107922	Not within preferred range (0.9-1.1)
Cations	1.056437	Within preferred range (0.9-1.1)
Calculated TDS to EC ratio	0.743	Not within preferred range (0.55-0.7)
Measured TDS to EC ratio	0.686	OK

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

IMW-2.5S

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.5683	Supersaturated
Aragonite	0.404	Supersaturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	8.76
Exchangeable Sodium Ratio	1.548
Magnesium Hazard	71.9
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer

Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	172.03°C
Na-K-Ca Geothermometer	158.63°C
Na-K-Ca-Mg Geothermometer	Not determined: relative Mg too high
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

IMW-2.5D

Water Type	Na-SO_4		
Dissolved Solids	2502.7 mg/kg	2500 mg/L	Measured
Density	0.99892 g/cm^3		Calculated
Conductivity	3620 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	852.11 mg/kg	851.19 mg/L	Calculated
Carbonate	788.5	787.64	
Non-Carbonate	63.617	63.548	

Primary Tests

Anion-Cation Balance		
Anions	39.5	
Cations	38.1	
% Difference	1.779	OK
Measured TDS = Calculated TDS		
Measured	2502.712	
Calculated	2663.736	
Ratio	0.940	Not within range 1.0 to 1.2
Measured EC = Calculated EC		
Measured	3620.000	
Calculated	3175.988	
Ratio	1.140	Not within range 0.9 to 1.1

Secondary Tests

Measured EC and Ion Sums:		
Anions	1.091863	Within preferred range (0.9-1.1)
Cations	1.053703	Within preferred range (0.9-1.1)
Calculated TDS to EC ratio (0.55-0.7)	0.736	Not within preferred range
Measured TDS to EC ratio	0.691	OK

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

IMW-2.5D

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.4155	Supersaturated
Aragonite	0.2512	Supersaturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	7.01
Exchangeable Sodium Ratio	1.202
Magnesium Hazard	67.7
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	173.66°C
Na-K-Ca Geothermometer	154.99°C
Na-K-Ca-Mg Geothermometer	Not determined: relative Mg too high
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

BG-1S

Water Type	$Na\text{-}SO_4$		
Dissolved Solids	2102.9 mg/kg	2100 mg/L	Measured
Density	0.99862 g/cm^3		Calculated
Conductivity	2920 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	762.44 mg/kg	761.38 mg/L	Calculated
Carbonate	525.91	525.19	
Non-Carbonate	236.52	236.19	

Primary Tests

Anion-Cation Balance		
Anions	30.8	
Cations	31.4	
% Difference	0.965	OK
Measured TDS = Calculated TDS		
Measured	2102.911	
Calculated	2108.088	
Ratio	0.998	Not within range 1.0 to 1.2
Measured EC = Calculated EC		
Measured	2920.000	
Calculated	2656.547	
Ratio	1.099	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions	1.056037	Within preferred range (0.9-1.1)
Cations	1.076611	Within preferred range (0.9-1.1)
Calculated TDS to EC ratio (0.55-0.7)	0.722	Not within preferred range
Measured TDS to EC ratio (0.55-0.7)	0.720	Not within preferred range

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

BG-1S

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.1372	Supersaturated
Aragonite	-0.02707	Approximately saturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	5.68
Exchangeable Sodium Ratio	1.029
Magnesium Hazard	54.1
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer

Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	178.11°C
Na-K-Ca Geothermometer	96.755°C
Na-K-Ca-Mg Geothermometer	Not determined: relative Mg too high
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

BG-1M

Water Type	Na-SO_4		
Dissolved Solids	1402.7 mg/kg	1400 mg/L	Measured
Density	0.99809 g/cm^3		Calculated
Conductivity	2180 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	593.15 mg/kg	592.02 mg/L	Calculated
Carbonate	394.71	393.96	
Non-Carbonate	198.44	198.06	

Primary Tests

Anion-Cation Balance		
Anions	22.2	
Cations	23.1	
% Difference	1.994	OK
Measured TDS = Calculated TDS		
Measured	1402.681	
Calculated	1530.515	
Ratio	0.916	Not within range 1.0 to 1.2
Measured EC = Calculated EC		
Measured	2180.000	
Calculated	2022.401	
Ratio	1.078	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions	1.018829	Within preferred range (0.9-1.1)
Cations	1.060295	Within preferred range (0.9-1.1)
Calculated TDS to EC ratio (0.55-0.7)	0.702	Not within preferred range
Measured TDS to EC ratio	0.643	OK

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

BG-1M

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.07722	Approximately saturated
Aragonite	-0.08709	Approximately saturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	High
Sodium Adsorption Ratio	4.47
Exchangeable Sodium Ratio	0.919
Magnesium Hazard	49.4
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	181.49°C
Na-K-Ca Geothermometer	84.987°C
Na-K-Ca-Mg Geothermometer	< 0°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

BG-1D

Water Type	$Na\text{-}SO_4$		
Dissolved Solids	1402.7 mg/kg	1400 mg/L	Measured
Density	0.99809 g/cm^3		Calculated
Conductivity	1974 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	605.53 mg/kg	604.37 mg/L	Calculated
Carbonate	296.1	295.54	
Non-Carbonate	309.43	308.83	

Primary Tests

Anion-Cation Balance		
Anions	22.2	
Cations	21.2	
% Difference	2.184	OK
Measured TDS = Calculated TDS		
Measured	1402.681	
Calculated	1454.400	
Ratio	0.964	Not within range 1.0 to 1.2
Measured EC = Calculated EC		
Measured	1974.000	
Calculated	1974.693	
Ratio	1.000	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions (0.9-1.1)	1.122553	Not within preferred range
Cations	1.074567	Within preferred range (0.9-1.1)
Calculated TDS to EC ratio (0.55-0.7)	0.737	Not within preferred range
Measured TDS to EC ratio (0.55-0.7)	0.711	Not within preferred range

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

BG-1D

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.2727	Supersaturated
Aragonite	0.1083	Supersaturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	High
Sodium Adsorption Ratio	3.54
Exchangeable Sodium Ratio	0.720
Magnesium Hazard	50.4
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	203.44°C
Na-K-Ca Geothermometer	84.522°C
Na-K-Ca-Mg Geothermometer	< 0°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

IMW-3S

Water Type	$Na\text{-}SO_4$		
Dissolved Solids	1802.9 mg/kg	1800 mg/L	Measured
Density	0.99839 g/cm^3		Calculated
Conductivity	2710 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	679.33 mg/kg	678.23 mg/L	Calculated
Carbonate	624.61	623.61	
Non-Carbonate	54.715	54.627	

Primary Tests

Anion-Cation Balance		
Anions	27.5	
Cations	28.5	
% Difference	1.868	OK
Measured TDS = Calculated TDS		
Measured	1802.902	
Calculated	1918.068	
Ratio	0.940	Not within range 1.0 to 1.2
Measured EC = Calculated EC		
Measured	2710.000	
Calculated	2391.090	
Ratio	1.133	Not within range 0.9 to 1.1

Secondary Tests

Measured EC and Ion Sums:		
Anions	1.012942	Within preferred range (0.9-1.1)
Cations	1.051514	Within preferred range (0.9-1.1)
Calculated TDS to EC ratio (0.55-0.7)	0.708	Not within preferred range
Measured TDS to EC ratio	0.665	OK

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

IMW-3S

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.169	Supersaturated
Aragonite	0.004713	Approximately saturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	5.51
Exchangeable Sodium Ratio	1.059
Magnesium Hazard	59.5
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	187.87°C
Na-K-Ca Geothermometer	158.67°C
Na-K-Ca-Mg Geothermometer	Not determined: relative Mg too high
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

IMW-3D

Water Type	$Na\text{-}SO_4$		
Dissolved Solids	1702.9 mg/kg	1700 mg/L	Measured
Density	0.99831 g/cm^3		Calculated
Conductivity	2330 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	671.65 mg/kg	670.52 mg/L	Calculated
Carbonate	427.49	426.77	
Non-Carbonate	244.17	243.76	

Primary Tests

Anion-Cation Balance		
Anions	25.1	
Cations	25.3	
% Difference	0.311	OK
Measured TDS = Calculated TDS		
Measured	1702.869	
Calculated	1710.813	
Ratio	0.995	Not within range 1.0 to 1.2
Measured EC = Calculated EC		
Measured	2330.000	
Calculated	2228.262	
Ratio	1.046	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions	1.078996	Within preferred range (0.9-1.1)
Cations	1.085718	Within preferred range (0.9-1.1)
Calculated TDS to EC ratio (0.55-0.7)	0.734	Not within preferred range
Measured TDS to EC ratio (0.55-0.7)	0.731	Not within preferred range

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

IMW-3D

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.04076	Approximately saturated
Aragonite	-0.1236	Undersaturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	4.37
Exchangeable Sodium Ratio	0.844
Magnesium Hazard	51.6
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	206.69°C
Na-K-Ca Geothermometer	96.236°C
Na-K-Ca-Mg Geothermometer	141.42°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

BG-4S

Water Type	Na-SO_4		
Dissolved Solids	1702.9 mg/kg	1700 mg/L	Measured
Density	0.99831 g/cm^3		Calculated
Conductivity	2610 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	833.58 mg/kg	832.17 mg/L	Calculated
Carbonate	246.74	246.33	
Non-Carbonate	586.83	585.84	

Primary Tests

Anion-Cation Balance		
Anions	27.3	
Cations	27.8	
% Difference	0.801	OK
Measured TDS = Calculated TDS		
Measured	1702.869	
Calculated	1796.597	
Ratio	0.948	Not within range 1.0 to 1.2
Measured EC = Calculated EC		
Measured	2610.000	
Calculated	2443.496	
Ratio	1.068	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions	1.046693	Within preferred range (0.9-1.1)
Cations	1.063593	Within preferred range (0.9-1.1)
Calculated TDS to EC ratio	0.688	OK
Measured TDS to EC ratio	0.652	OK

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

BG-4S

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.3969	Supersaturated
Aragonite	0.2326	Supersaturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	3.47
Exchangeable Sodium Ratio	0.602
Magnesium Hazard	49
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	279.71°C
Na-K-Ca Geothermometer	202.96°C
Na-K-Ca-Mg Geothermometer	> 350°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

BG-4M

Water Type	$Na\text{-}SO_4$		
Dissolved Solids	1702.9 mg/kg	1700 mg/L	Measured
Density	0.99831 g/cm^3		Calculated
Conductivity	2490 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	754.68 mg/kg	753.41 mg/L	Calculated
Carbonate	197.45	197.12	
Non-Carbonate	557.23	556.29	

Primary Tests

Anion-Cation Balance		
Anions	26.4	
Cations	24.5	
% Difference	3.728	OK
Measured TDS = Calculated TDS		
Measured	1702.869	
Calculated	1683.467	
Ratio	1.012	OK
Measured EC = Calculated EC		
Measured	2490.000	
Calculated	2316.317	
Ratio	1.075	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions	1.062212	Within preferred range (0.9-1.1)
Cations	0.985868	Within preferred range (0.9-1.1)
Calculated TDS to EC ratio	0.676	OK
Measured TDS to EC ratio	0.684	OK

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

BG-4M

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.287	Supersaturated
Aragonite	0.1227	Supersaturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	3.01
Exchangeable Sodium Ratio	0.549
Magnesium Hazard	50.3
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	311.8°C
Na-K-Ca Geothermometer	217.44°C
Na-K-Ca-Mg Geothermometer	> 350°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

BG-4D

Water Type	Na-SO_4		
Dissolved Solids	1502.8 mg/kg	1500 mg/L	Measured
Density	0.99816 g/cm^3		Calculated
Conductivity	2270 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	684.39 mg/kg	683.14 mg/L	Calculated
Carbonate	166.26	165.95	
Non-Carbonate	518.14	517.19	

Primary Tests

Anion-Cation Balance		
Anions	23.2	
Cations	22.9	
% Difference	0.583	OK
Measured TDS = Calculated TDS		
Measured	1502.759	
Calculated	1495.796	
Ratio	1.005	OK
Measured EC = Calculated EC		
Measured	2270.000	
Calculated	2116.628	
Ratio	1.072	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions	1.022397	Within preferred range (0.9-1.1)
Cations	1.010542	Within preferred range (0.9-1.1)
Calculated TDS to EC ratio	0.659	OK
Measured TDS to EC ratio	0.662	OK

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

BG-4D

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.3127	Supersaturated
Aragonite	0.1484	Supersaturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	3.16
Exchangeable Sodium Ratio	0.605
Magnesium Hazard	48.8
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	290.36°C
Na-K-Ca Geothermometer	206.84°C
Na-K-Ca-Mg Geothermometer	> 350°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

BG-6S

Water Type	$Na\text{-}SO_4$		
Dissolved Solids	2402.8 mg/kg	2400 mg/L	Measured
Density	0.99884 g/cm^3		Calculated
Conductivity	3320 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	804.54 mg/kg	803.61 mg/L	Calculated
Carbonate	279.46	279.13	
Non-Carbonate	525.08	524.47	

Primary Tests

Anion-Cation Balance		
Anions	37.7	
Cations	34.3	
% Difference	4.737	OK
Measured TDS = Calculated TDS		
Measured	2402.784	
Calculated	2426.521	
Ratio	0.990	Not within range 1.0 to 1.2
Measured EC = Calculated EC		
Measured	3320.000	
Calculated	3092.664	
Ratio	1.074	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions (0.9-1.1)	1.136807	Not within preferred range
Cations 1.1)	1.033978	Within preferred range (0.9-
Calculated TDS to EC ratio (0.55-0.7)	0.731	Not within preferred range
Measured TDS to EC ratio (0.55-0.7)	0.724	Not within preferred range

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

BG-6S

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.2822	Supersaturated
Aragonite	0.1179	Supersaturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	6.29
Exchangeable Sodium Ratio	1.111
Magnesium Hazard	44.1
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	151.58°C
Na-K-Ca Geothermometer	83.462°C
Na-K-Ca-Mg Geothermometer	215.75°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

BG-6M

Water Type	$Na\text{-}SO_4$		
Dissolved Solids	1802.9 mg/kg	1800 mg/L	Measured
Density	0.99839 g/cm^3		Calculated
Conductivity	2560 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	576.47 mg/kg	575.55 mg/L	Calculated
Carbonate	230.29	229.92	
Non-Carbonate	346.18	345.62	

Primary Tests

Anion-Cation Balance		
Anions	27.5	
Cations	18.5	
% Difference	19.628	Not within ± 5%
Measured TDS = Calculated TDS		
Measured	1802.902	
Calculated	1608.329	
Ratio	1.121	OK
Measured EC = Calculated EC		
Measured	2560.000	
Calculated	2164.888	
Ratio	1.183	Not within range 0.9 to 1.1

Secondary Tests

Measured EC and Ion Sums:		
Anions	1.074835	Within preferred range (0.9-1.1)
Cations	0.722134	Not within preferred range (0.9-1.1)
Calculated TDS to EC ratio	0.628	OK
Measured TDS to EC ratio	0.704	Not within preferred range (0.55-0.7)

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

BG-6M

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.2076	Supersaturated
Aragonite	0.04334	Approximately saturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	2.72
Exchangeable Sodium Ratio	0.567
Magnesium Hazard	47.9
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	233.13°C
Na-K-Ca Geothermometer	83.214°C
Na-K-Ca-Mg Geothermometer	23.083°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

BG-6D

Water Type	$Na\text{-}SO_4$		
Dissolved Solids	1802.9 mg/kg	1800 mg/L	Measured
Density	0.99839 g/cm^3		Calculated
Conductivity	2590 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	433.08 mg/kg	432.38 mg/L	Calculated
Carbonate	246.72	246.33	
Non-Carbonate	186.35	186.05	

Primary Tests

Anion-Cation Balance		
Anions	28.1	
Cations	14.7	
% Difference	31.363	Not within ± 5%
Measured TDS = Calculated TDS		
Measured	1802.902	
Calculated	1581.396	
Ratio	1.140	OK
Measured EC = Calculated EC		
Measured	2590.000	
Calculated	2073.137	
Ratio	1.249	Not within range 0.9 to 1.1

Secondary Tests

Measured EC and Ion Sums:		
Anions	1.086602	Within preferred range (0.9-1.1)
Cations	0.567745	Not within preferred range (0.9-1.1)
Calculated TDS to EC ratio	0.611	OK
Measured TDS to EC ratio	0.696	OK

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

BG-6D

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.1192	Supersaturated
Aragonite	-0.04508	Approximately saturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	2.72
Exchangeable Sodium Ratio	0.654
Magnesium Hazard	45.7
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	235.45°C
Na-K-Ca Geothermometer	83.124°C
Na-K-Ca-Mg Geothermometer	164.61°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

BG-3S

Water Type	$Na\text{-}SO_4$		
Dissolved Solids	1202.5 mg/kg	1200 mg/L	Measured
Density	0.99794 g/cm^3		Calculated
Conductivity	1770 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	506.32 mg/kg	505.28 mg/L	Calculated
Carbonate	279.71	279.13	
Non-Carbonate	226.61	226.14	

Primary Tests

Anion-Cation Balance		
Anions	19.1	
Cations	18.4	
% Difference	1.763	OK
Measured TDS = Calculated TDS		
Measured	1202.479	
Calculated	1258.946	
Ratio	0.955	Not within range 1.0 to 1.2
Measured EC = Calculated EC		
Measured	1770.000	
Calculated	1740.723	
Ratio	1.017	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions	1.077624	Within preferred range (0.9-1.1)
Cations	1.040281	Within preferred range (0.9-1.1)
Calculated TDS to EC ratio (0.55-0.7)	0.711	Not within preferred range
Measured TDS to EC ratio	0.679	OK

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

BG-3S

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.1125	Supersaturated
Aragonite	-0.05182	Approximately saturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	High
Sodium Adsorption Ratio	3.48
Exchangeable Sodium Ratio	0.775
Magnesium Hazard	45.6
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	221.66°C
Na-K-Ca Geothermometer	89.108°C
Na-K-Ca-Mg Geothermometer	285.8°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

BG-3M

Water Type	$Na\text{-}SO_4$		
Dissolved Solids	1102.4 mg/kg	1100 mg/L	Measured
Density	0.99786 g/cm^3		Calculated
Conductivity	1731 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	338 mg/kg	337.27 mg/L	Calculated
Carbonate	338	337.27	
Non-Carbonate	0.0	0.0	

Primary Tests

Anion-Cation Balance		
Anions	18.1	
Cations	17.6	
% Difference	1.408	OK
Measured TDS = Calculated TDS		
Measured	1102.356	
Calculated	1233.987	
Ratio	0.893	Not within range 1.0 to 1.2
Measured EC = Calculated EC		
Measured	1731.000	
Calculated	1640.954	
Ratio	1.055	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions	1.043602	Within preferred range (0.9-1.1)
Cations	1.014627	Within preferred range (0.9-1.1)
Calculated TDS to EC ratio (0.55-0.7)	0.713	Not within preferred range
Measured TDS to EC ratio	0.637	OK

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

BG-3M

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.2979	Supersaturated
Aragonite	0.1336	Supersaturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	High
Sodium Adsorption Ratio	5.69
Exchangeable Sodium Ratio	1.549
Magnesium Hazard	41.5
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	179.75°C
Na-K-Ca Geothermometer	91.906°C
Na-K-Ca-Mg Geothermometer	> 350°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

BG-3D

Water Type	$Na\text{-}SO_4$		
Dissolved Solids	1002.2 mg/kg	1000 mg/L	Measured
Density	0.99779 g/cm^3		Calculated
Conductivity	1637 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	288.23 mg/kg	287.6 mg/L	Calculated
Carbonate	288.23	287.6	
Non-Carbonate	0.0	0.0	

Primary Tests

Anion-Cation Balance		
Anions	17.1	
Cations	12.6	
% Difference	15.114	Not within ± 5%
Measured TDS = Calculated TDS		
Measured	1002.218	
Calculated	1074.728	
Ratio	0.933	Not within range 1.0 to 1.2
Measured EC = Calculated EC		
Measured	1637.000	
Calculated	1420.610	
Ratio	1.152	Not within range 0.9 to 1.1

Secondary Tests

Measured EC and Ion Sums:		
Anions	1.044157	Within preferred range (0.9-1.1)
Cations	0.769975	Not within preferred range (0.9-1.1)
Calculated TDS to EC ratio	0.657	OK
Measured TDS to EC ratio	0.612	OK

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

BG-3D

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.3216	Supersaturated
Aragonite	0.1573	Supersaturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	High
Sodium Adsorption Ratio	3.85
Exchangeable Sodium Ratio	1.135
Magnesium Hazard	40.1
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	205.01°C
Na-K-Ca Geothermometer	84.69°C
Na-K-Ca-Mg Geothermometer	> 350°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

BG-2S

Water Type	$Mg\text{-}SO_4$		
Dissolved Solids	3800.4 mg/kg	3800 mg/L	Measured
Density	0.99989 g/cm^3		Calculated
Conductivity	4300 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	2160.8 mg/kg	2160.6 mg/L	Calculated
Carbonate	426.81	426.77	
Non-Carbonate	1734	1733.8	

Primary Tests

Anion-Cation Balance		
Anions	59.7	
Cations	62.7	
% Difference	2.485	OK
Measured TDS = Calculated TDS		
Measured	3800.413	
Calculated	4099.896	
Ratio	0.927	Not within range 1.0 to 1.2
Measured EC = Calculated EC		
Measured	4300.000	
Calculated	4712.821	
Ratio	0.912	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions (0.9-1.1)	1.387975	Not within preferred range
Cations (0.9-1.1)	1.458706	Not within preferred range
Calculated TDS to EC ratio (0.55-0.7)	0.953	Not within preferred range
Measured TDS to EC ratio (0.55-0.7)	0.884	Not within preferred range

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

BG-2S

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.3686	Supersaturated
Aragonite	0.2043	Supersaturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	3.74
Exchangeable Sodium Ratio	0.403
Magnesium Hazard	51.5
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	290.07°C
Na-K-Ca Geothermometer	210.65°C
Na-K-Ca-Mg Geothermometer	> 350°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

BG-2M

Water Type	$Mg\text{-}SO_4$		
Dissolved Solids	1902.9 mg/kg	1900 mg/L	Measured
Density	0.99847 g/cm^3		Calculated
Conductivity	2300 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	970.08 mg/kg	968.59 mg/L	Calculated
Carbonate	361.71	361.15	
Non-Carbonate	608.37	607.44	

Primary Tests

Anion-Cation Balance		
Anions	27.2	
Cations	27.8	
% Difference	1.120	OK
Measured TDS = Calculated TDS		
Measured	1902.920	
Calculated	1880.235	
Ratio	1.012	OK
Measured EC = Calculated EC		
Measured	2300.000	
Calculated	2405.188	
Ratio	0.956	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions (0.9-1.1)	1.180810	Not within preferred range
Cations (0.9-1.1)	1.207555	Not within preferred range
Calculated TDS to EC ratio (0.55-0.7)	0.817	Not within preferred range
Measured TDS to EC ratio (0.55-0.7)	0.827	Not within preferred range

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

BG-2M

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.1963	Supersaturated
Aragonite	0.03203	Approximately saturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	2.38
Exchangeable Sodium Ratio	0.382
Magnesium Hazard	51
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer

Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	303.25°C
Na-K-Ca Geothermometer	208.25°C
Na-K-Ca-Mg Geothermometer	> 350°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

BG-2D

Water Type	$Ca\text{-}SO_4$		
Dissolved Solids	1702.9 mg/kg	1700 mg/L	Measured
Density	0.99831 g/cm^3	.	Calculated
Conductivity	1867 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	912.74 mg/kg	911.2 mg/L	Calculated
Carbonate	213.88	213.52	
Non-Carbonate	698.86	697.68	

Primary Tests

Anion-Cation Balance		
Anions	24.1	
Cations	23.2	
% Difference	1.898	OK
Measured TDS = Calculated TDS		
Measured	1702.869	
Calculated	1600.447	
Ratio	1.064	OK
Measured EC = Calculated EC		
Measured	1867.000	
Calculated	2146.199	
Ratio	0.870	Not within range 0.9 to 1.1

Secondary Tests

Measured EC and Ion Sums:		
Anions (0.9-1.1)	1.290636	Not within preferred range
Cations (0.9-1.1)	1.242555	Not within preferred range
Calculated TDS to EC ratio (0.55-0.7)	0.857	Not within preferred range
Measured TDS to EC ratio (0.55-0.7)	0.912	Not within preferred range

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

BG-2D

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.3881	Supersaturated
Aragonite	0.2238	Supersaturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	High
Sodium Adsorption Ratio	1.44
Exchangeable Sodium Ratio	0.239
Magnesium Hazard	45.2
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	310.53°C
Na-K-Ca Geothermometer	78.353°C
Na-K-Ca-Mg Geothermometer	39.434°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

LMW-9

Water Type	$Ca\text{-}SO_4$		
Dissolved Solids	3301.6 mg/kg	3300 mg/L	Measured
Density	0.99952 g/cm^3		Calculated
Conductivity	4070 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	1483.6 mg/kg	1482.9 mg/L	Calculated
Carbonate	139.77	139.7	
Non-Carbonate	1343.8	1343.2	

Primary Tests

Anion-Cation Balance		
Anions	50.9	
Cations	46.8	
% Difference	4.170	OK
Measured TDS = Calculated TDS		
Measured	3301.596	
Calculated	3242.947	
Ratio	1.018	OK
Measured EC = Calculated EC		
Measured	4070.000	
Calculated	4013.189	
Ratio	1.014	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions (0.9-1.1)	1.250687	Not within preferred range
Cations (0.9-1.1)	1.150561	Not within preferred range
Calculated TDS to EC ratio (0.55-0.7)	0.797	Not within preferred range
Measured TDS to EC ratio (0.55-0.7)	0.811	Not within preferred range

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

LMW-9

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.3683	Supersaturated
Aragonite	0.204	Supersaturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	4.18
Exchangeable Sodium Ratio	0.543
Magnesium Hazard	44.4
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	230.21°C
Na-K-Ca Geothermometer	177.46°C
Na-K-Ca-Mg Geothermometer	> 350°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

LMW-7

Water Type	Na-SO_4		
Dissolved Solids	2502.7 mg/kg	2500 mg/L	Measured
Density	0.99892 g/cm^3		Calculated
Conductivity	3220 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	1119.6 mg/kg	1118.4 mg/L	Calculated
Carbonate	197.33	197.12	
Non-Carbonate	922.29	921.29	

Primary Tests

Anion-Cation Balance		
Anions	37.2	
Cations	38.2	
% Difference	1.413	OK
Measured TDS = Calculated TDS		
Measured	2502.712	
Calculated	2475.182	
Ratio	1.011	OK
Measured EC = Calculated EC		
Measured	3220.000	
Calculated	3203.701	
Ratio	1.005	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions (0.9-1.1)	1.154444	Not within preferred range
Cations (0.9-1.1)	1.187547	Not within preferred range
Calculated TDS to EC ratio (0.55-0.7)	0.769	Not within preferred range
Measured TDS to EC ratio (0.55-0.7)	0.777	Not within preferred range

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

LMW-7

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.356	Supersaturated
Aragonite	0.1917	Supersaturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	4.29
Exchangeable Sodium Ratio	0.642
Magnesium Hazard	44.2
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer

Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	274.22°C
Na-K-Ca Geothermometer	203.26°C
Na-K-Ca-Mg Geothermometer	> 350°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

LMW-10

Water Type	$Na\text{-}SO_4$		
Dissolved Solids	4398.5 mg/kg	4400 mg/L	Measured
Density	1.0003 g/cm^3		Calculated
Conductivity	5110 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	815.95 mg/kg	816.22 mg/L	Calculated
Carbonate	167.53	167.59	
Non-Carbonate	648.41	648.63	

Primary Tests

Anion-Cation Balance		
Anions	64.2	
Cations	52.8	
% Difference	9.803	Not within ± 5%
Measured TDS = Calculated TDS		
Measured	4398.504	
Calculated	4072.415	
Ratio	1.080	OK
Measured EC = Calculated EC		
Measured	5110.000	
Calculated	4726.808	
Ratio	1.081	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions (0.9-1.1)	1.257202	Not within preferred range
Cations	1.032716	Within preferred range (0.9-1.1)
Calculated TDS to EC ratio (0.55-0.7)	0.797	Not within preferred range
Measured TDS to EC ratio (0.55-0.7)	0.861	Not within preferred range

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

LMW-10

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	-0.07224	Approximately saturated
Aragonite	-0.2365	Undersaturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	12
Exchangeable Sodium Ratio	2.107
Magnesium Hazard	41.9
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	220.2°C
Na-K-Ca Geothermometer	190.22°C
Na-K-Ca-Mg Geothermometer	> 350°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

LMW-11R

Water Type	$Ca\text{-}SO_4$		
Dissolved Solids	4298.9 mg/kg	4300 mg/L	Measured
Density	1.0003 g/cm^3		Calculated
Conductivity	5120 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	2029.1 mg/kg	2029.6 mg/L	Calculated
Carbonate	138.03	138.06	
Non-Carbonate	1891	1891.5	

Primary Tests

Anion-Cation Balance		
Anions	72.6	
Cations	62.9	
% Difference	7.214	Not within ± 5%
Measured TDS = Calculated TDS		
Measured	4298.860	
Calculated	4550.743	
Ratio	0.945	Not within range 1.0 to 1.2
Measured EC = Calculated EC		
Measured	5120.000	
Calculated	5273.516	
Ratio	0.971	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions (0.9-1.1)	1.418897	Not within preferred range
Cations (0.9-1.1)	1.227942	Not within preferred range
Calculated TDS to EC ratio (0.55-0.7)	0.889	Not within preferred range
Measured TDS to EC ratio (0.55-0.7)	0.840	Not within preferred range

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

LMW-11R

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.2643	Supersaturated
Aragonite	0.09995	Approximately saturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	4.64
Exchangeable Sodium Ratio	0.515
Magnesium Hazard	44.6
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer

Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	230.56°C
Na-K-Ca Geothermometer	179.55°C
Na-K-Ca-Mg Geothermometer	> 350°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

LMW-12R

Water Type	Na-SO_4		
Dissolved Solids	2786.4 mg/kg	2784 mg/L	Measured
Density	0.99913 g/cm^3		Calculated
Conductivity	3490 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	1144.4 mg/kg	1143.4 mg/L	Calculated
Carbonate	164.45	164.31	
Non-Carbonate	979.92	979.07	

Primary Tests

Anion-Cation Balance		
Anions	39.4	
Cations	39.4	
% Difference	0.020	OK
Measured TDS = Calculated TDS		
Measured	2786.425	
Calculated	2561.629	
Ratio	1.088	OK
Measured EC = Calculated EC		
Measured	3490.000	
Calculated	3335.948	
Ratio	1.046	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions (0.9-1.1)	1.130236	Not within preferred range
Cations (0.9-1.1)	1.129774	Not within preferred range
Calculated TDS to EC ratio (0.55-0.7)	0.734	Not within preferred range
Measured TDS to EC ratio (0.55-0.7)	0.798	Not within preferred range

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

LMW-12R

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.2895	Supersaturated
Aragonite	0.1252	Supersaturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	4.63
Exchangeable Sodium Ratio	0.685
Magnesium Hazard	43.2
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	216.98°C
Na-K-Ca Geothermometer	99.644°C
Na-K-Ca-Mg Geothermometer	> 350°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

LMW-16

Water Type	Na-SO_4		
Dissolved Solids	2584.6 mg/kg	2582 mg/L	Measured
Density	0.99898 g/cm^3		Calculated
Conductivity	3470 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	1003.3 mg/kg	1002.3 mg/L	Calculated
Carbonate	164.48	164.31	
Non-Carbonate	838.87	838.01	

Primary Tests

Anion-Cation Balance		
Anions	39.9	
Cations	39.1	
% Difference	1.019	OK
Measured TDS = Calculated TDS		
Measured	2584.641	
Calculated	2614.171	
Ratio	0.989	Not within range 1.0 to 1.2
Measured EC = Calculated EC		
Measured	3470.000	
Calculated	3343.094	
Ratio	1.038	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions (0.9-1.1)	1.149007	Not within preferred range
Cations (0.9-1.1)	1.125832	Not within preferred range
Calculated TDS to EC ratio (0.55-0.7)	0.753	Not within preferred range
Measured TDS to EC ratio (0.55-0.7)	0.745	Not within preferred range

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

LMW-16

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.3023	Supersaturated
Aragonite	0.138	Supersaturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	5.64
Exchangeable Sodium Ratio	0.890
Magnesium Hazard	45.2
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	228.98°C
Na-K-Ca Geothermometer	182.23°C
Na-K-Ca-Mg Geothermometer	> 350°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

LMW-13R

Water Type	$Ca\text{-}SO_4$		
Dissolved Solids	2864.3 mg/kg	2862 mg/L	Measured
Density	0.99919 g/cm^3		Calculated
Conductivity	3490 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	1451.6 mg/kg	1450.5 mg/L	Calculated
Carbonate	164.44	164.31	
Non-Carbonate	1287.2	1286.2	

Primary Tests

Anion-Cation Balance		
Anions	44.1	
Cations	39.8	
% Difference	5.090	Not within ± 5%
Measured TDS = Calculated TDS		
Measured	2864.325	
Calculated	2805.918	
Ratio	1.021	OK
Measured EC = Calculated EC		
Measured	3490.000	
Calculated	3535.621	
Ratio	0.987	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions (0.9-1.1)	1.262190	Not within preferred range
Cations (0.9-1.1)	1.139931	Not within preferred range
Calculated TDS to EC ratio (0.55-0.7)	0.804	Not within preferred range
Measured TDS to EC ratio (0.55-0.7)	0.821	Not within preferred range

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

LMW-13R

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.2256	Supersaturated
Aragonite	0.06129	Approximately saturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	2.63
Exchangeable Sodium Ratio	0.345
Magnesium Hazard	39.7
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	243.98°C
Na-K-Ca Geothermometer	82.276°C
Na-K-Ca-Mg Geothermometer	> 350°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

LMW-15

Water Type	Ca-SO_4		
Dissolved Solids	2948.2 mg/kg	2946 mg/L	Measured
Density	0.99925 g/cm^3		Calculated
Conductivity	3710 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	1517.8 mg/kg	1516.6 mg/L	Calculated
Carbonate	164.43	164.31	
Non-Carbonate	1353.3	1352.3	

Primary Tests

Anion-Cation Balance		
Anions	48.8	
Cations	42	
% Difference	7.459	Not within ± 5%
Measured TDS = Calculated TDS		
Measured	2948.207	
Calculated	3066.446	
Ratio	0.961	Not within range 1.0 to 1.2
Measured EC = Calculated EC		
Measured	3710.000	
Calculated	3791.265	
Ratio	0.979	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions (0.9-1.1)	1.314596	Not within preferred range
Cations (0.9-1.1)	1.132103	Not within preferred range
Calculated TDS to EC ratio (0.55-0.7)	0.827	Not within preferred range
Measured TDS to EC ratio (0.55-0.7)	0.795	Not within preferred range

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

LMW-15

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.2258	Supersaturated
Aragonite	0.06144	Approximately saturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	2.79
Exchangeable Sodium Ratio	0.359
Magnesium Hazard	40.7
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	239.1°C
Na-K-Ca Geothermometer	83.638°C
Na-K-Ca-Mg Geothermometer	> 350°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A

LMW-14R

Water Type	$Ca\text{-}SO_4$		
Dissolved Solids	3054 mg/kg	3052 mg/L	Measured
Density	0.99933 g/cm^3		Calculated
Conductivity	3670 µmho/cm		Measured
Hardness (as $CaCO_3$)			
Total	1551.4 mg/kg	1550.3 mg/L	Calculated
Carbonate	164.42	164.31	
Non-Carbonate	1387	1386	

Primary Tests

Anion-Cation Balance		
Anions	44.3	
Cations	42.3	
% Difference	2.312	OK
Measured TDS = Calculated TDS		
Measured	3054.044	
Calculated	2868.069	
Ratio	1.065	OK
Measured EC = Calculated EC		
Measured	3670.000	
Calculated	3619.421	
Ratio	1.014	OK

Secondary Tests

Measured EC and Ion Sums:		
Anions (0.9-1.1)	1.206910	Not within preferred range
Cations (0.9-1.1)	1.152354	Not within preferred range
Calculated TDS to EC ratio (0.55-0.7)	0.781	Not within preferred range
Measured TDS to EC ratio (0.55-0.7)	0.832	Not within preferred range

Organic Mass Balance

DOC ≥ Sum of Organics

DOC unavailable

LMW-14R

Speciation unavailable

Total Carbonate from Titration Alkalinity

No Measurement for Alkalinity

Titration Alkalinity from Total Carbonate

Speciation Unavailable

Mineral Saturation

Calcite	0.169	Supersaturated
Aragonite	0.004667	Approximately saturated

Partial Pressure of CO_2

Speciation Unavailable

Salinity Hazard	Very High
Sodium Adsorption Ratio	2.65
Exchangeable Sodium Ratio	0.337
Magnesium Hazard	37.2
Residual Sodium Carbonate	0.0 meq/L

Silica Geothermometer	
Quartz	N/A
Quartz (max. steam loss)	N/A
Chalcedony	N/A
α-Cristobalite	N/A
β-Cristobalite	N/A
Amorphous Silica	N/A
Na-K Geothermometer	248.78°C
Na-K-Ca Geothermometer	83.423°C
Na-K-Ca-Mg Geothermometer	> 350°C
Mg-Li Geothermometer	N/A
Na-Li Geothermometer	N/A