In-Situ Chromium Treatability Study Results Report

Nevada Environmental Response Trust Site
Henderson, Nevada

PREPARED FOR

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Revision 1

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LIST OF ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
AP Area	ammonium perchlorate manufacturing area
AP	ammonium perchlorate
Aquapure 3601®	monosodium orthophosphate
ASTM	American Society for Testing and Materials
AWF	Athens Road Well Field
bgs	below ground surface
BL	Baseline
BMI	Basic Management, Inc.
Cascade	Cascade Technical Services
COD	chemical oxygen demand
COPC	chemical of potential concern
CPS	calcium polysulfide
Cr(III)	chromium in trivalent state
$Cr(OH)_3$	chromic hydroxide
Cr(VI)	hexavalent chromium
DNA	deoxyribonucleic acid
DO	dissolved oxygen
EC	electrical conductivity
EOS_{PRO}®	Enhanced Emulsified Oil Substrate, a product of EOS® Remediation, LLC
EPA	U.S. Environmental Protection Agency
ETI	Envirogen Technologies, Inc.
EVO	emulsified vegetable oil
FBR	fluidized bed reactor
Fe(0)	zero-valent iron
Fe(II)	ferrous iron
Fe(III)	ferric iron
FS	Feasibility Study
ft/d	feet per day
ft/ft	feet per foot
gpm	gallons per minute
GWETS	Groundwater Extraction and Treatment System
GWTP	Groundwater Treatment Plant
H_2S	hydrogen sulfide

Acronyms/Abbreviations	Definition
$H_2S_{(aq)}$	aqueous hydrogen sulfide
HS-	bisulfide
IDW	investigation-derived waste
IWF	Interceptor Well Field
K	conductivity
kg	kilogram
kg/m3	kilogram per cubic meter
L	liter
m^2/g	square meter per gram
µg/kg	microgram per kilogram
µg/L	microgram per liter
µL/min	microliters per minute
µm	micrometer
mg/L	milligram per liter
mL	milliliter
MS/MSD	Matrix Spike and Matrix Spike Duplicate
mV	millivolt
National	National Exploration, Wells and Pumps
NDEP	Nevada Division of Environmental Protection
NERT or Trust	Nevada Environmental Response Trust
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NS	not sampled
ORP	oxidation-reduction potential
PLFA	phospholipid fatty acids
PME	performance monitoring event
psi	pounds per square inch
psig	pounds per square inch gauge
PVC	polyvinyl chloride
Qal	Quaternary Alluvium
RAO	remedial action objectives
RF2	RF2 Group
RNA	ribonucleic acid
rpm	revolutions per minute
S	storativity

Acronyms/Abbreviations	Definition
S^{2-}	sulfide
Site	Nevada Environmental Response Trust site
SLMW	stabilized Lake Mead water
$SO4^{2-}$	sulfate
SRB	sulfate reducing bacteria
T	transmissivity
TDS	total dissolved solid
Tetra Tech	Tetra Tech, Inc.
TOC	total organic carbon
UIC	Underground Injection Control
UMCf	Upper Muddy Creek formation
UNLV	University of Nevada at Las Vegas
urea/DAP	urea/diammonium phosphate
VFA	volatile fatty acid
WBZ	water-bearing zone

CERTIFICATION

In-Situ Chromium Treatability Study Results Report

Nevada Environmental Response Trust Site
(Former Tronox LLC Site)
Henderson, Nevada

Nevada Environmental Response Trust (NERT) Representative Certification
I certify that this document and all attachments submitted to the Division were prepared at the request of, or under the direction or supervision of NERT. Based on my own involvement and/or my inquiry of the person or persons who manage the systems(s) or those directly responsible for gathering the information or preparing the document, or the immediate supervisor of such person(s), the information submitted and provided herein is, to the best of my knowledge and belief, true, accurate, and complete in all material respects.

Office of the Nevada Environmental Response Trust

Le Petomane XXVII, not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

not individually, but solely as Pres't

Signature: Jay A Steinberg, not individually, but solely in his representative capacity as President of the Nevada Environmental Response Trust Trustee

Name: Jay A. Steinberg, not individually, but solely in his representative capacity as President of the Nevada Environmental Response Trust Trustee

Title: Solely as President and not individually

Company: Le Petomane XXVII, Inc., not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

Date: 6/22/18

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 prepared 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.

Description of Services Provided: Prepared In-Situ Chromium Treatability Study Results Report, Nevada Environmental Response Trust Site, Henderson, Nevada.

Kyle S. Hansen

June 22, 2018

Kyle Hansen, CEM
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Tetra Tech, Inc.

Date

Nevada CEM Certificate Number: 2167
Nevada CEM Expiration Date: September 18, 2018

EXECUTIVE SUMMARY

This report summarizes the technical approach and findings for the bench-scale and field treatability studies conducted for in-situ hexavalent chromium reduction in groundwater at the Nevada Environmental Response Trust (NERT or Trust) site (Site) in Henderson, Nevada. The work was performed in accordance with the In-situ Chromium Treatability Study Work Plan, approved by the Nevada Division of Environmental Protection (NDEP) on May 25, 2016. Field treatability studies were performed to separately evaluate biological and chemical reduction of hexavalent chromium. The biological reduction study was performed between November 2016 and October 2017 in the Central Retention Basin. The chemical reduction study was performed between August 2016 and October 2017 within the footprint of the on-going Ammonium Perchlorate (AP) Area Treatability Study, located just west of the AP-5 Pond at the Site.

Bench-Scale Studies

Prior to implementation of the field studies, Tetra Tech contracted with the University of Nevada Las Vegas's (UNLV's) Environmental Engineering and Water Quality Laboratory to conduct laboratory batch microcosm and column in-situ hexavalent chromium reduction studies. Soil and groundwater were collected during well installation activities from both the chemical and biological reduction study areas and transported to UNLV for use in the batch microcosm and column studies. The batch microcosm studies consisted of sets of 125 milliliter (mL) glass bottles filled with the desired amounts of soil, groundwater, and amendments. The bottles were sealed and continuously mixed in a rotary shaker prior to be sampled. The column tests consisted of applying groundwater and selected amendments through 50-inch long, two-inch diameter vertical pipes packed with soil and analyzing the effluent water.

The batch biological reduction microcosm studies were performed to examine the potential for in-situ biological reduction of hexavalent chromium and co-contaminants using various substrates or mixtures of substrates, consisting of emulsified vegetable oil (EVO; specifically EOS$_{PRO}$ ®), industrial sugar wastewater, a mixture of EVO and industrial sugar wastewater, and molasses as carbon donors. The feasibility of using various substrates or mixtures of substrates as electron donors was further evaluated using four laboratory-scale column bioreactors, two for the Quaternary Alluvium (Qal) that ran for 160 days and two for the Upper Muddy Creek formation (UMCf) that ran for 165 days. The main objective of the column studies was to demonstrate that hexavalent chromium could be reduced under conditions that simulated field groundwater flow conditions.

The results of the batch biological reduction microcosm and column studies indicated that hexavalent chromium could be reduced by over 99.9% in groundwater and saturated soils at the field biological treatability study area without the need for bioaugmentation. This demonstrates that sufficient indigenous bacteria were present in the groundwater and saturated soils at the field biological treatability study area with the ability to reduce hexavalent chromium and that EOS$_{PRO}$ ® and industrial sugar wastewater were effective in reducing hexavalent chromium. A mixture of EOS$_{PRO}$ ® and industrial sugar wastewater promoted faster reduction of hexavalent chromium and other co-contaminants than the use of EOS$_{PRO}$ ® or industrial sugar wastewater alone. Reduction rates of hexavalent chromium and co-contaminants were slower in the UMCf soils than the Qal soils. Only minor perchlorate degradation was observed through the duration of the microcosm and column studies using the UMCf soils.

The batch chemical reduction microcosm studies were performed to assess the potential for calcium polysulfide (CPS) and ferrous sulfate to reduce hexavalent chromium under conditions that simulated field conditions. Batch tests were conducted with groundwater spiked with a low concentration (500 micrograms per liter [µg/L]) and a high concentration (10,000 µg/L) of hexavalent chromium. Based on the results of the batch chemical reduction microcosm studies, column tests were performed with CPS over two stages. During the preliminary stage, two columns were used, one for the Qal and one for the UMCf, with a low concentration of hexavalent chromium in groundwater (1,000 µg/L) for a period of 36 days. During the second stage, three columns were used, one low concentration replicate for the Qal (1,000 µg/L) that ran for 36 days, one low concentration replicate for the UMCf that ran for 34 days, and one high concentration replicate for the UMCf (10,000 µg/L) that ran for 24 days.

The results of the batch chemical reduction microcosm studies indicated a 99% reduction in hexavalent chromium concentrations in the Qal and UMCf with the use of both CPS and ferrous sulfate. The results of the column studies indicated a 99% reduction in hexavalent chromium concentrations in the Qal and UMCf with the use of CPS. The optimal dosage of CPS was determined to be twice the stoichiometric ratio and the optimal dosage of ferrous sulfate was determined to be five times the stoichiometric ratio. A larger volume of precipitated solids was observed with the use of ferrous sulfate than with the use of CPS.

Field Biological Reduction Treatability Study

The biological reduction treatability study location was east of the Soil Flushing Treatability Test Area in the Central Retention Basin and approximately 640 feet upgradient of the Interceptor Well Field (IWF). The study area consisted of three dual-clustered injection wells and six dual-nested downgradient monitoring wells. Injection wells consisted of three single-completion injection wells screened in the Qal and three single-completion injection wells screened in the UMCf. The six dual-nested monitoring wells were screened separately in the Qal and in the UMCf.

Three separate carbon substrate injection events were conducted to promote in-situ biological reduction of hexavalent chromium. Carbon substrates injected over the three injection events included EOS$_{\text{PRO}}$ ®, industrial sugar wastewater, granular sugar, and/or molasses. Monosodium orthophosphate (Aquapure 3601®) and a 39% solution urea/diammonium phosphate (urea/DAP) blend were also injected as additional sources of phosphate and nitrogen nutrients. Sodium sulfite and ascorbic acid, both oxygen scavengers, were mixed with the substrate solution to promote anaerobic conditions prior to injecting. Sodium bicarbonate was also mixed with the substrate solution to adjust the pH, as needed. Stabilized Lake Mead Water (SLMW), used as chase/flush water, was injected to enhance the carbon substrate distribution across the injection well network.

Groundwater samples were collected from the injection wells and monitoring wells to establish baseline conditions prior to the injections. Eight performance groundwater monitoring events were conducted between 2 to 24 weeks following the initial injection event. During each performance groundwater monitoring event, water levels were gauged, field parameters were collected, and groundwater samples were collected and analyzed for a variety of laboratory parameters for the downgradient monitoring wells. In addition, Bio-Trap® samplers were deployed in select wells and analyzed for microbial populations during the baseline sampling event and 13 weeks following the initial injection event to evaluate the effect of the carbon substrate injections on the microbial populations. Due to variable hydraulic conductivities reported in the vicinity of the field study area and the relatively limited information available for the UMCf, slug tests were performed for the installed wells to obtain location-specific hydraulic conductivity. Slug tests were conducted in the deep wells screened in the UMCf, however, there was insufficient water in the shallow wells screened in the alluvium to permit slug testing. As a result, specific capacity tests were conducted in the shallow and deep wells, in order to provide supplemental estimates of aquifer parameters, including hydraulic conductivity prior to injection testing. Select wells were also tested after the injection was completed to assess whether hydraulic conductivity was affected by the substrate injections.

The main findings of the biological reduction study are as follows:

- Carbon substrates can be successfully injected into the Qal and UMCf through the use of permanent injection wells. For the shallow wells, the average injection flow rates ranged from 1.2 to 4.7 gallons per minute (gpm). For the deep wells, the average injection flow rates ranged from 1.3 to 8.6 gpm.
- The biological reduction study demonstrated effective and rapid reduction of hexavalent chromium concentrations in groundwater within the Qal. Hexavalent chromium concentrations in groundwater were reduced from approximately 11,000 µg/L to below 10 µg/L at four of the six monitoring wells within approximately 2 months. The hexavalent chromium concentrations in groundwater at the four monitoring wells remained below 10 µg/L through the end of the treatability study, approximately 24 weeks following

the initial injection event. The significant reduction in hexavalent chromium concentrations in groundwater within the Qal during the 24 week monitoring period is largely attributed to the relatively fast groundwater flow velocity and the ability to rapidly create and maintain reducing conditions. The remaining two monitoring wells are located slightly cross-gradient of the groundwater flow direction and are therefore located at the approximate western edge of the treatment zone. The groundwater at these two monitoring wells did not exhibit the same level of influence from the injections as groundwater at the other monitoring wells.

- Although the biological reduction study achieved reductions of hexavalent chromium concentrations in groundwater within the UMCf, these reductions were slower than and not as extensive as in the Qal. At the end of the biological reduction study, approximately 24 weeks following the initial injection event, the concentrations of hexavalent chromium in groundwater were still trending downwards at three downgradient UMCf monitoring wells, all of which also showed influence of carbon injections by an increase in total organic carbon (TOC) concentrations in groundwater during the study. Groundwater at the remaining three UMCf wells did not show evidence of increased TOC concentrations nor reductions in hexavalent chromium concentrations. This difference is likely a result of the tight formation, creating slow and non-uniform groundwater movement and the wells' location near the western edge of the treatment zone.
- The biological reduction study achieved effective reduction of groundwater concentrations of other chemicals of potential concern (COPCs) within the Qal, including perchlorate, chlorate and chloroform. As described above, the rapid movement of groundwater and TOC (i.e., carbon substrate) in the Qal led to the creation of reducing conditions in four of the downgradient monitoring wells. Concentration reductions of greater than 97% were achieved in several of the monitoring wells for perchlorate, chlorate and chloroform within the 24-week treatability study period. As with hexavalent chromium, groundwater at the two monitoring wells located slightly cross-gradient of the groundwater flow direction and at the western edge of the treatment area as evidenced by low TOC concentrations, did not exhibit the same level of influence from the injections as the other monitoring wells. Nevertheless, these wells provided valuable information related to the cross gradient distribution of the of carbon substrate in groundwater for use in the Feasibility Study (FS) and design of a potential full-scale remedy.
- The biological reduction study also demonstrated some reductions of chlorate and chloroform concentrations in groundwater within the UMCf. However, these reductions were not as rapid nor as extensive as for the Qal. At the end of the biological reduction study, the concentrations of chlorate in groundwater were still trending downwards in three UMCf monitoring wells, which also showed influence of increased TOC concentrations from the study. Although no reductions in perchlorate concentrations were observed in groundwater within the monitoring wells within the UMCf during the study timeframe, it is anticipated the perchlorate and chloroform concentrations in groundwater would decrease following hexavalent chromium, nitrate, and chlorate degradation, which began occurring towards the end of the study. Groundwater at the remaining three monitoring wells did not show increased TOC concentrations and did not exhibit reduction of chlorate, perchlorate, or chloroform, likely due to the tight formation and the wells' location at the western edge of the treatment area.
- Dissolved metal concentrations in groundwater such as arsenic, iron, and manganese increased at several downgradient monitoring wells during the biological reduction study; however, the increases are spatially limited to the monitoring wells located within the treatability study area and concentrations are expected to return to baseline concentrations downgradient and within the treatment zone as the geochemical conditions return to baseline conditions.

Field Chemical Reduction Treatability Study

The chemical reduction study is located in the AP Area Up and Down Flushing Treatability Study area, west of the AP-5 Pond and approximately 175 feet upgradient of the IWF. The chemical reduction study utilized the injection and monitoring wells installed as part of the AP Area Up and Down Flushing Treatability Study. Injection and monitoring wells are dispersed over two soil flushing plots (Plot 1 and 2). Each plot contains four triple cluster single-completion injection wells and three triple nested monitoring wells. Each triple-cluster or triple-nested injection and monitoring well consisted of shallow wells (screened in the Qal just above the Qal/UMCf contact), intermediate wells (screened in the UMCf, just below the Qal/UMCf contact), and deep wells (screened in the UMCf around 15 feet below the Qal/UMCf contact). The chemical reduction study consisted of one chemical injection event conducted between August 7 and August 8, 2017 that included a total of 600 gallons of a CPS solution, comprised of 60 gallons of CPS and 540 gallons of SLMW. The injectate solution was injected across the shallow and intermediate injection wells associated with Plots 1 and 2 in the AP Area Up and Down Flushing Treatability Study area. Additionally, a total of 3,910 gallons of SLMW used as chase/flush water was injected to enhance subsurface distribution. No injections were performed in the deep injection wells so they could be used to monitor the potential vertical migration of contaminants from injections into the intermediate injection wells.

The main findings of the chemical reduction study are as follows:

- Calcium polysulfide (10% solution by weight) can be successfully injected into the Qal and UMCf through the use of permanent injection wells. Within the Qal, injection flow rates ranged from 4.5 to 4.6 gpm. Within the UMCf, injection flow rates ranged from 4.1 to 5.6 gpm.
- The chemical reduction study evaluated hexavalent chromium reduction in the Qal and UMCf. Within the UMCf, hexavalent chromium concentrations were reduced by 67% to 99% in groundwater at five of the six intermediate monitoring wells when compared to baseline concentrations. Within the Qal, hexavalent chromium concentrations were reduced in groundwater at only one of the six shallow monitoring wells when compared to baseline concentrations. The limited reduction in hexavalent chromium concentrations in groundwater within the Qal is largely attributed to the limited saturated thickness present in the Qal, with three of the six shallow monitoring wells going dry by the final sampling event conducted in October 2017, as well as low baseline groundwater concentrations.

Conclusions and Recommendations

The following is a summary of the general conclusions and recommendations for the in-situ chromium treatability study and for the implementation of in-situ chromium remediation at the Site:

- In-situ treatment by biological reduction has been shown to be effective at reducing the concentrations of hexavalent chromium and other COPCs in groundwater within the Qal, and to a lesser extent in groundwater within the UMCf.
- A combination of water-soluble and slow-release carbon substrates including industrial sugar wastewater, granular sugar, EOS$_{PRO}$®, and molasses was successfully applied to create a sustained reducing environment in the Qal and to a lesser extent in the UMCf, which is required for hexavalent chromium reduction. Each carbon substrate has its advantages and disadvantages, which can be mitigated by combining substrates or through other amendments. The selection of the carbon substrate(s) used for future implementation should take into consideration the availability and cost of the carbon substrate, lithology and hydrology of the target formation, and intended longevity in the subsurface.
- The use of biological reduction is recommended over chemical reduction based on overall effectiveness and the ability to concurrently treat other COPCs, such as chlorate, perchlorate, nitrate, and chloroform.
- Nitrate and phosphate concentrations should be carefully monitored and supplemented if necessary to assist in maintaining the microbial populations necessary for biological reduction of other COPCs, such as chlorate, perchlorate, and chloroform.
- The use of oxygen scavengers (e.g., sodium sulfite, ascorbic acid) and buffering amendments (e.g., sodium bicarbonate) is recommended, as necessary, to minimize the impact of the injectate on the microbial populations. For instance, the low pH of the industrial sugar wastewater was mitigated through the addition of sodium bicarbonate to the injection solution to increase the pH and counteract the potential pH shock to the microbial populations.

- TOC should be carefully monitored to ensure an adequate amount of carbon substrate is present to maintain microbial growth, while not providing excess carbon substrate which could induce over-accumulation of biomass and reduction of permeability in the surrounding formation. Reduction in permeability in the surrounding formation was not a problem during the treatability study as demonstrated by the limited reduction in hydraulic conductivity and ability to inject carbon substrates over three separate injection events without observable trends of decreased injection flow rates or increased injection pressures.
- Additional groundwater monitoring is recommended for the biological reduction study. Due to the slow groundwater velocity in the UMCf, the influence from the carbon substrate injections were beginning to be observed in groundwater at the nearest downgradient groundwater monitoring wells after a substantial period of time, approximately 24 weeks following the initial injection event, as evidenced by the increase in TOC concentrations and decrease in hexavalent chromium, nitrate, and chlorate concentrations. However, complete reduction of hexavalent chromium and other COPCs were not observed. Collecting additional groundwater monitoring data will help finalize the evaluation of groundwater velocity, carbon substrate longevity, the degree to which reduction of hexavalent chromium and other COPCs could occur in groundwater within the UMCf, and confirm geochemical conditions return to baseline conditions.

The results of this in-situ chromium treatability study will be ultimately incorporated into the FS to be prepared by NERT following completion of the Remedial Investigation. The evaluation of the applicable remedial action alternatives completed in the FS will consider the findings of this treatability study, as well as any others conducted, to prepare NERT’s recommendation for remedial action alternatives to address Henderson legacy conditions.

1.0 INTRODUCTION

On behalf of the Nevada Environmental Response Trust (NERT or Trust), Tetra Tech, Inc. (Tetra Tech) has prepared this *In-Situ Chromium Treatability Study Results Report* for the NERT site (Site), located in Clark County, Nevada (Figure 1). This report is being submitted to the Nevada Division of Environmental Protection (NDEP) pursuant to the Interim Consent Agreement between NERT and NDEP effective February 14, 2011. This report presents a summary of the technical approach and an evaluation of the results for the bench-scale and field treatability studies conducted for hexavalent chromium reduction in groundwater. The treatability study was implemented consistent with the approved *In-Situ Chromium Treatability Study Work Plan* (Tetra Tech, Inc., 2016a).

The In-Situ Chromium Treatability Study included bench-scale studies that were performed by the University of Nevada at Las Vegas (UNLV) to evaluate several chemicals and biological carbon substrates for remediation of hexavalent chromium. After the completion of the bench-scale studies, the selected biological carbon substrates were injected as part of a biological reduction field treatability study that was performed in the Central Retention Basin at the Site, located approximately 640 feet upgradient of the Interceptor Well Field (IWF) (Figure 1). A chemical reduction field study was also performed between August 2016 and October 2017 concurrent with the Ammonium Perchlorate (AP) Area Up and Down Flushing Treatability Study, located just west of the AP-5 Pond at the Site. The results of the chromium reduction study are included in this *In-Situ Chromium Treatability Study Results Report*.

1.1 OBJECTIVE

The primary objective of the in-situ chromium treatability study was to evaluate the feasibility of achieving in-situ reduction of hexavalent chromium in groundwater at the Site using biological and chemical reduction processes. The results of this treatability study will also provide insights for the Unit 4 Source Area In-Situ Bioremediation Treatability Study that will be addressing chemicals of potential concern (COPCs) at depth in the Upper Muddy Creek formation (UMCf) near the former sodium perchlorate manufacturing area.

1.2 SITE DESCRIPTION

The Site has been used for industrial purposes since 1942, when it was initially developed by the United States government as a magnesium plant to support World War II operations. Since that time, the Site and the surrounding properties have been used for chemical manufacturing, including the production of various chlorate and perchlorate compounds. Entities that operated at the Site include Western Electrochemical Company, American Potash and Chemical Company, Kerr-McGee Chemical Corporation, and Tronox Incorporated. On February 14, 2011, NERT took title to the Site as part of the settlement of the Tronox Incorporated Chapter 11 bankruptcy proceedings. As part of a long-term lease, Tronox Limited (Tronox) operates a manufacturing facility on 114 acres of the Site producing manganese and boron products. Historical industrial production and related waste management activities conducted at the Site and on adjacent properties have resulted in the contamination of various environmental media, including soil, groundwater, and surface water. The most notable Site-related COPCs are chromium and perchlorate (Ramboll Environ, 2015).

Groundwater extraction has been implemented at the Site to address impacts to groundwater resulting from releases of perchlorate and hexavalent chromium. Collectively, the entire system of extraction wells, water conveyances, and treatment plants is referred to as the Groundwater Extraction and Treatment System (GWETS). The GWETS treats water from three groundwater extraction well fields: the IWF; the Athens Road Well Field (AWF); and the Seep Well Field. The Groundwater Treatment Plant (GWTP) removes chromium from groundwater and has been treating IWF-extracted groundwater since its construction in 1986-87.

The chromium-impacted groundwater extracted by the IWF is treated by first chemically reducing the hexavalent chromium by adding ferrous sulfate and then removing the resulting trivalent chromium through chemical precipitation. The precipitated solids settle in a clarifier and are pumped periodically into a filter press where a final sludge cake is produced and disposed of off-site. The treated groundwater effluent is pumped to either the GW-11 Pond or the equalization tanks before it enters the fluidized bed reactor (FBR) biological treatment plant (Ramboll Environ, 2017).

1.2.1 Biological Reduction Study Area

The Central Retention Basin is located approximately 640 feet south (upgradient) of the IWF and contains the locations of the former Beta Ditch and Beta Ditch Extension. The Beta Ditch was an unlined ditch constructed around 1941-1942 to receive several waste streams from various process operations at the Site. In addition, the Beta Ditch received storm water and non-contact cooling water (Ramboll Environ, 2016). The Beta Ditch was used to convey these liquids into the Upper and Lower Basic Management, Inc. (BMI) ponds. In 1970, the Beta Ditch Extension was constructed to extend accessibility of the Beta Ditch to chemical manufacturers located on the west side of the industrial complex. The Beta Ditch and Beta Ditch Extension were excavated during the 2010-2011 Interim Soil Removal Excavation at the Site and were graded to construct what is now currently the Central Retention Basin. The Central Retention Basin was constructed in order to retain storm water on-Site and is connected to another storm water retention basin, the Northern Retention Basin, via a shallow channel located along the eastern edge of the Site. The Northern Retention Basin is located approximately 300 feet north (downgradient) of the IWF and was also constructed during the 2010-2011 soil excavation activities (Ramboll Environ, 2016). The Central Retention Basin contains monitoring wells and former boring locations associated with site investigation activities, the former soil flushing test plots and monitoring wells constructed as part of the Soil Flushing Treatability Study. This area was selected for the In-Situ Chromium Treatability Study biological reduction field study based on the expected presence of high hexavalent chromium concentrations in groundwater and the fact the study area was located approximately 640 feet upgradient of the IWF, which minimized the potential for biofouling the IWF extraction wells (Figures 1 and 2).

1.2.2 Chemical Reduction Study Area

The former AP Area is located just north of the Central Retention Basin. Currently, a portion of the AP Area is being used for the ongoing AP Area Up and Down Flushing Treatability Study which features soil flushing plots in addition to injection wells, monitoring wells, and extraction wells. The injection wells and monitoring wells associated with the AP Area Up and Down Flushing Treatability Study were used for the chemical reduction field study conducted as part of this In-Situ Chromium Treatability Study. The location of the chemical reduction field study, within the AP Area Up and Down Flushing Treatability Study area (Figures 1 and 2), was selected based on the presence of existing data and an existing injection and monitoring well network that could be utilized for implementing the study.

1.2.3 Regional Geology

The Site is located at the southeast end of the Las Vegas Valley, a 55-mile long northwest-southeast trending structural basin that is bounded on the west by the Spring Mountains, on the north by the southern ends of the Sheep and Las Vegas Ranges, on the east by Frenchman and Sunrise Mountains, and on the south by the River Mountains and McCullough Range. The Las Vegas Valley is underlain by a structural basin comprised of Precambrian crystalline rocks; Precambrian and Paleozoic carbonate rocks; Permian, Triassic, and Jurassic clastic rocks; and Miocene igneous rocks (Plume, 1989).

The clastic sedimentary valley-fill deposits of Las Vegas Valley are more than 4,000 feet thick beneath Henderson, Nevada (Plume, 1989). The lithology of the top 250 feet consists of Qal deposits, transitional Muddy Creek Formation, and Pleistocene UMCf (ENVIRON, 2014a).

1.2.3.1 Alluvium

The Site is immediately underlain by Qal deposits that slope to the north toward the Las Vegas Wash. The alluvium generally consists of a reddish-brown heterogeneous mixture of well-graded sand and gravel with lesser amounts of silt, clay, and caliche. Beds or units observed in the area are typically discontinuous due to the mode of deposition. Cobbles and boulders are common, and clasts within the alluvium are primarily composed of volcanic material. The thickness of these alluvial deposits ranges from less than 1 foot to more than 50 feet.

Several known major paleochannels transect the region, from as far south as the Site, towards the Las Vegas Wash. These paleochannels were eroded into the surface of the Muddy Creek Formation during infrequent flood runoff periods with stream-deposited sands and gravels. The generally uniform sand and gravel deposits are narrow, vary in thickness, and exhibit higher permeability than the adjacent well-graded deposits (ENVIRON, 2014a).

1.2.3.2 Muddy Creek Formation

The Muddy Creek Formation represents deposition in an alluvial apron environment from the Spring Mountains to the west, grading into fluvial, paludal (swamp), playa, and lacustrine environments farther out into the valley center (ENVIRON, 2014a). The UMCf underlies the alluvium, and consists of interbedded fine-grained sediments (clay and silt representing the first and second fine-grained facies) and coarse-grained materials (sand, silt, and gravel representing the first and second coarse-grained facies) that become progressively finer-grained to the north towards the central portion of the Las Vegas Valley.

1.2.4 Hydrogeology

According to previous work performed around the region, the depth to groundwater ranges from approximately 27 to 80 feet bgs, is generally deepest in the southern portion of the Site, and becomes shallower to the north toward the Las Vegas Wash. The average groundwater gradient ranges from 0.015 to 0.020 feet per foot (ft/ft), south of the AWF, and decreases to approximately 0.007 to 0.010 ft/ft to the north of the AWF (ENVIRON, 2014a). The direction of groundwater flow on the Site is generally north to north-northwest and then changes slightly to the northeast towards the Las Vegas Wash.

The NDEP has defined the following three water-bearing zones (WBZs) that occur within the Site:

- Shallow WBZ – The first occurrence of groundwater in the area occurs within either the Qal or the UMCf. Groundwater in the Shallow WBZ occurs under unconfined to partially confined conditions and is considered the "water table aquifer." At the Site, the Shallow WBZ is comprised of the saturated portions of the alluvium and the uppermost portion of the UMCf to depths of approximately 90 feet bgs (ENVIRON, 2014a).
- Middle WBZ – Groundwater in the Middle WBZ generally occurs between 90 and 300 feet bgs. Water-bearing units in the Middle WBZ are confined (ENVIRON, 2014a). Groundwater in the Middle WBZ exhibits an upward vertical gradient (Ramboll Environ, 2015).
- Deep WBZ – Groundwater in the Deep WBZ generally occurs between 300 and 400 feet bgs. Water-bearing units in Deep WBZ are confined. Groundwater in the Deep WBZ exhibits an upward vertical gradient (Ramboll Environ, 2015).

1.2.5 Extent of Chromium Impacts

Since the early 1980s, subsurface investigations have identified chromium impacts in groundwater north of the Unit Buildings and extending as far north as the City of Henderson Bird Viewing Preserve. The highest concentrations of chromium in groundwater at the Site have been historically reported south (upgradient) of the IWF and the barrier wall. NDEP identified 70 contaminant source areas for the Site, including process chemicals suspected to have leaked to soil through cracks in the basements of Units 4, 5, and 6 (ENVIRON, 2014a).

In the most recent *Annual Remedial Performance Report for Chromium and Perchlorate* dated December 8, 2017, the maximum total chromium concentrations in groundwater were reported in monitoring wells M-65 and M-66 (16 and 15 milligrams per liter [mg/L], respectively) and in extraction wells I-G, I-T, and I-U (ranging from 21 to 23 mg/L) (Ramboll Environ, 2017). Immediately upgradient of the IWF, chromium appears to primarily be in the hexavalent state with a maximum hexavalent chromium concentration of 11 mg/L in groundwater at M-38 (total chromium concentration reported as 13 mg/L). While these wells are screened across both the alluvium and UMCf, groundwater elevations at most of these monitoring and extraction wells are below the UMCf contact (M-65, I-G, I-T, and I-U), indicating significant hexavalent chromium concentrations are present within the UMCf. Additionally, as presented in Table 11 of the *Annual Remedial Performance Report* dated December 8, 2017, it is estimated that approximately 98.5% of the chromium mass on-Site is currently present in the UMCf with only 1.5% present within the alluvium (Ramboll Environ, 2017).

1.3 REPORT ORGANIZATION

The report is organized as follows:

- **Introduction (Section 1.0):** Provides the primary objectives of this treatability study and the organization of this report.
- **Technology Description (Section 2.0):** Provides an overview of biological and chemical reduction of hexavalent chromium.
- **Laboratory Bench-Scale Studies (Section 3.0):** Presents the objectives, procedures, and results of the laboratory bench-scale microcosm and column studies conducted at UNLV.
- **Field Treatability Study Activities (Section 4.0):** Provides a summary of field treatability study activities including the study area locations and layout, injection and monitoring well installations, injection events, effectiveness monitoring program, and permitting requirements for the treatability study.
- **Analysis of Results (Section 5.0)**: Summarizes results for analytical soil and groundwater data, including geochemical and field parameters, and provides an evaluation of effectiveness for biological and chemical reduction of hexavalent chromium and other COPCs.
- **Summary of Key Findings (Section 6.0):** Summarizes the overall findings of the treatability study and provides considerations for both cost and large-scale implementation of chromium reduction at the NERT site.
- **References (Section 7.0):** Lists the documents referenced in this report.

2.0 TECHNOLOGY DESCRIPTION

This treatability study evaluated the use of biological substrates and chemicals for the in-situ reduction of hexavalent chromium in groundwater at the Site. A brief discussion of the biological and chemical reduction technologies are provided in the following sections. The three carbon substrates used in the bench-scale tests and field biological reduction treatability study are discussed in the subsections following the general discussion of the biological reduction technology.

2.1 BIOLOGICIAL REDUCTION

In-situ microbial reduction of hexavalent chromium [Cr(VI)] to its trivalent state [Cr(III)] can be enhanced by injecting a carbon substrate solution. The carbon substrate is readily degraded by heterotrophic microorganisms present in the aquifer. This process depletes the available dissolved oxygen and causes reducing conditions within the aquifer. Various mechanisms for conversion of Cr(VI) to Cr(III) include: (1) the direct enzymatic reduction of Cr(VI) by numerous bacteria species, such as *Bacillus subtilis* (Fredrickson, Kostandarithes, Li, Plymale, & Daly, 2000; Lovely, 1993; Lovely & Coates, 1997; Tebo & Obraztsova, 1998); (2) an extracellular reaction with by-products of sulfate reduction such as hydrogen sulfide (H_2S); and (3) abiotic oxidation of the organic compounds including soil organic matter such as humic and fulvic acids. Microbial reduction of Cr(VI) primarily occurs under anaerobic conditions. In addition, microbial reduction of ferric iron [Fe(III)] and sulfate ($SO4^{2-}$) creates chemical reductants, ferrous iron [Fe(II)] and sulfide (S^{2-}) respectively, which can reduce Cr(VI) to Cr(III) (Fendorf, Hansel, & Wielinga, 2002; Wielinga, Mizuba, Hansel, & Fendorf, 2001).

As shown in the following chemical equation, the primary end product of hexavalent chromium reduction is chromic hydroxide [$Cr(OH)_3$], which readily precipitates out of solution under moderately acidic and alkaline conditions:

$$\text{Carbon Substrate} + 4\ CrO_4^{2-} + 8\ H^+ \rightarrow 3\ CO_2 + 4\ Cr(OH)_3 + H_2$$

The chromium precipitates remain immobilized within the soil matrix of the aquifer, ensuring short-term and long-term effectiveness (Sass & Rai, 1987; Pettine, D'ottone, Campanella, Millero, & Passino, 1998).

Adding a carbon substrate to the subsurface can sustain the appropriate redox range (approximately -200 to -300 millivolts [mV]) in aquifers with limited supply of natural organic carbon. Numerous carbon donors are available and the selection is based on several physical, chemical, geochemical, and economic factors. At the Site, the objective is to examine the feasibility of biological reduction, which requires the engineered addition of a carbon substrate to the groundwater to optimize and sustain in-situ biodegradation of hexavalent chromium in groundwater.

Previous bench-scale testing for the Site at UNLV have demonstrated that the sequence of biological degradation is:

chromium > nitrate > chlorate > perchlorate

The presence of high total dissolved solids (TDS) could inhibit perchlorate reducing microorganisms. The biodegradation of chloroform can occur through co-metabolism or through bacteria using chloroform as a terminal electron acceptor (Capppelletti, Frascari, Zannoni, & Fedi, 2012). Chloroform degradation typically does not occur under denitrifying conditions (Bouwer & McCarty, 1983). Therefore, at the NERT site, chloroform degradation would be expected to occur after denitrification under reducing conditions. Bench-scale testing planned for the Unit 4 Source Area In-situ Bioremediation Treatability Study will further evaluate this sequence and how the biodegradation of chloroform fits into the sequence.

2.1.1 Emulsified Vegetable Oil

Emulsified vegetable oil is prepared by mixing edible oils with emulsifying agents and water, yielding a smooth blended oil-in-water emulsion. The small, uniform emulsion droplets can transport in most aquifers and have a negative surface charge to reduce droplet capture by the solid surfaces (Solutions-IES, Inc., 2006). Oil droplets can collide with sediment surfaces and coat them with a thin layer of oil droplets when they migrate through the aquifer pore spaces, which provides a carbon source for long-term biodegradation. A single injection can provide sufficient carbon to drive biodegradation for several months, which can help lower operational and maintenance costs. The small oil droplets of emulsified vegetable oil can be transported substantial distances (up to 45 feet depending on the geological conditions) with low to moderate oil retention and little permeability loss. Therefore, the major advantage of these carbon substrates is their longevity in the subsurface and less frequent injection intervals.

EVO may be formulated to include a mixture of fast-release carbon substrates, such as glycerin and/or or sugars, with the slow release emulsified vegetable oil. An example of such a mixture is EOS$_{\mathrm{PRO}}$®, a product of EOS® Remediation, LLC. EOS$_{\mathrm{PRO}}$® has previously been evaluated for the Site and was successfully applied during the Groundwater Bioremediation Treatability Study located approximately 2,000 feet downgradient of the AWF (Tetra Tech, Inc., 2016b). Results of this study indicated that the injection of EOS$_{\mathrm{PRO}}$® provided a sustained reducing environment that is required for perchlorate biodegradation in groundwater and was effective at reducing perchlorate concentrations in groundwater by greater than 90% in many downgradient monitoring wells. Therefore, EOS$_{\mathrm{PRO}}$® was used in the bench-scale and biological reduction field treatability study.

2.1.2 Industrial Sugar Wastewater

As the cost of the carbon substrate is one of the primary costs for implementing biological reduction, finding a cost-effective, local supply of carbon substrate is preferable. A facility located in the general vicinity of the Site manufactures consumer fruit juice and generates a substantial quantity of fruit juice that does not meet quality standards for distribution and rinse water used to clean juice lines. In 2015, UNLV analyzed a representative sample of the solution, which the facility discharges under permit to the sanitary sewer. UNLV determined that it had a chemical oxygen demand (COD) of 26,880 mg/L, a pH of 5.5 standard units, and ammonia concentration of 10 mg/L as nitrogen. While the pH of the solution is slightly acidic, sodium bicarbonate can easily be added to increase the pH if required. This reclaimed industrial sugar wastewater was used in the bench-scale and biological reduction study to evaluate its effectiveness as a carbon substrate.

2.1.3 Molasses

Molasses is a viscous by-product of the refining of sugarcane or sugar beets into sugar. It has been used for remediation of hexavalent chromium in groundwater for over 20 years with a relatively high degree of success. Molasses is a water-soluble carbon substrate that provides an electron donor and carbon source for native bacteria present in the aquifer. The increased activity of the bacteria will rapidly utilize any dissolved oxygen and any other electron acceptors present in the groundwater, driving conditions to be anaerobic and causing hexavalent chromium to be reduced to trivalent chromium (Chen, Zhao, & Bai, 2015). The trivalent chromium precipitates out of the groundwater as chromium hydroxide and remains as part of the soil matrix. The advantage of this soluble carbon substrate is that it is a low-cost alternative, food-grade, and easy to handle and use. However, molasses also has a shorter half-life, can alter the groundwater pH, and may require multiple rounds of injections depending on the groundwater conditions. Blackstrap molasses was used in the bench-scale and biological reduction field study due to the additional nutrients present that help promote biological growth.

2.2 CHEMICAL REDUCTION

Chemical reduction of Cr(VI) to Cr(III) refers to abiotic reduction via an electron donor such as sulfur, or iron (as Fe(II) or zero-valent iron [Fe(0)]). From this reduction, Cr(III) precipitates out of solution and Cr(VI) toxicity is reduced. Examples of engineered chemical reduction technologies include in-situ injection of an electron donor such as calcium polysulfide (CPS), ferrous sulfate, and other sulfate-based reductants. During injection, the pH level is optimized to facilitate electrostatic surface interactions between the Cr(VI) anionic species and the electron donor. In areas that exhibit high Cr(VI) concentrations, pH is increased so that Cr(III) forms precipitates (Guertin, Jacobs, & Avakian, 2005). While numerous chemicals are capable of achieving chemical reduction of Cr(VI) to Cr(III), CPS was selected for further evaluation due to its relative ease of use, availability, documented effectiveness, and relative costs. Ferrous sulfate was also considered and incorporated into the laboratory bench-scale studies, but based on the preliminary bench-scale results, was not selected for the chemical reduction field study.

CPS is used extensively as an agricultural soil amendment, a fungicide at vineyards, and for removal of metals in water treatment systems (Padzadeh & Batista, 2011). It has more recently been found to be capable of fixating many heavy metals (e.g., arsenic, lead, copper, cadmium) in the environment. There have been numerous successful applications of CPS to treat Cr(VI) in groundwater over the last 15 years (Freedman, Lehmicke, & Verce, 2005; Graham, et al., 2006; Storch, Messer, Palmer, & Pyrih, 2002; Messer, Storch, & Palmer, 2003; Yu & Tremaine, 2002) at industrial sites with Cr(VI) concentrations as high as 240 mg/L (Blessing & Rouse, 2002).

Once CPS is mixed with water, polysulfide dissociates to form bisulfide (HS-) and aqueous hydrogen sulfide ($H_2S_{(aq)}$), which can react directly with Cr(VI) to form Cr(III). Alternatively, the sulfide can reduce Fe(III) present in the aquifer to Fe(II), which reduces Cr(VI) to Cr(III). In the pH range of 4 to 10, Cr(III) will precipitate as $Cr(OH)_3$. If reduction is by Fe(II), Cr(III) will co-precipitate with Fe(III) to form the less soluble $Fe_{0.75}Cr_{0.25}(OH)_3$ (Sass & D. Rai, 1987). In summary, calcium polysulfide can reduce Cr(VI) to Cr(III) to form a non-toxic, low solubility form of chromium, chromium hydroxide, as generally described by the following chemical equation:

$$2\ CrO_4^{2-} + 3\ CaS_5 + 10\ H^+ \dashrightarrow 2\ Cr(OH)_3 + 15\ S + 3\ Ca^{2+} + 2H_2O$$

CPS is typically more stable and persistent in groundwater than other reductants and is relatively safe to handle. CPS and ferrous sulfate were both evaluated as part of the laboratory bench-scale studies to evaluate dosage and expected treatment times, and to select the preferred chemical for use in the chemical reduction study.

3.0 LABORATORY BENCH-SCALE STUDIES

Prior to implementation of the field studies, Tetra Tech contracted UNLV's Environmental Engineering and Water Quality Laboratory to conduct laboratory batch microcosm and column studies to evaluate in-situ hexavalent chromium reduction. The primary goal of the batch microcosm and column studies was to evaluate proposed amendments for injection into the saturated zone with regard to promoting hexavalent chromium reduction under site-specific conditions. This section summarizes the objectives, general setup/procedures, and brief findings, conclusions, and recommendations drawn from the bench-scale studies. Appendix A provides the final UNLV report, *Bench-Scale Investigation: Chemical and Biological Reduction of Hexavalent Chromium and Co-Contaminants at the Interceptor Well Field (IWF) of the NERT Site, Henderson, Nevada* (referred to herein as the final UNLV laboratory report), which presents the details of the experimental approach, data, and analysis of results.

3.1 BENCH-SCALE OBJECTIVES

As described in the *In-Situ Chromium Treatability Study Work Plan*, the objectives of the bench-scale studies were to accomplish the following:

- Determine the most appropriate chemical and biological carbon substrate amendments to promote the reduction of hexavalent chromium under site-specific conditions;
- Evaluate chemical and biological carbon substrate dosage;
- Determine chemical and biological carbon substrate persistence;
- Evaluate impact of chemical and carbon substrate type on degradation kinetics; and
- Evaluate impact of pH on degradation kinetics.

3.2 COLLECTION AND EVALUATION OF SOIL AND GROUNDWATER

Soil used in the laboratory bench-scale studies was obtained as cuttings and soil cores from two newly drilled monitoring wells in the biological reduction study area (CTMW-03S and CTMW-03D; Figure 3a) and three newly drilled injection wells in the chemical reduction study area (UFIW-02S, UFIW-02I, and UFIW-02D; Figure 4a). Soil samples were collected by Tetra Tech in sterile plastic buckets with sterile hand shovels from the following intervals:

- Qal: 18 to 23 feet bgs from CTMW-03S
- Qal: 23 to 28 feet bgs from UFIW-02S
- UMCf: 31 to 36 feet bgs from UFIW-02I
- UMCf: 33 to 38 feet bgs from CTMW-03D
- UMCf: 43 to 48 feet bgs from UFIW-02D

Approximately four gallons of soil cuttings (two 2-gallon buckets) were collected from each 5-foot drilling interval. Soil from each sampling interval was blended in the laboratory and used for both batch microcosm and column studies. Soil collected from the chemical reduction study area was used for the chemical batch microcosm and column studies. Soil collected from the biological reduction study area was used for the biological batch microcosm and column studies. Groundwater samples for the chemical batch microcosm and column studies were collected from wells UFIW-06S (screened from 25 to 30 feet bgs) and UFIW-06I (screened from 35 to 40 feet bgs) at the start of the study and periodically thereafter during the column studies. During later studies, groundwater samples were also collected from UFIW-03S (screened from 19 to 24 feet bgs). Groundwater samples for the biological batch microcosm and column studies were collected from CTMW-03S (screened from

19 to 24 feet bgs) and CTIW-01D (screened from 33 to 38 feet bgs). UNLV analyzed the soil samples for moisture content, grain size distribution, and contaminant concentrations.

3.3 BIOLOGICAL REDUCTION STUDIES

The experimental methodology and results of biological reduction batch microcosm and column studies performed by UNLV are described in this subsection.

3.3.1 Batch Microcosm Studies

The batch microcosm studies were performed to examine the potential for in-situ biological reduction of hexavalent chromium and co-contaminants using various substrates or mixtures of substrates, consisting of EOS$_{\text{PRO}}$®, industrial sugar wastewater, a mixture of EVO and industrial sugar wastewater, and molasses as carbon donors.

3.3.1.1 Microcosm Setup and Effectiveness Monitoring

All microcosm studies were performed using 125 milliliter (mL) autoclave-sterilized borosilicate glass bottles. The final UNLV laboratory report in Appendix A describes in detail the various setups. Each bottle was filled with the desired amounts of soil, groundwater, carbon substrate, and any supplements (e.g., nutrients such as phosphate). The estimated initial COD added to all microcosms was 12,000 mg/L, either as EVO, industrial sugar wastewater, a mixture of EVO and industrial sugar wastewater, or molasses. The microcosm bottles were crimped closed using butyl rubber caps and aluminum rings to ensure anaerobic/anoxic conditions, and were continuously mixed in a rotary shaker at 30 revolutions per minute (rpm) at room temperature. All studies were performed in duplicate. At pre-determined time intervals, one bottle and its duplicate were removed for analysis, unless specified. The microcosm bottles were taken out of the rotor and were left to settle for at least 6 to 8 hours. The liquid was decanted and filtered through a 0.2 micrometer (µm) sterile filter. The samples were analyzed for hexavalent chromium, nitrate, perchlorate, chlorate, and COD (Appendix A).

3.3.1.2 Results

The key results and findings from the batch biological reduction microcosm studies include the following:

- EVO and industrial sugar wastewater were effective in supporting hexavalent chromium reduction.
- Industrial sugar wastewater or a mixture of EVO and industrial sugar wastewater promoted faster reduction rates of hexavalent chromium than the use of EVO alone.
- The use of industrial sugar wastewater alone was not preferred by bacteria to reduce nitrate, chlorate, and perchlorate.
- Reduction rates of hexavalent chromium, nitrate, chlorate, and perchlorate were slower in the UMCf microcosms than the Qal regardless of the substrate used. This is largely attributed to the difference in soil properties and varying acclimation times for the indigenous bacteria present in the Qal compared to the UMCf.
- The addition of ammonium phosphate to a mixture of EVO and industrial sugar wastewater promoted faster reduction rates than a mixture of EVO and industrial sugar wastewater without ammonium phosphate.
- Batch microcosm studies demonstrated that sufficient indigenous bacteria, with the ability reduce hexavalent chromium, were present in groundwater and saturated soils at the treatability study area.
- The elevated TDS concentrations in Site groundwater did not appear to have an effect on hexavalent chromium reduction rate, but is a potential factor in the reduction rate of perchlorate, nitrate, and chlorate.

- Because of the high nitrate concentrations in groundwater (ranging from above 600 mg/L in the Qal and 200 mg/L in the UMCf), it was not necessary to augment the system with nitrogen micronutrients.
- The nitrate concentration in the Qal was approximately three times that of the UMCf, and significant chlorate degradation only occurred after nitrate was significantly degraded.
- Only minor perchlorate degradation was observed in both the Qal and UMCf microcosms during the term of the microcosm studies.
- The pH resulting from the addition of industrial sugar wastewater, EVO, or a mixture of both substrates ranged from 6.5 to 7.5, within the favorable range for in-situ biological reduction, and did not appear to have had a major impact on degradation kinetics.

3.3.2 Biological Reduction Column Studies

The feasibility of using various substrates or mixtures of substrates (specified in Section 3.3.1) as electron donors for in-situ biological reduction of hexavalent chromium and co-contaminants was evaluated using four laboratory-scale column bioreactors, two for the Qal and two for the UMCf. The column bioreactors were designed to evaluate treatment of hexavalent chromium-contaminated groundwater obtained from the Site, such that the flow rates were comparable to the groundwater flow rates at the Site. The main objective of the column studies was to demonstrate that hexavalent chromium could be reduced under conditions that simulated field groundwater flow conditions in both the Qal and UMCf.

3.3.2.1 Column Setup and Effectiveness Monitoring

A total of four columns, two for the Qal and two for the UMCf, were filled with packed soil from the cuttings produced during the drilling of UFIW-02S and CTMW-03D to simulate groundwater velocities within the Qal and UMCf. The columns were two inches in diameter and 50 inches long. Approximately three kilograms (kg) of dried Qal soil were packed in the two Qal columns and approximately 2.3 kg of dried UMCf soil were packed in the two UMCf columns. The approximate dry bulk densities of soil were 1,300 kilogram per cubic meter (kg/m^3) for the Qal columns and 910 kg/m^3 for the UMCf columns. Before biodegradation testing started, the dried soils were saturated with groundwater, free of any electron donor or nutrients. A detailed discussion of the experimental setup of the columns is provided in the final UNLV laboratory report.

The influent groundwater for the Qal columns was obtained from CTMW-03S, and the influent groundwater for the UMCf columns was obtained from CTMW-03D. The Qal columns were gravity fed with groundwater obtained from the treatability study area initially, but the Qal columns were operated under a pressure of 5 pounds per square inch (psi) from Day 28 until the end of the study due to decreases in the column flow rate, which were attributed to the transport of fine-grained material present in the Qal to the lower portion of the column, where they accumulated. The UMCf columns began under a pressure of 15 psi, but the pressure was reduced to 10 psi on the first day of the study and generally remained at this pressure throughout the study. Each column was saturated with groundwater in a down flow mode. The composition of the column influent varied over time, and column influent mixtures consisted of groundwater with EVO; a mixture of industrial sugar wastewater, groundwater, and EVO; and groundwater alone.

The solid media from the soil and plastic bioreactor were collected at the end of the column study and shipped to a commercial laboratory for bacterial community analysis. The laboratory extracted deoxyribonucleic acid (DNA) and used Illumina next-generation sequencing technology to identify the microorganisms. The primers selected for the study were previously used in a study (Coates, et al., 1999) to identify bacteria capable of reducing perchlorate but present in uncontaminated soil. The final results obtained from the laboratory included the percentages for each organism identified to species level.

3.3.2.2 Results

The main findings of the laboratory biological reduction column studies are as follows:

- Hexavalent chromium reduction was attainable under flow-through conditions using Site groundwater. The hexavalent chromium reduction rates were faster in the Qal columns, where hexavalent chromium concentrations reached non-detect levels in 45 days. In comparison, hexavalent chromium concentrations reached non-detect levels in 90 days in the UMCf columns. The results suggested that EVO and industrial sugar wastewater were effective at promoting reducing conditions and that hexavalent chromium-reducing microorganisms were present in native soil and groundwater.
- Denitrification and perchlorate reduction were attainable under flow-through conditions using Site groundwater. Denitrification and perchlorate reduction rates were faster in the Qal columns. The rate of denitrification, however, was affected by the concentration of hexavalent chromium. Decreasing concentrations of hexavalent chromium typically preceded higher rates of denitrification. Increasing rates of chlorate and perchlorate reduction were observed in response to decreasing concentrations of nitrate.
- Higher hydraulic residence time (contact time) significantly improves the rate of in-situ biological reduction of hexavalent chromium and nitrate.
- As discussed in Section 2.1.1, EVO behaves as a slow release electron donor. When groundwater flowed through soil columns to which EVO was added, the excess oil that did not adsorb to the soil was flushed out. Sorbed oil was slowly released, as measured by the COD in the effluent of the columns. In field application, the influence of EVO addition may be expected to be well beyond the vicinity of injection due to groundwater transport of a portion of the oil.
- No clogging was observed in the Qal or UMCf columns caused by the biological activity, but reduced flow rates in the Qal columns were observed due to displacement of the fine material contained in the Qal to the bottom of the Qal columns.

3.4 CHEMICAL REDUCTION STUDIES

The experimental methodology and results of chemical reduction batch microcosm and column studies performed by UNLV is described in this subsection.

3.4.1 Batch Microcosm Studies

The batch microcosm studies described herein were performed to assess the potential for CPS or ferrous sulfate to be used as reducing agents for in-situ hexavalent chromium reduction at the Site.

3.4.1.1 Microcosm Setup and Effectiveness Monitoring

For bench-scale study purposes, a low and a high hexavalent chromium concentration was established to evaluate the hexavalent chromium removal efficiency of CPS and ferrous sulfate under two different concentration ranges present at the Site. The low concentration of hexavalent chromium was 500 µg/L, and the high concentration of hexavalent chromium was 10,000 µg/L.

Batch chemical reduction studies were conducted in one liter glass beakers using a Phillip and Bird Batch Tester. A preliminary batch test was performed to select a range of reducing agent (i.e., CPS or ferrous sulfate) to chromium ratios. Hexavalent chromium concentrations in groundwater samples collected for the batch tests from UFIW-06S (Qal) and UFIW-06I (UMCf) were less than 500 µg/L. In response, Qal and UMCf groundwater samples were spiked to achieve a concentration of approximately 10,000 µg/L for a high concentration test, and the samples for use in a low concentration test were generally spiked to achieve a concentration of approximately 500 µg/L. The final UNLV laboratory report in Appendix A describes the experimental methodology used to select the quantity and type of reducing agent to hexavalent chromium concentration ratios and conduct the batch chemical reduction tests.

For the batch chemical reduction studies, 250 or 500 mL of Site groundwater, either a low concentration or high concentration replicate, was placed in a glass beaker. The reducing agent dose was added and the contents of each beaker (i.e., water, any suspended solids, and coagulant) were stirred rapidly at 100 rpm for a minute. After one minute, the mixer speed was decreased to 30 rpm to promote slow mixing for a period of 30 minutes. After 30 minutes, the contents of the beaker were transferred to a graduated cylinder to allow formed solids to settle for 10 minutes. The goal of the settling period was to evaluate the mass of precipitated solids generated by addition of ferrous sulfate and CPS.

Approximately 100 mL of supernatant from the graduated cylinder were subsequently transferred into vials to measure pH, total chromium, and turbidity. For hexavalent chromium analysis, about 25 mL of the decant solution was preserved with trace metal quality nitric acid for inductively coupled plasma analysis. The settled solids volume, after 10 minutes settling time, was recorded. The entire cylinder content was then transferred to a large bottle and centrifuged for 30 minutes at 3,000 rpm. The supernatant was carefully poured and filtered (0.45 µm membrane filter) to analyze for nitrate, perchlorate, and hexavalent chromium. The solids were transferred into pre-weighed aluminum dishes for suspended solids testing. The blades and the beaker walls were inspected for scale formation. The complete results of the batch studies are presented in the final UNLV laboratory report (Appendix A).

3.4.1.2 Results

The key results and findings from the batch chemical reduction microcosm studies include the following:

- A 99% reduction in hexavalent chromium concentrations in the Qal and UMCf microcosms was observed when CPS was used as a reducing agent. The optimal CPS dosage identified was twice the calculated stoichiometric ratio. Higher removals were not observed when CPS dosages above twice the calculated stoichiometric ratio were used.
- Similar to CPS, a 99% reduction in hexavalent chromium concentrations in the Qal and UMCf microcosms was observed when ferrous sulfate was used as a reducing agent. The optimal ferrous sulfate dosage was at least five times the stoichiometric ratio. The use of ferrous sulfate as a reducing agent generated a larger volume of precipitated solids than the use of CPS as a reducing agent.
- The use of CPS or ferrous sulfate did not affect nitrate or perchlorate concentrations.
- The final pH standards obtained after treatment using CPS or ferrous sulfate were within approximately 6 to 9 standard units.

3.4.2 Chemical Reduction Column Studies

The feasibility of using CPS as a reducing agent for in-situ hexavalent chromium reduction was evaluated as part of a two-stage study using laboratory-scale column reactors. CPS was selected as the reducing agent for the chemical reduction column studies as it was able to achieve 99% reduction in hexavalent chromium concentrations with a lower stoichiometric ratio than ferrous sulfate. During the preliminary stage, column studies were performed using two columns, one for the Qal and one for the UMCf, with a low concentration of hexavalent chromium in groundwater (1,000 µg/L) for a period of 36 days. During the second stage, column studies were performed using three columns, one low-concentration replicate for the Qal (1,000 µg/L), one low concentration replicate for the UMCf, and one high-concentration replicate for the UMCf (10,000 µg/L). The column reactors were designed to evaluate treatment of hexavalent chromium-contaminated groundwater at the Site, such that the concentrations and flow rates were comparable to the concentrations and hydraulic conductivities present at the Site, in both the Qal and UMCf.

3.4.2.1 Column Setup and Effectiveness Monitoring

For the preliminary column studies, two columns, one for the Qal and one for the UMCf, were packed with layers of glass beads and gravel and packed soil produced during the drilling of UFIW-02S and CTMW-03D to simulate groundwater velocities within the Qal and UMCf. The preliminary column tests were performed using groundwater with a low concentration of hexavalent chromium (1,000 µg/L). The Qal column was gravity fed, and the UMCf column was operated under a pressure of 30 psi. Based on the batch chemical reduction microcosm studies, the minimum dosage of CPS required was twice the stoichiometric ratio (34 mL CPS /1,000 L groundwater). However, due to concerns related to inadequate mixing in the columns, the effective dosage used during the preliminary column studies was 20 times the stoichiometric ratio based on previous experience and observed inadequate mixing in test columns. CPS was introduced into the Qal column using a drip delivery system that maintained a continuous CPS flow rate between 370 microliters per minute (µL/min) and 400 µL/min. CPS was introduced into the UMCf column using a syringe to inject the reducing agent through a port drilled approximately one inch above the contact soil (simulated aquifer zone being tested) in the column.

For the column studies during the second stage, three columns, one low-concentration replicate for the Qal (1,000 µg/L), one low-concentration replicate for the UMCf, and one high-concentration replicate for the UMCf (10,000 µg/L) were packed with layers of glass beads and gravel and packed soil as described in the final UNLV laboratory report (Appendix A). The Qal column was gravity fed, and the UMCf columns were operated under a pressure of 15 psi. The dosage of CPS for the low-concentration replicates was 20 times the stoichiometric ratio, and the dosage of CPS for the high-concentration replicate was 40 times the stoichiometric ratio. The increased dosages used a factor of 10 to account for inadequate mixing within the columns. For the Qal columns, half of the estimated dosage of CPS (2 mL) was injected twice everyday (i.e., 1 mL on each injection). For the UMCf columns, the CPS injection dosages of 0.3 and 1 mL for the low and high concentration columns respectively, were injected once a day. The operation of the columns included measurement of flow rate, throughput volume, pH, hexavalent chromium (as a 24-hour composite sample and a grab sample), and total chromium (in composite samples). Every two days, groundwater spiked with 1,000 µg/L or 10,000 µg/L of hexavalent chromium was prepared, and added to the feed tanks. The chromium concentration in the feed tank was measured every time new groundwater was added to the tank.

3.4.2.2 Results

The main findings of the laboratory chemical reduction column studies are as follows:

- Column studies indicated that reduction of hexavalent chromium is feasible using CPS in both the Qal and UMCf as studies achieved over 99% reduction in hexavalent chromium concentrations in groundwater for columns packed with soil from both the Qal and UMCf.
- The use of CPS as a reducing agent is more effective for higher concentrations of hexavalent chromium than for lower hexavalent chromium concentrations.
- Increasing the amount of CPS from 20 times to 40 times the stoichiometric ratio had no significant effect on the reduction of hexavalent chromium concentrations in groundwater for columns packed with soil from the UMCf.

4.0 FIELD TREATABILITY STUDY ACTIVITIES

As described in Sections 1 and 2, two comparison studies were implemented to evaluate the feasibility of, and the optimal approach for, achieving in-situ reduction of hexavalent chromium in groundwater at the Site. This section provides a summary of the field activities associated with each of the biological and chemical reduction studies.

4.1 BIOLOGICAL REDUCTION STUDY

The biological reduction study was located east of the previous Soil Flushing Treatability Study area in the Central Retention Basin and approximately 640 feet upgradient of the IWF (Figure 2). This area was selected for the following reasons:

- Sufficient distance from the IWF to minimize potential for unintended migration of the carbon;
- Not located within a reported paleochannel (Ramboll Environ, 2017);
- High hexavalent chromium concentrations expected to be present (Ramboll Environ, 2017);
- No significant structures present in the Central Retention Basin; and
- Located within the area where in-situ reduction in hexavalent chromium would reduce the influent loading to the IWF.

The layout of the treatability study consisted of a transect injection design with injection wells configured in a single row and a network of generally downgradient monitoring wells used for performance monitoring to observe and evaluate potential influence from the injections (Figure 3a). The study area consisted of three paired injection well locations and six dual-nested monitoring well locations. Each of the three-paired injection well locations (CTIW-01S/D, CTIW-02S/D, and CTIW-03S/D) consisted of a shallow well (screened in the Qal, designated by “S”) and a deep injection well (screened in the UMCf, designated by “D”) that were installed in separate boreholes. Each dual-nested monitoring well location (two wells installed within the same borehole) consisted of one shallow well (CTMW-01S through CTMW-06S) that is screened in the Qal and one deep well (CTMW-01D through CTMW-06D) that is screened in the UMCf. Additional details regarding well construction and screen intervals are provided in Section 4.1.3.1 and a depiction of the layout is provided in Figure 3a.

4.1.1 Biological Study Area Geology

There are two reported paleochannels within the alluvial deposits that cross the IWF in a northerly direction (Figure 2). Similar to the other reported paleochannels throughout the region, these paleochannels are inferred to have eroded into the surface of the UMCf during infrequent flood runoff periods with stream-deposited sands and gravels. The sand and gravel deposits are narrow, vary in thickness, and exhibit higher permeability than the adjacent well-graded deposits. The two on-Site paleochannels are presumed to merge downgradient of the Site and continue through the area towards the Las Vegas Wash. The nearest reported paleochannels appear to be approximately 200 feet east and 400 feet west of the biological study area (Ramboll Environ, 2017).

The alluvial deposits generally extend to 20 to 30 feet bgs at the Site (Ramboll Environ, 2017). Depending on location, Qal soil types observed in the biological reduction study area generally consist of well-graded sands, fine- to medium-grained poorly-graded sands, and silty sand, all with varying amounts of gravel (Figures 3b and 3c; Appendix B). The contact between the base of the Qal and the top of the UMCf in the biological reduction study area is encountered at a depth of approximately 24 feet bgs (Figures 3b and 3c). The UMCf in the area consists of predominantly silt with thin interbedded sandy silt, and clayey silt to a depth up to 61.5 feet bgs (Appendix B). The UMCf is also characterized by cemented white nodules varying in size (from fine to coarse gravel) and percentages, ranging from <1% to 30%, throughout the sampled interval. The nodules were observed to be reactive to hydrochloric acid, indicating they may be comprised of calcium carbonate. The coarse-grained paleochannel deposits were not encountered in the boreholes advanced in the biological reduction study area.

4.1.2 Biological Study Area Hydrogeology

The depth to groundwater at the Site ranges from about 11 to 43 feet bgs and is generally deepest in the southern portion of the Site; the depth to groundwater becomes shallower to the north, toward the AWF (Ramboll Environ, 2017). The direction of groundwater flow on the Site is generally towards the north to north-northwest and then changes slightly to the northeast offsite. Groundwater flow may be altered in areas across the Site as a result of the paleochannels, the on-Site barrier wall, and the IWF.

Based on data collected from boreholes advanced in the Central Retention Basin for the biological reduction study, groundwater was encountered in the Qal at depths ranging from 22 feet to 23 feet bgs (Figures 3b and 3c; Appendix B). The groundwater potentiometric surface measured at these locations following the installation of the injection and monitoring wells was approximately 22.5 feet bgs, for both shallow and deep well locations. Groundwater in both shallow wells screened within the alluvium and deep wells screened within the UMCf flows generally northeast (Figures 5a and 5b). The average hydraulic gradient calculated in the study area for wells screened in the alluvium was calculated to be 0.019 feet per foot (ft/ft) in the area around the monitoring wells and 0.055 ft/ft, in the area between the injection and monitoring wells. The average hydraulic gradient calculated in the study area for wells screened in the UMCf was calculated to be 0.021 ft/ft.

Several hydrogeologic investigations have been performed at the Site since the early 1980s to obtain aquifer data (i.e., hydraulic conductivity [K], transmissivity [T], and storativity [S]) in support of groundwater remediation efforts. Aquifer tests performed include slug and baildown tests, constant rate pumping tests, step-drawdown tests, and recovery tests. Based on the results of these tests, the average hydraulic conductivity for the alluvium and UMCf was calculated to be 38.5 feet per day (ft/d) and 3.2 ft/d, respectively (Tronox, LLC, 2010).

Tetra Tech performed additional aquifer tests as part of the biological reduction study and results are discussed in Section 5.1.5. The groundwater flow velocity was estimated for the alluvium and UMCf in order to evaluate how quickly the proposed carbon substrate may pass through the study area. Based on the estimated K values for shallow and deep wells (see Section 5.1.5; Appendix C), hydraulic gradient values of 0.011 to 0.055 feet per foot (ft/ft; shallow wells) and 0.014 ft/ft to 0.021 (deep wells), average porosity values of 47.5% (shallow wells) and 61.2% (deep wells) as determined from site-specific sampling (See Section 5.1.1), and an estimated effective porosity of 15%, the estimated groundwater velocity for the shallow and deep intervals of the biological reduction study area ranges from 0.003 ft/d to 47 ft/d and 0.00004 ft/d to 0.42 ft/d, respectively.

4.1.3 Drilling and Well Installation

This section describes the activities associated with drilling and installation of wells located in the Central Retention Basin that were used for the biological reduction study.

4.1.3.1 Installation

Prior to advancing the borings, Tetra Tech reviewed available utility maps and retained the services of a geophysical locator to check for underground utility lines. Each borehole was cleared for utilities to at least 5 feet bgs using a Hydrovac unit that injected pressurized water through a handheld wand and extracted the resulting slurry by a powerful vacuum.

As previously explained, a total of three paired injection well clusters were installed. Each cluster consisted of one injection well screened in the Qal, designated CTIW-01S through CTIW-03S and one injection well screened in the UMCf, designated CTIW-01D through CTIW-03D. The injection wells were installed in separate boreholes to avoid potential short circuiting between the shallow and deep wells during injection activities. Additionally, six dual-nested monitoring wells (two wells installed within the same borehole) screened separately in each the Qal and the UMCf, designated CTMW-01S/D through CTMW-06S/D, were installed as part of the biological reduction study to monitor remedial effectiveness (Figure 3a).

The borehole drilling and well installation activities were conducted during three mobilizations. This phased approach was used to collect area-specific data, including groundwater levels, physical soil properties, and estimated groundwater gradient, in order to adjust the overall injection and monitoring network. The first phase occurred from November 28 through December 1, 2016, and consisted of the drilling and installation of two injection wells (CTIW-01S and CTIW-01D), and one dual-nested monitoring well (CTMW-03S/D). The well IDs were based on the preliminary well layout and not based on the order of installation. Based on the data obtained from this mobilization, the layout was adjusted for the next phase of wells to include the addition of one more clustered injection well based on the results of the slug tests and geological characteristics in the area. The second phase occurred from March 20 through March 27, 2017, and consisted of the drilling and installation of the remaining two paired injection well locations (CTIW-02S/D and CTIW-03S/D) and three additional dual-nested monitoring wells (CTMW-01S/D, CTMW-02S/D, and CTMW-04S/D). The results and observations obtained from the baseline groundwater monitoring, first carbon substrate injection event, and first three performance monitoring events were used to guide the final phase of drilling and well installation. The third and final phase occurred from June 5 through June 6, 2017, and consisted of the drilling and installation of two dual-nested monitoring wells (CTMW-05S/D and CTMW-06S/D).

All drilling and well installation activities were conducted by National Exploration, Wells and Pumps (National, later acquired by Cascade Drilling, LP) using the hollow-stem auger method. Soil for lithological logging purposes was collected using a CME Continuous Sample Tube System consisting of a 3-inch by 5-foot sample tube with a cutting shoe that extends below the auger cutter head. Soil for analytical purposes (chemical testing and physical parameter analysis) was collected using the California-modified split-spoon sampler lined with stainless steel sleeves. Upon retrieval from the borehole, the lowermost sleeve was removed from the sampler and the ends of the sleeve were covered with Teflon sheets and tight-fitting plastic caps. The soil samples were then labeled, placed in resealable plastic bags, and stored in an ice chest cooled with ice pending delivery to the laboratory under chain-of-custody protocols. The soil borings were logged by a trained geologist or engineer in general accordance with the American Society for Testing and Materials (ASTM) Standard D-2488-09 *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)* (ASTM International, 2009). Copies of the soil boring logs are provided in Appendix B.

Depth discrete groundwater samples were collected while performing drilling during the first mobilization. A SimulProbe sampler was utilized to target specific saturated intervals corresponding to the shallow and deep well screens. Grab groundwater samples were successfully collected at a depth of 36 ft bgs from CTIW-01D and CTMW-03D. Insufficient water was present at 23 ft bgs to collect the grab groundwater samples from the saturated alluvium. The SimulProbe sampler is used to collect both soil and groundwater samples concurrently. The probe is driven into the ground at the selected interval by a hammer. The core is collected in the core-barrel at the bottom of the probe. The probe is then lifted up a few inches, opening up a hidden compartment that provides a pathway for water to channel into the canister. The water canister is closed by back pressurization and utilizes compressed gas to lift the water sample to the surface through a network of tubing and check valves.

A summary table of the well construction details is provided along with the boring logs that contain well construction diagrams in Appendix B. All of the wells installed consisted of 2-inch inner diameter Schedule 40 PVC casing and slotted Schedule 40 PVC screen. The shallow wells (designated “S”) were screened in the Qal, just above the Qal/UMCf contact, with 5-foot screens from approximately 19 to 24 ft bgs. The deep wells (designated “D”) were screened in the UMCf at 10 feet below the Qal/UMCf contact with varied screen lengths. During the first phase, the deep injection well CTIW-01D was installed with a 5-foot screen from approximately 33 to 38 feet bgs and the deep monitoring well was installed with a 15-foot screen from approximately 34 to 49 feet bgs. All of the deep injection and monitoring wells installed in the second phase were screened with 15-foot screens from approximately 34 to 49 feet bgs. The two deep monitoring wells installed in the third phase were screened with 20-foot screens from approximately 34 to 54 feet bgs. The screen intervals were increased for the deep wells installed during the second and third phases based on the hydrogeology observed during the first phase.

Following the completion of well construction, but no sooner than 24 hours after well construction was complete, the newly installed wells were developed using a surge block and bailer to swab and surge the filter pack and remove sediment from the wells. This process was followed by pumping with a submersible pump to purge the well of fine-grained sediment. Well development was considered complete when three to ten casing volumes of water had been removed from the well, and index parameters consisting of pH, specific conductivity, turbidity, and temperature were stable (pH within 0.1 and other parameters within 10 percent) over three consecutive measurements.

Once all injection and monitoring well installation activities were complete, a land surveyor surveyed the horizontal coordinates of each well relative to North American Datum 83 with an accuracy of 0.1 foot. The elevation of the ground surface and top of well casing measuring point relative to North American Vertical Datum 88 were surveyed with accuracies of 0.1 foot and 0.01 foot, respectively.

4.1.3.2 Laboratory Analysis

Selected soil and depth-discrete groundwater samples collected during drilling were submitted to TestAmerica Laboratories, Inc., for environmental analyses and/or PTS Laboratories, Inc., for physical parameter analyses, which are presented in ***Table 1***. The depth-discrete groundwater samples were used for initial screening of the groundwater concentrations within the biological reduction study area. Depth-discrete groundwater samples were obtained at one depth from each of the borings CTIW-01S, CTIW-01D, CTMW-03S, and CTMW-03D. The collection of additional depth-discrete groundwater samples was attempted, but were unsuccessful due to poor groundwater recovery at these locations. However, the vertical extent of hexavalent chromium, chromium, perchlorate, and chlorate in groundwater were assessed later through depth-discrete groundwater sampling performed at boring location CTMW-07D as part of the Remedial Investigation Phase 2 Modification No. 7 (Tetra Tech, Inc., 2017). More representative groundwater samples were collected after well installation as part of the baseline groundwater monitoring event as part of the effective monitoring program (Section 4.1.6).

Table 1 Baseline Soil and Depth-Discrete Groundwater Sampling Protocol

Parameter(s)	Method	Purpose
Soil Analyses		
Hexavalent Chromium	SW7199	Estimate mass of chromium in saturated soil
Total Chromium	SW-6010B	Estimate mass of chromium in saturated soil
Perchlorate and Chlorate	E314 and E300.1B	Assess treatment of other site COPCs
Total Organic Carbon	E415	Estimate available natural organic carbon
Soil pH	SW9045	Assess geochemical conditions
Soluble Cations and Anions	See Notes 1 and 2	Assess salt loading
Total Dissolved Solids[2]	E160.1	Assess salt loading
Metals[3]	SW6020	Assess potential secondary impacts of treatment
Physical Parameters[4]	API RP40 ASTM D2216 EPA 9100	Assess geophysical properties, porosity and hydraulic conductivity of soil

Parameter(s)	Method	Purpose
Depth-Discrete Groundwater Analyses		
Hexavalent Chromium	SW7199	Assess vertical extent of chromium impacts
Total Chromium	SW-6010 or 6020	Assess vertical extent of chromium impacts
Perchlorate and Chlorate	E314	Assess vertical extent of perchlorate impacts
Chloroform	8260B	Assess potential chloroform impacts

Notes:

1 - Cations include sodium, potassium, calcium, and magnesium (Method SW6020). Anions include chloride, sulfate, nitrate (Method E300/SW9056), carbonate, and bicarbonate (Method E2320B).

2 - Analysis performed on water extract prepared per method SW9056.

3 - Metals include arsenic, iron, and manganese.

4 - Physical parameters include native-state permeability to water (hydraulic conductivity), grain density, dry bulk density, total porosity, air-filled porosity, moisture content and total pore fluid saturation (reported as water only).

4.1.3.3 Management of Investigation-Derived Wastes

Investigation-derived waste (IDW) generated during the field testing program was managed according to applicable state, federal, and local regulations and as described in *Field Guidance Document No. 001, Managing Investigation-Derived Waste* in the Field Sampling Plan, Revision 1 (ENVIRON, 2014b). IDW that was generated during the field testing program included soil cuttings, personal protective equipment, equipment decontamination water, and groundwater generated during depth-discrete groundwater sampling and well development. IDW was stored in plastic-lined roll-off bins. Solids were characterized by collecting representative samples, as necessary, to determine disposal options. Soil bins were labeled with “pending analysis” labels, the date accumulation began, contents, source, and contact information, and stored in a designated area. Waste water generated during purging or decontamination activities was temporarily stored in 500-gallon totes and transferred to the GW-11 Pond.

4.1.4 Aquifer Testing

Due to variable hydraulic conductivities reported in the vicinity of the biological reduction study area and relatively limited information available, aquifer tests (specific capacity and slug testing) were performed in the newly installed shallow and deep wells screened in the Qal and UMCf to obtain location-specific hydraulic conductivity. Although shallow wells were installed and screened within the alluvium, insufficient water was present in the shallow wells to permit slug testing. However, specific capacity tests were conducted in the shallow wells, along with the deep wells, in order to provide supplemental estimates of aquifer parameters, including hydraulic conductivity, prior to injection testing. Slug tests were also performed in the deep wells screened in the UMCf. Select wells were also tested after the completion of the biological reduction study, approximately 2 months following the last carbon substrate injection event, to assess whether the injections affected hydraulic conductivity. Results obtained from the slug and specific capacity testing are summarized in Section 5.1.5 and are provided in Appendix C, which includes software analysis reports.

The slug tests were performed in general accordance with American Society for Testing and Materials (ASTM) Standard D4044-96 (ASTM International, 2008). Prior to conducting each slug test, the water level in the well was measured manually with an electronic water level probe (Solinst Model 101 water level meter or Solinst Model 122 interface probe) to determine the static groundwater level. An electronic pressure transducer/data logger (Solinst Levelogger Gold M5 pressure transducer) was then suspended in the well, and water levels were monitored manually until static conditions were reestablished. A falling-head test was then conducted by smoothly lowering a length of weighted and sealed PVC pipe (slug) into the well, securing it in place above the transducer, and recording the rate of water level decline. Once static conditions were reestablished, a rising-head test was conducted by removing the slug and allowing the water level to again recover to static conditions while recording the rate of recovery. At the end of each test, the pressure transducer was removed from the well, and the water level displacement data was downloaded to a laptop computer. The data was interpreted using AQTESOLV (Duffield, 2014) analysis software.

Specific capacity tests were conducted on the newly installed wells by utilizing a MegaMonsoon® electronic pump set at a constant flow rate. Prior to conducting each specific capacity test, the water level in the well was measured manually with an electronic water level probe (Solinst Model 101 water level meter or Solinst Model 122 interface probe) to determine the static groundwater level. The pump was then started and water levels were monitored manually to record the rate of water level decline. The pump was then stopped and water levels were again monitored manually to record the rate of water level recovery until static conditions were reestablished. The recorded specific capacity test data was interpreted using AQTESOLV (Duffield, 2014) analysis software.

4.1.5 Injections

This section describes the three carbon substrate injection events that were conducted to promote in-situ biological reduction of hexavalent chromium. The amount of carbon substrate injected during each event was determined by taking into consideration the size and depth of the treatment area, concentrations and mass flux of hexavalent chromium and other COPCs in the treatment zone, stoichiometric demand (based on the chemical equation provided in Section 2.1), and an appropriate safety factor using the bench-scale results. For the slow-release substrate, EOS, the manufacturer suggested injecting approximately three percent of the pore volume, as indicated by the following equation:

Injection Volume of EOS = Treatment Area x Treatment Depth x Porosity x 3% x Safety Factor

Subsequent injection events were conducted based on the results of the performance monitoring results, using both contaminant and TOC concentrations as indicators of quantities and timing.

4.1.5.1 Carbon Substrate Injection Event 1

The first carbon substrate injection event was conducted between April 17 and April 21, 2017 using a custom-built injection platform mobilized to the Site. Based on the laboratory bench-scale study results and other industrial applications, the carbon substrates selected for this event included a slow-release substrate, EOS_{PRO}®, as well as soluble substrates, industrial sugar wastewater and granular sugar. Sodium sulfite was used as an oxygen scavenger to promote anaerobic conditions and Aquapure 3601® was used as an additional phosphate source.

A total of 8,459 gallons (2,849 gallons across the shallow wells and 5,610 gallons across the deep wells) of solution containing the carbon substrates and injection amendments was injected. Additionally, a total of 5,358 gallons (2,524 gallons across the shallow wells and 2,834 gallons across the deep wells) of Stabilized Lake Mead Water (SLMW), used as chase/flush water, was injected to enhance carbon substrate distribution across the injection well network. The amount of chase/flush water was estimated based on transport of the carbon substrate solution within the desired 15-foot radius of influence of the injection well network. In general, the substrate and SLMW were evenly distributed among all of the shallow and deep injection wells. For the shallow wells, sustained injection pressures generally ranged from 0 to 12 pounds per square inch gauge (psig) and average flow rates ranged from 1.2 to 3.6 gpm. For the deep wells, sustained injection pressures generally ranged from 0 to 10 psig and average flow rates ranged from 1.3 to 4.2 gpm. Injection logs for the first carbon substrate injection event are provided in Appendix D.

4.1.5.2 Carbon Substrate Injection Event 2

The second carbon substrate injection event was conducted from June 6 to June 9, 2017, using the same injection rig setup as the previous injections. The carbon substrates selected for this event were similar to the first event and included EOS PRO®, industrial sugar wastewater, granular sugar, and Aquapure 3601®. Changes to the injectate solution included the addition of ascorbic acid, urea, and sodium bicarbonate. To evaluate an alternative oxygen scavenger, ascorbic acid was used in the second injection event. Additionally, a 39% solution urea/diammonium phosphate (urea/DAP) blend was used as an alternate phosphate source and a way to introduce nitrogen. Finally, sodium bicarbonate was added as needed to the injection solution to mitigate the low pH of the industrial sugar wastewater by increasing the pH of the injection solution and minimizing the potential pH shock to the microbial populations.

A total of 8,811 gallons (2,211 gallons across the shallow wells and 6,600 gallons across the deep wells) of solution containing the carbon substrates and injection amendments was injected. Additionally, a total of 9,639 gallons (4,239 gallons across the shallow wells and 5,400 gallons across the deep wells) of SLMW used as chase/flush water was injected to enhance carbon substrate distribution across the injection well network. The amount of chase/flush water was estimated based on transport of the carbon substrate solution within the desired 15-foot radius of influence of the injection well network. In general, the substrate and SLMW were evenly distributed among all of the shallow and deep injection wells. For the shallow wells, sustained injection pressures generally ranged from 2 to 15 psig and average flow rates ranged from 2.3 to 4.7 gpm. For the deep wells, sustained injection pressures generally ranged from 3 to 6 psig and average flow rates ranged from 2.4 to 8.6 gpm. Injection logs for the second carbon substrate injection event are provided in Appendix D.

4.1.5.3 Carbon Substrate Injection Event 3

The third carbon substrate injection event was conducted from August 9 to August 11, 2017, using the same injection rig setup as the previous injections. The carbon substrates selected for this event were EOS$_{PRO}$® and molasses, to evaluate the potential use of molasses as an alternative to industrial sugar wastewater or granular sugar. Ascorbic acid was also included in the injectate solution as an oxygen scavenger to promote anaerobic conditions. A 39% solution urea/DAP blend was used as a phosphate and nitrogen source. Additionally, sodium bicarbonate was added to the injection solution to assist in buffering potential pH changes.

Based on the performance monitoring results following injection events 2 and 3, the third carbon substrate injection event primarily focused on providing carbon substrate to the deep wells with the goal of maintaining existing TOC concentrations in the shallow wells. A total of 6,450 gallons (450 gallons across the shallow wells and 6,000 gallons across the deep wells) of solution containing the carbon substrates and injection amendments was injected. Additionally, a total of 9,975 gallons (2,250 gallons across the shallow wells and 7,725 gallons across the deep wells) of SLMW used as chase/flush water was injected to enhance carbon substrate distribution across the injection well network. The amount of chase/flush water was estimated based on transport of the carbon substrate solution within the desired 15-foot radius of influence of the injection well network. In general, the substrate and SLMW were evenly distributed among all of the shallow and deep injection wells. For the shallow wells, sustained injection pressures generally ranged from 5 to 7 psig and average flow rates ranged from 2.9 to 3.6 gpm. For the deep wells, sustained injection pressures generally ranged from 7 to 16 psig and average flow rates ranged from 2.5 to 4.4 gpm. Injection logs for the third carbon substrate injection event are provided in Appendix D.

4.1.5.4 Chase/Flush Water

The quantity of SLMW water (a total of approximately 24,000 gallons) that was injected for chase/flush water over the three injection events is estimated to be less than five percent of the groundwater that flowed through the biological reduction treatment area during the 24-week monitoring period following the first injection event. Therefore, the injected chase/flush water is unlikely to have a significant impact on concentrations observed within the biological reduction treatment area. This is further supported by the fact that groundwater concentration reductions were not observed consistently across every constituent analyzed as would be expected if chase/flush water dilution was a significant factor.

4.1.6 Effectiveness Monitoring Program

After development of the wells, groundwater samples were collected from both injection and monitoring wells in the study area to establish baseline conditions prior to the injections. After injections had occurred, groundwater samples were periodically collected from downgradient monitoring wells using low-flow purging and sampling techniques. Groundwater sampling activities followed the guidance of the Field Sampling Plan, Revision 1 (Environ, 2014b). A low-flow pump was used to purge the monitoring well at a rate between approximately 400 to 500 mL per minute to minimize drawdown and induce inflow of fresh groundwater. The pump discharge water was passed through a flow-through cell field water analyzer for continuous monitoring of field parameters (temperature, pH, turbidity, electrical conductivity [EC], dissolved oxygen [DO], and oxidation reduction potential [ORP]). Field parameters were monitored and recorded on field sampling forms during purging. Purging was considered complete and the wells were sampled when the field parameter readings and water levels stabilized, or after a maximum of one hour of purging. Groundwater samples were analyzed as outlined in ***Table 2***. VOCs were added to the effectiveness monitoring program primarily to evaluate the potential effect of biological reduction on chloroform, a COPC at the Site. Field sampling logs are provided in Appendix E.

Table 2 Biological Reduction Study Effectiveness Monitoring Sampling Protocol

Analytical Requirements		Performance Monitoring Event								
Parameter	Analytical Method	BL	1	2	3	4	5	6	7	8
		Weeks Following Initial Injection Event								
		BL	2	4	6	9	13	18	22	24
Field Parameters										
EC	Field Meter	X	X	X	X	X	X	X	X	X
pH	Field Meter	X	X	X	X	X	X	X	X	X
DO	Field Meter	X	X	X	X	X	X	X	X	X
ORP	Field Meter	X	X	X	X	X	X	X	X	X
Temperature	Field Meter	X	X	X	X	X	X	X	X	X
Turbidity	Field Meter	X	X	X	X	X	X	X	X	X
Laboratory Analyses										
Hexavalent Chromium	SW7199	X	X	X	X	X	X	X	X	X
Total Chromium	SW6010B	X	X	X	X	X	X	X	X	X
Alkalinity	SM2320B	X	X	X	X	X	X	X	X	X
TOC	SM5310B	X	X	X	X	X	X	X	X	X
Nitrate	E300.0	X	X	X	X	X	X	X	X	X
Sulfate	E300.0	X	X	X	X	X	X	X	X	X
Sulfide	EPA Method 9034	X	X	X	X	X	X	X	X	X
Total Nitrogen	E351.2	X	X	X	X	X	X	X	X	X
Total Phosphorus	E365.3	X	X	X	X	X	X	X	X	X
TDS	SM2540C	X	X	X	X	X	X	X	X	X

Analytical Requirements		Performance Monitoring Event								
Parameter	Analytical Method	BL	1	2	3	4	5	6	7	8
		Weeks Following Initial Injection Event								
		BL	2	4	6	9	13	18	22	24
Field Parameters										
Ferrous Iron	HACH Method 8146	X	X	X	X	X	X	X	*	X
Hardness	SM2340C	X	X	X	X	X	X	X	X	X
Manganese	SW6010B	X	X	X	X	X	X	X	X	X
Dissolved Methane	EPA Method RSK-175	X	X	X	X	X	X	X	X	X
Dissolved Metals[1]	SW6020	X	X	X	X	X	X	X	X	X
Volatile Fatty Acids	SW8015-Modified	X	X	X	X	X	X	X	X	X
Volatile Organic Compounds	EPA Method 8260B	X	X	X	X	X	X	X	X	X
Perchlorate	E314.0	X	X	X	X	X	X	X	X	X
Chlorate/Chlorite	E300.1B	X	X	X	X	X	X	X	X	X
Chloride	E300.0	X	X	X	X	X	X	X	X	X
PLFA	Microbial Insights Bio-Trap®	X					X			
Microbial Census	Microbial Insights Bio-Trap®	X					X			

Notes:

BL - Baseline
PME - Performance Monitoring Event
EC - Electrical conductivity
DO - Dissolved Oxygen
ORP - Oxidation-reduction potential
TOC - Total organic carbon
TDS - Total dissolved solids
PLFA - Phospholipid fatty acids

*Ferrous iron was not analyzed during this event.

[1] Dissolved metals include the following: aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, silver, thallium, uranium, vanadium, and zinc.

4.2 CHEMICAL REDUCTION STUDY

The chemical reduction study area was located west of the AP-5 Pond and approximately 175 feet upgradient of the IWF (Figure 2). This area was selected for the chemical reduction study due to the distance from the biological reduction study area and the ability to take advantage of the existing AP Area Up and Down Flushing Treatability Study infrastructure. This included a row of four triple clusters of single-completion injection wells and a row of three downgradient triple-nested monitoring wells, which are part of the northern test plot, designated "Plot 1," of the AP Area Up and Down Flushing Treatability Study. It also used a near identical configuration located in the southern test plot, designated "Plot 2" (Figure 4a).

4.2.1 Chemical Study Area Geology

As described in Section 4.1.1, there are two reported paleochannels within the alluvial deposits that cross the IWF in a northerly direction (Figure 2). The nearest reported paleochannels appear to be approximately 160 feet to the east and 600 feet to the east of the chemical study area, respectively (Ramboll Environ, 2017). Qal soil types observed in the boreholes advanced in the AP Area consist mostly of silty sand with interbeds of well sorted sand, poorly sorted gravel, silty gravel, and poorly sorted sand (Figures 4b, 4c, and 4d; Appendix B). The contact between the base of the Qal and the top of the UMCf in the AP Area is encountered at depth ranging from approximately 27 feet to 34 feet bgs (Figures 4b, 4c, and 4d). The UMCf in the area consists of silt, silt with sand, and sandy silt to a depth up to 61.5 feet bgs (Appendix B), the maximum depth explored. The UMCf is also characterized by cemented white nodules that vary in size and percentages throughout the sampled interval, similar to lithologies in the Central Retention Basin. The coarse-grained paleochannel deposits were not encountered in the boreholes advanced in the AP Area; however, apparent depressions were observed in the vicinity of injection well clusters UFIW-03 and UFIW-06 where the Qal/UMCf contact was encountered at a depth up to approximately 2 feet lower than the depth observed in the adjacent wells (Figures 4c and 4d).

4.2.2 Chemical Study Area Hydrogeology

Based on data collected from boreholes advanced in the AP Area, groundwater was encountered in the Qal at depths ranging from approximately 28 feet to 34 feet bgs (Figures 4b, 4c, and 4d; Appendix B). The groundwater potentiometric surface measured at these locations following the installation of the injection, monitoring, and extraction wells ranges from approximately 26.9 feet to 28.4 feet bgs, for the shallow, intermediate and deep well screened intervals. Groundwater in shallow wells screened within the alluvium and deep wells screened within the UMCf flows generally north (Figures 6a, 6b, and 6c). The average hydraulic gradients calculated in the field study area for wells screened in the alluvium (shallow wells) and UMCf (intermediate and deep wells) were calculated to be 0.024 ft/ft, 0.033 ft/ft, and 0.023 ft/ft, respectively.

Several hydrogeologic investigations have been performed at the Site since the early 1980s to obtain aquifer data (i.e., K, T, and S) in support of groundwater remediation efforts. Aquifer tests performed include slug and baildown tests, constant rate pumping tests, step-drawdown tests, and recovery tests. Based on the results of these tests, the average hydraulic conductivity for the alluvium and UMCf was calculated to be 38.5 feet per day (ft/d) and 3.2 ft/d, respectively (Tronox, LLC, 2010).

Tetra Tech performed additional aquifer tests as part of the chemical reduction study. The groundwater flow velocity was estimated for the alluvium and UMCf in order to evaluate how quickly the proposed chemical injectate may pass through each area. Based on the estimated K values (see Section 5.2.2), hydraulic gradient values (0.0217 to 0.0236 ft/ft [shallow]; 0.0156 to 0.0192 ft/ft [intermediate]; 0.0179 to0.0357 ft/ft [deep]), and porosity values for the shallow (40.7 to 66.4%), intermediate (42.3 to 69.2%), and deep wells (60.7 to 73.8%), the estimated groundwater velocity for the shallow, intermediate, and deep intervals of the study area ranges from 0.003 ft/d to 2.6 ft/d, 0.00027 ft/d to 0.44 ft/d, and 0.00004 ft/d to 0.40 ft/d, respectively.

4.2.3 Drilling and Well Installation

The ongoing AP Area Up and Down Flushing Treatability Study is primarily focused on the implementation of technologies relevant to the removal of perchlorate from the subsurface. However, some of the data and well infrastructure associated with the AP Area Up and Down Flushing Treatability Study was also pertinent to the evaluation of in-situ chemical reduction of hexavalent chromium. Therefore, data obtained from the drilling and well installation activities associated with the AP Area Up and Down Flushing Treatability Study were used to evaluate the potential implementation of chemical reduction processes for hexavalent chromium. Furthermore, injection wells installed as part of the AP Area Up and Down Flushing Treatability Study were available to be used for chemical injections and downgradient monitoring wells were available to be used to evaluate potential influence (Figure 4a). The following sections provide a summary of the drilling and well installation program portions of the AP Area Up and Down Flushing Treatability Study also relevant to the chemical reduction study.

4.2.3.1 Installation

Wells were installed and sampled as part of the AP Area Up and Down Flushing Treatability Study following the same procedures as previously discussed in Section 4.1.3.1. Four triple-cluster completion injection wells, designated UFIW-01S/I/D through UFIW-04S/I/D, and three triple-nested groundwater monitoring wells, designated UFMW-01S/I/D through UFMW-03S/I/D, were installed for Plot 1 (Figure 4a). Four triple-cluster completion injection wells, designated UFIW-05S/I/D through UFIW-08S/I/D, and three triple-completion groundwater monitoring wells, designated UFMW-04S/I/D through UFMW-06S/I/D, were installed for Plot 2 (Figure 4a). Drilling and well installation were conducted by National Exploration, Wells and Pumps (later acquired by Cascade Drilling, LP) from July 12 to August 26, 2016, using the hollow-stem auger method. Selected soil samples were collected during drilling activities and the results will be presented as part of the ongoing AP Area Up and Down Flushing Treatability Study once complete. Soil for lithological logging purposes was collected using a CME Continuous Sample Tube System consisting of a 3-inch by 5-foot sample tube with a cutting shoe that extends below the auger cutter head. The soil borings were logged by a trained geologist or engineer in general accordance with ASTM Standard D-2488-09 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) (ASTM International, 2009). Copies of the soil boring logs are provided in Appendix B.

All the injection and monitoring wells consisted of 2-inch inner diameter Schedule 40 PVC blank casing and 0.020-inch slotted PVC screen. The shallow wells (designated “S”) were screened in the Qal 5 foot screens ending just above the Qal/UMCf contact from approximately 25 to 30 feet bgs. The intermediate wells (designated “I”) were screened near the top of the UMCf beginning 5 feet or less below the Qal/UMCf contact from approximately 35 to 40 feet bgs. The deep wells (designated “D”) were screened in the UMCf around 15 feet below the Qal/UMCf contact from approximately 45 to 50 feet bgs. UFIW-02I and UFIW-06I were installed with 10 feet screen intervals in the UMCf to evaluate the effect a larger screen interval has on injecting into the UMCf. Injection wells were installed in single completions to avoid potential short circuiting during injection activities. Well construction information is depicted on the soil boring logs provided in Appendix B. Following completion of installation activities, all wells were developed and then surveyed as previously discussed in Section 4.1.3.1.

4.2.3.2 Management of Investigation-Derived Wastes

Investigation-derived waste (IDW) generated during the field testing program was managed according to applicable state, federal, and local regulations and as described in *Field Guidance Document No. 001, Managing Investigation-Derived Waste* in the Field Sampling Plan, Revision 1 (ENVIRON, 2014b). The same procedures were followed as previously discussed in Section 4.1.3.3.

4.2.4 Aquifer Testing

Aquifer tests, including both slug and specific capacity tests, were performed in the installed wells to obtain location-specific hydraulic conductivity as described in Section 4.1.4. Slug tests were conducted in the intermediate and deep wells screened in the UMCf; however, there was insufficient water in the shallow wells screened in the alluvium to permit slug testing. Specific capacity tests were conducted in the shallow wells, along with one intermediate well, to provide supplemental estimates of aquifer parameters, including hydraulic conductivity prior to injection testing. Select wells were also tested after the injection was completed to assess whether the injections affected hydraulic conductivity. Details and results obtained from the aquifer testing are provided in Appendix C, which includes software analysis reports. The same procedures for aquifer testing described in Section 4.1.4 were followed for this testing.

4.2.5 Injections

The chemical injections completed as part of the chemical reduction study were conducted between August 7 and August 8, 2017. As with the biological reduction study, injections were performed using a custom-built injection platform. Based on the results of the laboratory bench-scale study, CPS was selected over ferrous sulfate for use in the field study. The amount of CPS injected during each event was determined by taking into consideration the size and depth of the treatment area, hexavalent chromium concentrations, stoichiometric demand (based on the chemical equation provided in Section 2.2), an appropriate safety factor based on bench-scale testing. The safety factor was used to account for calcium polysulfide reactions with other non-target compounds in the subsurface and other considerations typically associated with in-situ injections. The equations used to determine the mass of hexavalent chromium present and planned injection volume were as follows:

$$\text{Mass of } CrO_4^{2-} = [CrO_4] \times \text{Treatment Area} \times \text{Treatment Depth} \times \text{Porosity}$$

$$\text{Injection Volume of CPS} = \text{Mass of } CrO_4^{2-} \times \text{Stoichiometric Demand} \times \text{Safety Factor}$$

A total of 600 gallons of a CPS solution, comprised of 60 gallons of CPS and 540 gallons of SLMW, was generally injected evenly across the eight shallow and eight intermediate injection wells associated with Plot 1 and Plot 2 associated with the AP Area Up and Down Flushing Treatability Study (Figure 4a). Additionally, a total of 3,910 gallons of SLMW used as chase/flush water was injected to enhance subsurface distribution. For the shallow injection wells, sustained injection pressures were below 21 psig and average flow rates ranged from 4.5 to 4.6 gpm. For the intermediate injection wells, sustained injection pressures were below 15 psig and average flow rates ranged from 4.1 to 5.6 gpm. No injections were performed in the deep injection wells so they could be used to monitor the potential vertical migration of contaminants from injections into the intermediate injection wells. Injection logs for the chemical injection event are provided in Appendix D.

4.2.6 Effectiveness Monitoring Program

After development of the wells, groundwater samples were collected from both the injection and monitoring wells in the study area to establish baseline conditions prior to the injections. After injections had occurred, groundwater samples were periodically collected from downgradient monitoring wells using low-flow purging and sampling techniques. Groundwater sampling activities followed the guidance of the Field Sampling Plan, Revision 1 (Environ, 2014b). During low-flow purging of the wells, a pump was used to purge at a rate between approximately 0.1 to 0.13 gpm to minimize drawdown and induce inflow of ambient groundwater. The pump discharge water was passed through a flow-through cell field water analyzer for continuous monitoring of field parameters (temperature, pH, turbidity, EC, DO, and ORP). Field parameters were monitored and recorded on field sampling forms during purging. Purging was considered complete and the wells were sampled when the field parameter readings and water levels stabilized, or after a maximum of one hour of purging. Groundwater samples were analyzed as outlined in ***Table 3***.

Table 3 Chemical Reduction Study Performance Monitoring Sampling Protocol

Analytical Requirements		Weeks Following Injection Event		
Parameter	**Analytical Method**	**BL**	**1**	**9**
Field Parameters				
EC	Field Meter	X	X	X
pH	Field Meter	X	X	X
DO	Field Meter	X	X	X
ORP	Field Meter	X	X	X
Temperature	Field Meter	X	X	X
Turbidity	Field Meter	X	X	X
Laboratory Analyses				
Hexavalent Chromium	SW7199	X	X	X
Total Chromium	SW6010B	X	X	X
Nitrate	E300.0		X	X
Sulfide	SM2540C		X	X

Analytical Requirements		Weeks Following Injection Event		
Parameter	**Analytical Method**	**BL**	**1**	**9**
TDS	SM2540C		X	X
Manganese	SW6010B			X
Dissolved Metals[1]	SW6020			X
Perchlorate	E314.0	X	X	X
Chlorate/Chlorite	E300.1B		X	X

Notes:

BL - Baseline
EC - Electrical conductivity
DO - Dissolved Oxygen
ORP - Oxidation-reduction potential
TDS - Total dissolved solids

[1] Dissolved metals includes the following: aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, silver, thallium, uranium, vanadium, and zinc.

4.3 PERMITTING REQUIREMENTS

4.3.1 Nevada Division of Environmental Protection – Underground Injection Control Program

An NDEP Long-Term Underground Injection Control (UIC) General Permit was required for the injection of biological carbon substrates and CPS into the saturated subsurface. A long-term UIC general permit with permit number GU07RL and authorization identification number 51056 was issued by NDEP on August 16, 2016. A copy of this permit is provided in Appendix F.

4.3.2 Nevada Division of Water Resources

For the wells associated with the biological reduction study located within the Central Retention Basin, a Notice of Intent (NOI) card and associated amendments from the State of Nevada, Department of Conservation and Natural Resources, Division of Water Resources (NOI #39157) were obtained for the installation of 6 injection wells and 12 monitoring wells. For the wells associated with the AP Area Up and Down Flushing Treatability Study that were used for the chemical reduction study, NOI cards (NOI #37995 and 37996) were obtained for the installation of 24 injection wells, 18 monitoring wells, and 8 extraction wells (the extraction wells were not used as part of the chemical reduction study and are associated with other activities being conducted as part of the AP Area Up and Down Flushing Treatability Study). Copies of NOI cards are provided in Appendix F.

4.4 HEALTH AND SAFETY

All field work was conducted in accordance with an Activity Hazard Analyses and other elements of the site-wide Health and Safety Plan, which addresses potential chemical and physical hazards associated with the field studies. Modified Level D personal protective equipment was required for all field activities. Available chemical fact sheets and safety data sheets had been incorporated into the Health and Safety Plan, and were made available on-Site at all times during field activities. No health and safety incidents occurred during the implementation of the biological and chemical reduction studies.

5.0 ANALYSIS OF RESULTS

This section examines results observed within the biological and chemical reduction study areas and provides a discussion of each of the significant geochemical parameters that were sampled during the treatability study timeframe. The relationships between each of these parameters are also evaluated and described herein.

Groundwater monitoring field logs from all groundwater sampling events are provided in Appendix E. Soil and groundwater analytical results for all groundwater parameters can be found in the comprehensive data tables provided as Appendix G and a data validation report is provided in Appendix H.

5.1 BIOLOGICAL REDUCTION STUDY

This section presents the soil, groundwater, and field parameter data collected as part of the biological reduction study. The most significant parameters that are discussed as part of the biological reduction study are hexavalent chromium, TOC, nitrate, chlorate, perchlorate, chloroform, sulfate and sulfide, metals, DO, and ORP, all of which are tabulated in individual tables presented within this section. A summary and analysis of the microbial results obtained from the Bio-Trap® sampling conducted as part of the biological reduction study is provided in Section 5.1.4. Additionally, a hydrogeological evaluation based on the results of groundwater gauging and aquifer testing is provided in Section 5.1.5.

5.1.1 Soil Analytical Results

As described in Section 4.1.3.2, soil samples were collected from each of the wells installed as part of the biological reduction study and analyzed for a variety of parameters to evaluate subsurface conditions prior to performing injections. Soil analytical results for the wells are summarized in the comprehensive soil data tables provided as Appendix G. A summary of these parameters and their significance are presented below:

- Hexavalent chromium concentrations in soil up to 60 feet bgs, the maximum depth investigated, ranged from non-detect to 22,000 micrograms per kilogram (µg/kg). Within the vadose zone, hexavalent chromium concentrations in soil were below 1,000 µg/kg. Within the saturated Qal, the average hexavalent chromium concentration in soil was 2,500 µg/kg, with a maximum hexavalent chromium concentration of 8,000 µg/kg. Within the UMCf, the average hexavalent chromium concentration in soil was 9,100 µg/kg, with a maximum hexavalent chromium concentration of 22,000 µg/kg. These results indicate that hexavalent chromium impacts are present within the saturated zone and that the majority of the hexavalent chromium mass is present within the UMCf.

- Total chromium concentrations in soil up to 60 feet bgs, the maximum depth investigated, ranged from 11,000 to 81,000 µg/kg. Within the vadose zone, the average total chromium concentration in soil was 19,000 µg/kg, with a maximum total chromium concentration of 57,000 µg/kg. Within the saturated Qal, the average total chromium concentration in soil was 35,000 µg/kg, with a maximum total chromium concentration of 58,000 µg/kg. Within the UMCf, the average total chromium concentration in soil was 42,000 µg/kg, with a maximum total chromium concentration of 81,000 µg/kg. These results indicate that the total chromium concentrations in the UMCf are generally higher than in the Qal.

- Perchlorate concentrations in soil up to 60 feet bgs, the maximum depth investigated, ranged from 700 to 4,900,000 µg/kg. Within the vadose zone, the average perchlorate concentration in soil was 662,000 µg/kg, with a maximum perchlorate concentration of 3,800,000 µg/kg. Within the saturated Qal, the average perchlorate concentration in soil was 1,438,000 µg/kg, with a maximum perchlorate concentration of 4,900,000 µg/kg. Within the UMCf, the average perchlorate concentration in soil was 559,000 µg/kg, with a maximum perchlorate concentration of 1,400,000 µg/kg. These results indicate that the perchlorate concentrations in soil within the saturated Qal are generally higher than the within the UMCf.

- Chlorate concentrations in soil up to 60 feet bgs, the maximum depth investigated, ranged from non-detect to 4,000,000 µg/kg. Within the vadose zone, the average chlorate concentration in soil was approximately 8,000 µg/kg, with a maximum chlorate concentration of 26,000 µg/kg. Within the saturated Qal, the average chlorate concentration in soil was approximately 386,000 µg/kg, with a maximum chlorate concentration of 2,300,000 µg/kg. Within the UMCf, the average chlorate concentration in soil was approximately 2,210,000 µg/kg, with a maximum chlorate concentration of 4,000,000 µg/kg. These results indicate that the majority of the chlorate mass is present in the saturated zone and that the chlorate concentrations in soil within the saturated UMCf are generally higher than the within the Qal.

- Total organic carbon in the soil ranged from 1,700 to 34,000 mg/kg.

- The soil pH ranged from 7.6 to 8.7, with an average pH of 8.1. Soil alkalinity, reported as calcium carbonate, was analyzed from the water extract and ranged from 36 to 1,400 mg/L, with an average concentration of 323 mg/L. These results indicate that the soil is slightly alkaline.

- Average concentrations of soluble cations in soil, as analyzed from the water extract, were 241 mg/L for sodium, 10.6 mg/L for potassium, 24 mg/L for calcium, and 9.7 mg/L for magnesium. Average concentrations of soluble anions in soil were 146 mg/L for chloride, 176 mg/L for sulfate, and 115 mg/L for nitrate. TDS concentrations in soil, as analyzed from the water extract, ranged from 520 mg/L to 4,900 mg/L, with an average concentration of approximately 1,850 mg/L. These results, along with the perchlorate and chlorate results, indicate that the soils contain a high salt content.

- Arsenic concentrations in soil ranged from 17 to 37 mg/kg, with an average concentration of 24 mg/kg. Lead concentrations in soil ranged from 2.1 to 9.9 mg/kg, with an average concentration of 6.1 mg/kg. Additional metal concentrations are summarized in Appendix G.

Soil samples were also collected near the center of the proposed well screen interval in both the Qal and UMCf for physical parameter analysis. The average dry bulk density for the Qal soil samples was 1.37 grams per cubic centimeter (g/cc) with an average total porosity of 47.5%. The average vertical and horizontal hydraulic conductivity for the Qal soil samples was 3.21 x 10^{-4} cm/s and 4.63 x 10^{-4} cm/s, respectively. The average dry bulk density for the UMCf soil samples was 1.02 g/cc with an average total porosity of 61.2%. The average vertical and horizontal hydraulic conductivity for the UMCf soil samples was 3.5 x 10^{-6} cm/s and 6.4 x 10^{-6} cm/s, respectively. Physical parameter analytical results and laboratory reports are provided in Appendix G and Appendix I, respectively.

5.1.2 Groundwater Analytical Results

The following subsections present the groundwater analytical results for hexavalent chromium, TOC, nitrate, chlorate, perchlorate, chloroform, sulfate, sulfide, metals, and microbial data. Field parameters, consisting of DO, ORP, and pH are also discussed in detail. In addition, a subset of analytical results and field parameters, including TDS, alkalinity, chlorite, chloride, dissolved methane, total nitrogen, and volatile fatty acids (VFAs), are summarized here. For reference, monitoring wells CTMW-01 and CTMW-02 are located approximately 15 feet from the injection wells; CTMW-03, CTMW-04, and CTMW-06 are located approximately 34 feet from the injection wells; and CTMW-05 is located approximately 47 feet from the injection wells (Figure 3a).

5.1.2.1 Hexavalent Chromium

Hexavalent chromium was analyzed periodically throughout the treatability study to monitor changes in concentration from baseline values after injections in the Qal and UMCf to ascertain the effectiveness of the technology.

Shallow Wells

Groundwater results for the shallow monitoring wells screened in the Qal are summarized in ***Table 4*** and presented on Figure 7a.

Table 4 Hexavalent Chromium Groundwater Results in Shallow Wells – Biological Reduction Study

Event	Weeks Following 1st Injection	Hexavalent Chromium Concentration (mg/L)					
		CTMW-01S	CTMW-02S	CTMW-03S	CTMW-04S	CTMW-05S	CTMW-06S
Baseline	0	11	11	13	9.9	NS	NS
Carbon Substrate Injection Event #1 (4/18/17 – 4/21/17)							
PME #1	2	0.026	1.3	13	5.4	NS	NS
PME #2	4	0.00025 U	0.110	14	0.150	NS	NS
PME #3	6	0.00025 U	0.760	14	0.470	NS	NS
Carbon Substrate Injection Event #2 (6/6/17 – 6/9/17)							
PME #4	9	0.00025 U	0.00025U	4.4	0.00025 U	4.9	0.00025 U
PME #5	13	0.00025 U	0.00025U	14	0.00034 J	2.5	0.00025 U
Carbon Substrate Injection Event #3 (8/7/17 – 8/11/17)							
PME #6	18	0.0026	Dry	4.8	0.00025 U	3.4	0.00025 U
PME #7	22	0.00037 J	0.00025U	14	0.00025 U	2.3	0.00025 U
PME #8	24	0.00025 U	0.00025U	16	0.00025 U	5.9	0.00025 U

Notes:

mg/L – milligrams per liter
NS – not sampled; well was not yet installed
Dry – not sampled; well was observed to be dry
PME – Performance Monitoring Event
U – The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit indicated.
J – The result is an estimated quantity.

The baseline groundwater sampling event in April 2017 indicated that hexavalent chromium concentrations in groundwater within the Qal ranged from 9.9 to 13 mg/L within the biological reduction treatability study area.

Three performance monitoring events (PME #1 through PME #3) were performed approximately 2 weeks, 4 weeks, and 6 weeks following carbon substrate injection event #1. Hexavalent chromium concentrations in groundwater decreased at monitoring wells CTMW-01S, CTMW-02S, and CTMW-04S by approximately 99%, 93%, and 95%, respectively, when compared to the baseline concentrations. Groundwater concentrations at CTMW-03S, which is located cross-gradient of the injection wells, remained constant during this time period which may reflect the well’s location outside of the ROI for carbon substrate injection event #1.

Carbon substrate injection event #2 was performed approximately 7 weeks after carbon substrate injection event #1. Additionally, monitoring wells CTMW-05S and CTMW-6S were installed during carbon substrate injection event #2. Two performance monitoring events (PME #4 and PME #5) were performed approximately 2 weeks and 6 weeks following carbon substrate injection event #2. Hexavalent chromium concentrations in groundwater were non-detect or near non-detect at monitoring wells CTMW-01S, CTMW-02S, CTMW-04S, and CTMW-06S during this time period. Hexavalent chromium decreased by 49% in groundwater at CTMW-05S, located cross-gradient of the injection wells, between PME #4 and PME #5. Additionally, hexavalent chromium concentrations decreased in groundwater at CTMW-03S from 14 mg/L during PME #3, prior to carbon substrate injection event #2, to 4.4 mg/L during PME #4, corresponding to an increase in TOC concentrations from 2.1 mg/L to 250 mg/L (Section 5.1.2.2). By PME #5, however, the hexavalent chromium concentration in groundwater at CTMW-03S increased to its pre-carbon substrate injection event #2 concentration, with a corresponding increase in ORP, which may be due to the concentration rebounding after the consumption of carbon substrate in proximity to these monitoring wells or migration of carbon substrate downgradient of these monitoring wells.

Carbon substrate injection event #3 was performed approximately 9 weeks after carbon substrate injection event #2. Three performance monitoring events (PME #6 through PME #8) were performed approximately 2 weeks, 6 weeks, and 8 weeks following carbon substrate injection event #3. Hexavalent chromium concentrations in groundwater remained non-detect or close to non-detect at monitoring wells CTMW-01S, CTMW-02S, CTMW-04S, and CTMW-06S during this time period. Similar to after carbon substrate injection event #2, the hexavalent chromium concentration in groundwater at CTMW-03S decreased by a comparable amount and increased back to concentrations near those prior to the carbon substrate injection event #3. Hexavalent chromium concentrations in groundwater at CTMW-05S decreased from 3.4 mg/L to 2.3 mg/L between PME #6 and PME #7, but increased to 5.9 mg/L by PME #8.

In general, the groundwater in the Qal within the biological reduction study area responded favorably to biological reduction of hexavalent chromium following injection activities. Groundwater concentrations reached non-detect levels at each of the 4 downgradient monitoring wells, including the farthest downgradient monitoring well CTMW-06S. Although minimal overall hexavalent chromium changes in groundwater concentrations at monitoring wells CTMW-03S and CTMW-05Swere observed, these wells were the farthest side/cross-gradient wells in the study and likely slightly outside the injection influence necessary for sustained reduction. Hexavalent chromium concentrations in groundwater at CTMW-03S did exhibit slight fluctuations immediately following the second and third injection events, but these were temporary and correlate with intermittent fluctuations of TOC, which indicates that this well was likely on the fringe of the treatment zone. Based on the results, the treatment zone in the Qal was demonstrated to extend at least 34 feet downgradient of the injection wells. The lack of perchlorate reduction immediately following injections (Section 5.1.2.5), among other supporting factors, suggests that the chromium reductions observed in the Qal were associated with the creation of reducing conditions.

A maximum first-order degradation rate was calculated for the reduction in hexavalent chromium concentrations in groundwater at monitoring well CTMW-01S using the steepest decline of concentrations. The maximum first-order degradation rate for hexavalent chromium in the Qal was -0.37 day^{-1}.

Deep Wells

Groundwater results for deep monitoring wells screened in the UMCf are summarized in ***Table 5*** and presented on Figure 7b.

Table 5 Hexavalent Chromium Groundwater Results in Deep Wells – Biological Reduction Study

Event	**Weeks Following 1st Injection**	**Hexavalent Chromium Concentration (mg/L)**					
		CTMW-01D	**CTMW-02D**	**CTMW-03D**	**CTMW-04D**	**CTMW-05D**	**CTMW-06D**
Baseline	0	24	20	17	19	NS	NS
Carbon Substrate Injection Event #1 (4/18/17 – 4/21/17)							
PME #1	2	22	15	16	16	NS	NS
PME #2	4	21	19	16	19	NS	NS
PME #3	6	22	19	15	19	NS	NS
Carbon Substrate Injection Event #2 (6/6/17 – 6/9/17)							
PME #4	9	20 J-	16	15	19	16	15
PME #5	13	16	13	14	19	15 J-	17
Carbon Substrate Injection Event #3 (8/7/17 – 8/11/17)							
PME #6	18	13	14	14	18	15	15
PME #7	22	12	13	14	17	15	14
PME #8	24	12	15	15	18	14	12

Notes:

mg/L – milligrams per liter
NS – not sampled; well was not yet installed
PME – Performance Monitoring Event
J- –The result is an estimated quantity, but the result may be biased low.

The baseline groundwater sampling event in April 2017 indicated that hexavalent chromium concentrations in the UMCf ranged from 17 to 24 mg/L within the biological reduction study area.

Three performance monitoring events (PME #1 through PME #3) were performed approximately 2 weeks, 4 weeks, and 6 weeks following carbon substrate injection event #1. Hexavalent chromium concentrations in groundwater at CTMW-01D through CTMW-04D fluctuated slightly throughout this time period, but remained close to baseline values likely due to the reduced hydraulic conductivity and groundwater flow velocity in the UMCf compared to the Qal.

Carbon substrate injection event #2 was performed approximately 7 weeks after carbon substrate injection event #2. Additionally, monitoring wells CTMW-05D and CTMW-6D were installed during carbon substrate injection event #2. Two performance monitoring events (PME #4 and PME #5) were performed approximately 2 weeks and 6 weeks following carbon substrate injection event #2. Hexavalent chromium concentrations in groundwater decreased slightly at monitoring wells CTMW-01D and CTMW-02D, which correlated to ORP and DO decreases and a TOC increase at both wells. Hexavalent chromium concentrations decreased slightly in groundwater at CTMW-03D as well; however, no TOC concentrations were observed at CTMW-03D indicating that the observed hexavalent chromium decrease may be due to natural fluctuations. No decreases were observed at the farther downgradient wells, CTMW-04D, CTMW-05D, and CTMW-06D.

Carbon substrate injection event #3 was performed approximately 9 weeks after carbon substrate injection event #2. Three performance monitoring events (PME #6 through PME #8) were performed approximately 2 weeks, 6 weeks, and 8 weeks following carbon substrate injection event #3. By PME #7, hexavalent chromium concentrations decreased in groundwater at monitoring wells CTMW-01D, CTMW-02D, CTMW-04D, and CTMW-06D, correlated to DO concentration decreases at each well. Additionally, TOC concentrations increased in groundwater at CTMW-01D, CTMW-04D, and CTMW-06D, indicating that substrate had reached these wells. By PME #8, however, hexavalent chromium concentrations in groundwater increased at CTMW-02D, CTMW-03D, and CTMW-04D and remained unchanged in groundwater at CTMW-01D and CTMW-06D. TOC concentrations in groundwater by PME #8 were only elevated compared to baseline values in groundwater at monitoring wells CTMW-01D and CTMW-06D. The hexavalent chromium concentrations in groundwater remained either unchanged or within the range of natural fluctuations for CTMW-03D and CTMW-05D during this time period, indicating that substrate had not propogated to these wells. In additon, the geochemical conditions favorable for chromium reduction were not observed at CTMW-03D and CTMW-05D.

Although hexavalent chromium concentrations in groundwater at each UMCf well were generally less than baseline concentrations, hexavalent chromium concentrations in groundwater within the UMCf did not decrease to the same degree that hexavalent chromium concentrations decreased in groundwater within the Qal. The limiting factors to hexavalent chromium reduction in the UMCf likely included the groundwater flow velocity and hydraulic conductivity, both of which were less than the Qal. This is demonstrated by the evaluation of hexavalent chromium concentrations in groundwater at the closest downgradient monitoring well CTMW-01D, which is located approximately 10 feet downgradient of the injection well CTIW-01D. Groundwater at his well exhibited an approximate 50% reduction in hexavalent chromium concentrations, which was the most significant reduction observed in groundwater at the deep monitoring wells. The lack of perchlorate reduction immediately following injections (Section 5.1.2.5), among other supporting factors, suggests that the chromium reductions observed in the UMCf were associated with the creation of reducing conditions.

A maximum first-order degradation rate was calculated for the reduction in hexavalent chromium concentrations in groundwater at monitoring well CTMW-01D using the steepest decline of concentrations. The maximum first-order degradation rate for hexavalent chromium in the UMCf was -0.005 day^{-1}.

5.1.2.2 Total Organic Carbon

Total organic carbon (TOC) is often used as a surrogate parameter to track the carbon substrate injectate in the groundwater. As previously explained, hexavalent chromium tends to be biologically stable under aerobic conditions or when there is a limited source of organic carbon. TOC is also used as an important indicator to determine the appropriate timing for reinjection activities. As a result, TOC was analyzed throughout the treatability study to monitor changes in carbon concentrations in groundwater from baseline and after injections.

Shallow Wells

TOC results for shallow monitoring wells are summarized in ***Table 6*** and presented on Figures 7a and 8a.

Table 6 Summary of TOC Groundwater Results in Shallow Wells – Biological Reduction Study

Event	Weeks Following 1st Injection	TOC Concentration (mg/L)					
		CTMW-01S	CTMW-02S	CTMW-03S	CTMW-04S	CTMW-05S	CTMW-06S
Baseline	0	2.4	2.0	1.8	2.0	NS	NS
Carbon Substrate Injection Event #1 (4/18/17 – 4/21/17)							
PME #1	2	2,300	53	2.4	56	NS	NS

Event	Weeks Following 1st Injection	TOC Concentration (mg/L)					
		CTMW-01S	CTMW-02S	CTMW-03S	CTMW-04S	CTMW-05S	CTMW-06S
PME #2	4	3,000	14	2.5	250	NS	NS
PME #3	6	2,000	15	2.1	58	NS	NS
Carbon Substrate Injection Event #2 (6/6/17 – 6/9/17)							
PME #4	9	6,600	1,500	250	170	8.6	730
PME #5	13	9,000	2,300	5.4	320	7.1	3,100
Carbon Substrate Injection Event #3 (8/7/17 – 8/11/17)							
PME #6	18	6,700	Dry	39	1,800	11	3,200
PME #7	22	6,200	2,000	2.8	820	7.1	2,700
Carbon Substrate Injection Event #3 (8/7/17 – 8/11/17)							
PME #8	24	6,300 J-	1,900 J-	2.6	140 J-	3.5	3,000

Notes:

mg/L – milligrams per liter
NS – not sampled; well was not yet installed
Dry – not sampled; well was observed to be dry
PME – Performance Monitoring Event
J- –The result is an estimated quantity, but the result may be biased low.

The baseline groundwater sampling event in April 2017 indicated TOC concentrations in groundwater within the Qal between 1.8 and 2.4 mg/L throughout the treatability study area.

Based on the sampling data collected during PME #1 through PME #3, TOC concentrations increased by three orders of magnitude in groundwater at CTMW-01S and two orders of magnitude in groundwater at CTMW-02S and CTMW-04S. The TOC concentration increased slightly in groundwater at CTMW-03S during this time period, but based on the cross-gradient position of CTMW-03S, substrate propagation to this well was likely limited.

Based on the sampling data collected during PME #4 through PME #5, TOC concentrations in groundwater continued to increase at CTMW-01S, CTMW-02S, and CTMW-04S, indicating that substrate is propagating to these wells. In addition, the TOC concentration in groundwater at downgradient well CTMW-06S (sampled for the first time during PME #4) increased from 730 mg/L to 3,100 mg/L. The TOC concentration in groundwater at CTMW-03S increased by two orders of magnitude to 250 mg/L during PME #4, but decreased to 5.4 mg/L during PME #5, indicating that limited substrate is propagating to CTMW-03S due to its cross-gradient location. The TOC concentration of 8.6 mg/L in groundwater at CTMW-05S (sampled for the first time during PME #4) was slightly higher than the baseline sampling event, but the TOC concentration decreased to 7.1 mg/L during PME #5, indicating that the amount of substrate propagating to CTMW-05S was limited.

During events PME #6 through PME #8, TOC concentrations in groundwater at CTMW-01S and CTMW-02S increased by three orders of magnitude; TOC concentrations in groundwater at CTMW-04S increased by two orders of magnitude; and TOC concentrations in groundwater at CTMW-06S increased by one order of magnitude when compared to baseline conditions. Slight TOC concentration increases were detected in groundwater at CTMW-03S and CTMW-05S during PME #6, conducted after carbon substrate injection event #3, but TOC concentrations in groundwater declined during PME #7 and PME #8.

Deep Wells

TOC results for the deep monitoring wells are summarized in ***Table 7*** and Figures 7b and 8b.

Table 7 Summary of TOC Groundwater Results in Deep Wells – Biological Reduction Study

Event	Weeks Following 1st Injection	TOC Concentration (mg/L)					
		CTMW-01D	CTMW-02D	CTMW-03D	CTMW-04D	CTMW-05D	CTMW-06D
Baseline	0	4.1	3.7	2.7	5.7	NS	NS
Carbon Substrate Injection Event #1 (4/18/17 – 4/21/17)							
PME #1	2	8.0	12	3.0	2.9	NS	NS
PME #2	4	9.8	11	2.5	3.4	NS	NS
PME #3	6	16	6.2	2.0	3.0	NS	NS
Carbon Substrate Injection Event #2 (6/6/17 – 6/9/17)							
PME #4	9	11	90	2.2	2.6	3.5	3.5
PME #5	13	66	150	2.0	2.4	2.3	4.9
Carbon Substrate Injection Event #3 (8/7/17 – 8/11/17)							
PME #6	18	350	17	2.0	2.8	2.6	25
PME #7	22	430	8.6	1.9	3.3	2.3	85
PME #8	24	440 J-	7.8	2.8	3.7	2.3	120

Notes:

mg/L – milligrams per liter
NS – not sampled; well was not yet installed
PME – Performance Monitoring Event
J- –The result is an estimated quantity, but the result may be biased low.

The baseline groundwater sampling event in April 2017 indicated TOC concentrations in groundwater within the UMCf between 2.7 mg/L and 5.7 mg/L. No TOC concentration increases in groundwater were observed when compared to baseline during PME #1 through PME #3, indicating that substrate had not propagated to these wells during this time period. During PME #4 through PME #5, TOC increased in groundwater by an order of magnitude above baseline at CTMW-01D and CTMW-02D, the two closest wells to the injection wells. TOC concentrations generally continued to increase in groundwater at CTMW-01D and CTMW-06D during events PME #6 through PME #8, indicating that substrate was propagating to both wells. TOC concentrations decreased in groundwater at CTMW-02D and remained generally stable in groundwater at CTMW-03D, CTMW-04D, and CTMW-05D, indicating that substrate had not propagated to these wells.

Upon completion of PME #8, TOC concentrations in groundwater within the shallow wells were generally higher than TOC concentrations in groundwater within the deep wells, although TOC concentrations in groundwater at cross-gradient well clusters CTMW-03 and CTMW-05 were generally similar. The overall pattern of substrate propagation based on TOC concentrations in groundwater was similar between well clusters CTMW-01, CTMW-02, and CTMW-06, indicating that well position was a significant factor affecting substrate distribution. The highest TOC concentrations were associated with monitoring wells located in the closest proximity to injection wells

(CTMW-01S/D and CTMW-02S/D) or the downgradient monitoring well (CTMW-06S/D), indicating that substrate propagation generally followed the groundwater flow direction for the treatability study area and lateral dispersion was limited.

5.1.2.3 Nitrate

Nitrate concentrations were evaluated throughout the study since it is a competing electron acceptor and carbon substrate consumer.

Shallow Wells

Nitrate results for shallow monitoring wells are summarized in ***Table 8*** and presented on Figure 8a.

Table 8 Summary of Nitrate Groundwater Results in Shallow Wells – Biological Reduction Study

Event	Weeks Following 1st Injection	Nitrate Concentration (mg/L)					
		CTMW-01S	CTMW-02S	CTMW-03S	CTMW-04S	CTMW-05S	CTMW-06S
Baseline	0	120	160	55	150	NS	NS
Carbon Substrate Injection Event #1 (4/18/17 – 4/21/17)							
PME #1	2	210	540	27	120	NS	NS
PME #2	4	55	530	31	93	NS	NS
PME #3	6	2.6	320	38	51	NS	NS
Carbon Substrate Injection Event #2 (6/6/17 – 6/9/17)							
PME #4	9	9.5	1.1 U	34	18	60	1.1 U
PME #5	13	0.55 U	0.63 J	30	1.1 U	24	1.2 J
Carbon Substrate Injection Event #3 (8/7/17 – 8/11/17)							
PME #6	18	4.8 J	Dry	17	1.1 U	32	1.1 U
PME #7	22	1.1 U	0.28 U	26	1.1 U	14	1.1 U
PME #8	24	0.55 U	1.1 U	26	5.3 J	28	2.8 U

Notes:

mg/L – milligrams per liter
U – The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit indicated.
NS – not sampled; well was not yet installed
Dry – not sampled; well was observed to be dry
PME – Performance Monitoring Event
J – The result is an estimated quantity.

The baseline groundwater sampling event in April 2017 indicated nitrate concentrations (reported as nitrate-nitrogen) in groundwater ranging from 55 to 160 mg/L at the shallow wells within the treatability study area.

Based on sampling data collected during PME #1 through PME #3, a general decrease in nitrate concentrations in groundwater was observed at monitoring wells CTMW-01S, CTMW-03S, and CTMW-04S by approximately 98%, 31%, and 66%, respectively, during this time period when compared to baseline concentrations. The nitrate concentration in groundwater at CTMW-02S tripled by PME #2 and then slightly decreased by PME #3 when compared to baseline concentrations, but this increase may be the result of natural fluctuation.

Based on sampling data collected during PME #4 through PME #5, nitrate concentrations in groundwater continued to exhibit an overall decreasing trend when compared to baseline concentrations at CTMW-01S, CTMW-02S, CTMW-03S, CTMW-04S, and CTMW-05S. The greatest nitrate concentration decrease was observed in groundwater at CTMW-02S, which decreased by approximately 99% when compared to the PME #3 concentration. Nitrate concentrations achieved non-detect levels in groundwater at four wells during these events.

Based on sampling data collected during PME #6 through PME #8, slight fluctuations in nitrate concentrations in groundwater were observed at each monitoring well. Nitrate concentrations in groundwater detected during these events, however, were consistently less than baseline concentrations, indicating that denitrification was occurring in the biological reduction study area. The nitrate concentration in groundwater at CTMW-06S was the exception, as the nitrate concentration detected during PME #8 was slightly higher than the baseline concentration (non-detect; collected during PME #4).

Nitrate concentrations detected in groundwater at CTMW-06S generally remained very low or non-detect from PME #4 through PME #8. Nitrate concentrations in groundwater at CTMW-03S and CTMW-05S decreased when compared to baseline, but nitrate concentrations in groundwater at CTMW-03S and CTMW-05S were an order of magnitude higher than CTMW-01S, CTMW-02S, CTMW-04S, and CTMW-06S at the completion of performance monitoring. The magnitude of the nitrate concentration decreases in groundwater at CTMW-03S and CTMW-05S is likely related to the side-gradient position of both wells that would almost certainly result in a reduced amount of substrate that would propagate to these wells, which is evidenced by low TOC concentrations.

Deep Wells

Nitrate results for the deep monitoring wells are summarized in ***Table 9*** and presented on Figure 8b.

Table 9 Summary of Nitrate Groundwater Results in Deep Wells – Biological Reduction Study

Event	Weeks Following 1st Injection	Nitrate Concentration (mg/L)					
		CTMW-01D	CTMW-02D	CTMW-03D	CTMW-04D	CTMW-05D	CTMW-06D
Baseline	0	20	34	47	26	NS	NS
Carbon Substrate Injection Event #1 (4/18/17 – 4/21/17)							
PME #1	2	21	30	48	33	NS	NS
PME #2	4	22	26	41	32	NS	NS
PME #3	6	20	25	34	31	NS	NS
Carbon Substrate Injection Event #2 (6/6/17 – 6/9/17)							
PME #4	9	17	22	33	33	73	97
PME #5	13	14	5.8	27	34	64 J+	84
Carbon Substrate Injection Event #3 (8/7/17 – 8/11/17)							
PME #6	18	9.9	18	23	36	52	52
PME #7	22	12	14	23	36	52	48
PME #8	24	11	17	24	38	48	41

Notes:

mg/L – milligrams per liter
NS – not sampled; well was not yet installed
PME – Performance Monitoring Event
J+ – The result is an estimated quantity, but the result may be biased high.

The baseline groundwater sampling event in April 2017 indicated nitrate concentrations (reported as nitrate-nitrogen) ranged from 20 mg/L to 47 mg/L in groundwater adjacent to the deep wells within the treatability study area.

Based on sampling data collected during PME #1 through PME #3, nitrate concentrations were generally stable in groundwater at CTMW-01D, decreased in groundwater at CTMW-02D and CTMW-03D, and slightly increased in groundwater at CTMW-04D. A correlation between decreasing nitrate concentrations and decreasing chlorate concentrations in groundwater was observed in CTMW-02D from PME #1 to PME #3, but perchlorate concentrations did not exhibit the same correlation.

Based on the sampling data collected during PME #4 through PME #5 (following the second injection event), nitrate concentrations decreased in groundwater at CTMW-01D, CTMW-02D, CTMW-03D, CTMW-05D, and CTMW-06D. The greatest nitrate concentration decrease in groundwater was observed at CTMW-02D, which decreased by approximately 77% when compared to its PME #3 concentration. Nitrate concentration decreases in groundwater at CTMW-01D and CTMW-02D correlated to increases in TOC at both wells observed during this time period.

Although slight fluctuations in nitrate concentrations were observed in groundwater at CTMW-01D, CTMW-02D, CTMW-03D, CTMW-05D, and CTMW-06D during PME #6 through PME #8, overall, nitrate concentrations in groundwater at each of these five wells during PME #8 were significantly less than the corresponding baseline concentration. Groundwater collected from CTMW-04D continued to exhibit a slightly increasing trend in nitrate concentrations during this time period, indicating that appreciable rates of denitrification were not occurring at this well.

Overall, nitrate concentrations in groundwater at several of the downgradient monitoring wells showed a marked decrease compared to baseline concentrations. Nitrate concentrations in groundwater at the closest downgradient monitoring wells, CTMW-01D, CTMW-02D, and CTMW-03D decreased by 45%, 50%, and 49%, respectively. Nitrate concentrations in groundwater at the downgradient wells CTMW-05D and CTMW-06D decreased by 34% and 58%, respectively.

5.1.2.4 Chlorate

Generally, chlorate biodegradation precedes perchlorate biodegradation, although the two processes can also occur simultaneously, particularly in the presence of organic carbon. As a result, chlorate was monitored to assess potential secondary impacts of treatment.

Shallow Wells

Chlorate results for shallow monitoring wells are summarized in ***Table 10*** and presented on Figure 8a.

Table 10 Summary of Chlorate Groundwater Results in Shallow Wells – Biological Reduction Study

Event	Weeks Following 1st Injection	Chlorate Concentration (mg/L)					
		CTMW-01S	CTMW-02S	CTMW-03S	CTMW-04S	CTMW-05S	CTMW-06S
Baseline	0	2,500	2,500	2,900	2,500	NS	NS
Carbon Substrate Injection Event #1 (4/18/17 – 4/21/17)							
PME #1	2	870	860	3,200	1,800	NS	NS
PME #2	4	730	550	3,200	910	NS	NS
PME #3	6	650	750	4,000	1,100	NS	NS

Event	Weeks Following 1st Injection	Chlorate Concentration (mg/L)					
		CTMW-01S	CTMW-02S	CTMW-03S	CTMW-04S	CTMW-05S	CTMW-06S
Carbon Substrate Injection Event #2 (6/6/17 – 6/9/17)							
PME #4	9	64	0.50 U	1,600	290	2,100	20
PME #5	13	72	0.50 U	3,100	20	1,700	19
Carbon Substrate Injection Event #3 (8/7/17 – 8/11/17)							
PME #6	18	13	Dry	1,600	16	2,000	0.29
PME #7	22	1.0 U	1.0 U	3,400	5.1	1,900	0.50 U
PME #8	24	0.61	0.50 U	3,400	320	2,700	1.0 U

Notes:

mg/L – milligrams per liter
NS – not sampled; well was not yet installed
Dry – not sampled; well was observed to be dry
PME – Performance Monitoring Event
U – The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit indicated.

The baseline groundwater sampling event in April 2017 indicated that chlorate concentrations in groundwater within the Qal ranged from 2,500 mg/L to 2,900 mg/L within the treatability study area. Based on sampling data collected during PME #1 through PME #3, chlorate concentrations in groundwater at CTMW-01S, CTMW-02S, and CTMW-04S dropped by approximately 74%, 70%, and 56%, respectively, during this time period. Chlorate concentrations in groundwater either remained low or continued to decrease in these wells during PME #4 and PME #5, while also observing decreases in CTMW-05S and CTMW-06S during this time period. The chlorate concentration in groundwater at CTMW-03S decreased during PME #4, but rebounded during PME #5 to a concentration above baseline.

Chlorate concentrations during events PME #6 through PME #8 decreased to the lowest concentrations observed during the study, with non-detect results at two of the wells and overall decreases in groundwater as much as 99% when compared to baseline. Although fluctuations occurred in some wells, chlorate concentrations remained below baseline concentrations in groundwater at all wells except CTMW-05S and CTMW-03S (which are believed to be at fringe of the area impacted by in-situ treatment).

A maximum first-order degradation rate was calculated for the reduction in chlorate concentrations in groundwater at monitoring well CTMW-02S using the steepest decline of concentrations. The maximum first-order degradation rate for chlorate in the Qal was -0.10 day^{-1}.

Deep Wells

Chlorate results for the deep monitoring wells are summarized in ***Table 11*** and presented on Figure 8b.

Table 11 Summary of Chlorate Groundwater Results in Deep Wells – Biological Reduction Study

Event	Weeks Following 1st Injection	Chlorate Concentration (mg/L)					
		CTMW-01D	CTMW-02D	CTMW-03D	CTMW-04D	CTMW-05D	CTMW-06D
Baseline	0	4,900	4,800	3,700	4,300	NS	NS
Carbon Substrate Injection Event #1 (4/18/17 – 4/21/17)							
PME #1	2	4,900	4,200	3,500	4,200	NS	NS

Event	Weeks Following 1st Injection	Chlorate Concentration (mg/L)					
		CTMW-01D	CTMW-02D	CTMW-03D	CTMW-04D	CTMW-05D	CTMW-06D
PME #2	4	4,500	4,000	3,400	4,000	NS	NS
PME #3	6	4,800	3,300	3,500	4,700	NS	NS
Carbon Substrate Injection Event #2 (6/6/17 – 6/9/17)							
PME #4	9	4,300	2,000	3,400	3,700	3,400	4,000
PME #5	13	4,100	4,400	3,400	4,600	3,400	3,900
Carbon Substrate Injection Event #3 (8/7/17 – 8/11/17)							
PME #6	18	3,700	3,500	3,200	4,100	3,500	3,700
PME #7	22	3,800	3,700	3,400	3,500	3,300	2,700
PME #8	24	3,500	3,600	3,500	3,900	3,400	3,100

Notes:

mg/L – milligrams per liter
NS – not sampled; well was not yet installed
PME – Performance Monitoring Event

The baseline groundwater sampling event in April 2017 indicated that chlorate concentrations in groundwater within the UMCf ranged from 3,700 mg/L to 4,900 mg/L within the treatability study area. Based on sampling data collected during PME #1 through PME #3, chlorate concentrations in groundwater decreased in CTMW-02D when compared to baseline, while chlorate concentrations fluctuated in remaining wells. In remaining events throughout the study, chlorate concentrations generally did not exhibit a significant decrease in the groundwater within the UMCf, with the exception of groundwater adjacent to CTMW-01D where concentrations decreased from 4,900 mg/L in baseline to 3,500 mg/L in PME #8 (29% reduction). Remaining changes to chlorate concentration were likely a result of natural fluctuation. Based on observed TOC concentrations (Section 5.1.2.2), the volume of substrate in each well was likely a limiting factor to chlorate reduction in in groundwater at each well.

A maximum first-order degradation rate was calculated for the reduction in chlorate in groundwater at monitoring well CTMW-01D using the steepest decline of concentrations. The maximum first-order degradation rate for chlorate in the UMCf was -0.002 day^{-1}.

5.1.2.5 Perchlorate

Perchlorate was analyzed periodically throughout the treatability study to monitor changes in concentration from baseline values after injections in the shallow (Qal) and deep (UMCf) wells to ascertain perchlorate degradation as a potential beneficial byproduct of the technology.

Shallow Wells

Groundwater results for shallow monitoring wells are summarized in ***Table 12*** and presented on Figure 8a.

Table 12 Perchlorate Groundwater Results in Shallow Wells – Biological Reduction Study

Event	Weeks Following 1st Injection	Perchlorate Concentration (mg/L)					
		CTMW-01S	CTMW-02S	CTMW-03S	CTMW-04S	CTMW-05S	CTMW-06S
Baseline	0	410	410	470	420	NS	NS

Event	Weeks Following 1st Injection	Perchlorate Concentration (mg/L)					
		CTMW-01S	CTMW-02S	CTMW-03S	CTMW-04S	CTMW-05S	CTMW-06S
Carbon Substrate Injection Event #1 (4/18/17 – 4/21/17)							
PME #1	2	340	460	460	420	NS	NS
PME #2	4	280	380	510	570	NS	NS
PME #3	6	140	440	610	650	NS	NS
Carbon Substrate Injection Event #2 (6/6/17 – 6/9/17)							
PME #4	9	39	110	670	560	560	460
PME #5	13	4	26	540	180	570	18 J-
Carbon Substrate Injection Event #3 (8/7/17 – 8/11/17)							
PME #6	18	32	Dry	600	140	610	13
PME #7	22	0.32	13	540	510	570	0.010 U
PME #8	24	0.15 J+	0.29	560	120	570	0.025 U

Notes:

mg/L – milligrams per liter
NS – not sampled; well was not yet installed
Dry – not sampled; well was observed to be dry
PME – Performance Monitoring Event
J- –The result is an estimated quantity, but the result may be biased low.
U – The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit indicated.
J+ – The result is an estimated quantity, but the result may be biased high.

The baseline groundwater sampling event in April 2017 indicated that perchlorate concentrations in groundwater within the Qal ranged from 410 to 470 mg/L within the treatability study area.

Three performance monitoring events (PME #1 through PME #3) were performed approximately 2 weeks, 4 weeks, and 6 weeks following carbon substrate injection event #1. By PME #3, the perchlorate concentration decreased in groundwater at monitoring well CTMW-01S by approximately 66%. The perchlorate concentration in groundwater at CTMW-02S decreased slightly by the time of PME #2, following decreases in chlorate, nitrate, and ORP, indicating that geochemical conditions favorable to perchlorate degradation were beginning to be established. However, perchlorate concentrations in groundwater increased at CTMW-02S by PME #3, which generally correlated to increases in chlorate and nitrate concentrations as well as ORP. Perchlorate concentrations in groundwater at CTMW-03S and CTMW-04S generally increased during this time period with generally correlated increases in chlorate, nitrate, and ORP. The perchlorate concentration increases in groundwater at CTMW-02S, CTMW-03S, and CTMW-04S may be due to concentrations rebounding after the consumption of carbon substrate in the proximity of these monitoring wells or migration of carbon substrate downgradient of these monitoring wells.

Carbon substrate injection event #2 was performed approximately 7 weeks after carbon substrate injection event #1. Additionally, monitoring wells CTMW-05S and CTMW-6S were installed during carbon substrate injection event #2. Two performance monitoring events (PME #4 and PME #5) were performed approximately 2 weeks and 6 weeks following carbon substrate injection event #2. During this time period, perchlorate concentrations in groundwater decreased at all shallow monitoring wells, with the exception of CTMW-05S, and generally correlated to decreases in chlorate and nitrate concentrations as well as ORP, which were indicative of geochemical conditions favorable for perchlorate reduction. Perchlorate concentrations in groundwater at monitoring wells CTMW-01S, CTMW-02S, CTMW-04S, and CTMW-06S decreased by 90%, 76%, 67%, and

96%, respectively. The perchlorate concentration in groundwater at CTMW-05S increased, but chlorate and nitrate concentrations in groundwater decreased during this time period, indicating that reducing conditions were not sustained for a sufficient time period for perchlorate reduction to occur.

Carbon substrate injection event #3 was performed approximately 9 weeks after carbon substrate injection event #2. Three performance monitoring events (PME #6 through PME #8) were performed approximately 2 weeks, 6 weeks, and 8 weeks following carbon substrate injection event #3. By the time of PME #8, perchlorate concentrations in groundwater decreased at monitoring wells CTMW-01S, CTMW-02S, CTMW-04S, and CTMW-06S when compared to concentrations prior to carbon substrate injection event #3. A direct correlation between decreasing nitrate and chlorate concentrations and decreasing perchlorate concentrations in groundwater at these wells was not exhibited during this time period, but ORP measurements indicated that geochemical conditions were favorable for perchlorate reduction at each well. Perchlorate concentrations increased slightly in groundwater at CTMW-03S and CTMW-05S immediately following carbon substrate injection event #3, but decreased to concentrations generally consistent with those prior to carbon substrate injection event #3 by the time of PME #8.

A maximum first-order degradation rate was calculated for the reduction in perchlorate concentrations in groundwater at monitoring well CTMW-01S using the steepest decline of concentrations. The maximum first-order degradation rate for perchlorate in the Qal was -0.05 day^{-1}.

Deep Wells

Groundwater results for deep monitoring wells are summarized in ***Table 13*** and presented on Figure 8b.

Table 13 Perchlorate Groundwater Results in Deep Wells – Biological Reduction Study

Event	Weeks Following 1st Injection	Perchlorate Concentration (mg/L)					
		CTMW-01D	CTMW-02D	CTMW-03D	CTMW-04D	CTMW-05D	CTMW-06D
Baseline	0	1,400	960	530	980	NS	NS
Carbon Substrate Injection Event #1 (4/18/17 – 4/21/17)							
PME #1	2	1,400	1,100 J	490	950	NS	NS
PME #2	4	1,400	1,100	520	870	NS	NS
PME #3	6	1,300	1,300	570	890	NS	NS
Carbon Substrate Injection Event #2 (6/6/17 – 6/9/17)							
PME #4	9	1,400	1,100	520	990	660	1,000
PME #5	13	1,400	950	580	950	510	920
Carbon Substrate Injection Event #3 (8/7/17 – 8/11/17)							
PME #6	18	1,400	1,200	610	780	550	950
PME #7	22	1,500	2,500	540	820	550	800
PME #8	24	1,300	1,200	540	740	650	970

Notes:

mg/L – milligrams per liter
NS – not sampled; well was not yet installed
PME – Performance Monitoring Event
J – The result is an estimated quantity.

The baseline groundwater sampling event in April 2017 indicated that perchlorate concentrations in groundwater within the UMCf ranged from 530 mg/L to 1,400 mg/L within the treatability study area. Perchlorate concentrations fluctuated throughout treatability study; however, no significant reduction was observed during the 6 month monitoring period. Perchlorate is expected to biodegrade after hexavalent chromium, nitrate, and chlorate. As discussed previously, hexavalent chromium, nitrate, and chlorate were just starting to degrade in the closest downgradient monitoring wells by the end of PME #8.

5.1.2.6 Chloroform

As discussed in Section 2.1, chloroform is also amendable to in-situ biological reduction and is expected to be reduced following the reduction of nitrate (Bouwer & McCarty, 1983). However, additional testing is warranted to determine the exact sequence due to presence of high TDS concentrations at the Site.

Shallow Wells

Chloroform results from PME for shallow monitoring wells are summarized in ***Table 14***.

Table 14 Chloroform Groundwater Results in Shallow Wells – Biological Reduction Study

Event	Weeks Following 1st Injection	Chloroform Concentration (mg/L)					
		CTMW-01S	CTMW-02S	CTMW-03S	CTMW-04S	CTMW-05S	CTMW-06S
Baseline	0	0.85	0.95	0.93	0.72	NS	NS
Carbon Substrate Injection Event #1 (4/18/17 – 4/21/17)							
PME #1	2	0.42	0.62	1.1	0.81	NS	NS
PME #2	4	0.34	0.42	0.97	0.64	NS	NS
PME #3	6	0.23	0.52	1.2	0.61	NS	NS
Carbon Substrate Injection Event #2 (6/6/17 – 6/9/17)							
PME #4	9	0.14	0.21	0.92	0.59	0.96	0.67
PME #5	13	0.13	0.18	1.3	0.62	1.1	0.61
Carbon Substrate Injection Event #3 (8/7/17 – 8/11/17)							
PME #6	18	0.086	Dry	0.90	0.52	0.75	0.32
PME #7	22	0.019 J	0.078	0.51	0.067	0.41	0.17 J-
PME #8	24	0.025 R	0.013 J-	0.70	0.048	0.63	0.12 J-

Notes:

mg/L – milligrams per liter
NS – not sampled; well was not yet installed
Dry – not sampled; well was observed to be dry
PME – Performance Monitoring Event
J- – The result is an estimated quantity, but the result may be biased low.
R – The data are unusable. The sample results are rejected due to serious deficiencies in meeting QC criteria. The analyte may or may not be present in the sample.

The baseline groundwater sampling event performed in April 2017 indicated the chloroform concentrations in groundwater within the Qal ranged from 0.72 mg/L to 0.95 mg/L within the treatability study area.

Based on sampling data collected during PME #1 through PME #3, chloroform concentrations in groundwater decreased by approximately 45%, 16%, and 25% at downgradient wells CTMW-01S, CTMW-02S, and CTMW-04S when compared to baseline.

Chloroform concentrations continued to decrease in groundwater at CTMW-01S and CTMW-02S, the two closest downgradient wells to the injection wells, during the subsequent events PME #4 and PME #5. The chloroform concentration in groundwater at CTMW-06S decreased slightly from PME #4 to PME #5, but the decrease was not outside of the range of natural fluctuation.

Data collected during PME #6 through PME #8 indicated a reduction in chloroform concentrations between approximately 82% and 99% when compared to baseline in groundwater at downgradient shallow wells CTMW-01S, CTMW-02S, CTMW-04S, and CTMW-06S. Chloroform concentrations in groundwater at cross-gradient shallow wells (CTMW-03S and CTMW-05S) decreased by approximately 25% and 34% when compared to baseline.

A maximum first-order degradation rate was calculated for the reduction in chloroform concentrations in groundwater at monitoring well CTMW-01S using the steepest decline of concentrations. The maximum first-order degradation rate for chloroform in the Qal was -0.02 day^{-1}.

Deep Wells

Chloroform results from PME for deep monitoring wells are summarized in ***Table 15***.

Table 15 Chloroform Groundwater Results in Deep Wells – Biological Reduction Study

Event	Weeks Following 1st Injection	Chloroform Concentration (mg/L)					
		CTMW-01D	CTMW-02D	CTMW-03D	CTMW-04D	CTMW-05D	CTMW-06D
Baseline	0	1.8	1.5	0.88	1.6	NS	NS
Carbon Substrate Injection Event #1 (4/18/17 – 4/21/17)							
PME #1	2	1.7	1.5	1.3	1.4	NS	NS
PME #2	4	1.7	1.3	1.1	1.6	NS	NS
PME #3	6	1.8	1.9	1.4	1.6	NS	NS
Carbon Substrate Injection Event #2 (6/6/17 – 6/9/17)							
PME #4	9	1.6	1.5	1.2	1.6	1.3	1.5
PME #5	13	1.7	1.6	1.3	1.7	1.3	1.7
Carbon Substrate Injection Event #3 (8/7/17 – 8/11/17)							
PME #6	18	1.5	1.4	1.1	1.7	1.2	1.4
PME #7	22	1.5	1.5	1.1	1.4	0.63	1.2
PME #8	24	1.3	1.5	1.0	1.3	1.0	1.2

Notes:

mg/L – milligrams per liter
NS – not sampled; well was not yet installed
PME – Performance Monitoring Event

The baseline groundwater sampling event performed in April 2017 indicated that chloroform concentrations in groundwater within the UMCf ranged from 0.88 mg/L to 1.8 mg/L within the treatability study area. Based on sampling data collected, the reduction in chloroform was not as significant as in groundwater in the shallow wells. Chloroform concentrations decreased in groundwater between approximately 19% and 28%at deep downgradient wells CTMW-01D, CTMW-04D, and CTMW-06D and by approximately 23% at deep cross-gradient well CTMW-05D, but the minor reduction in concentrations may be due to natural fluctuations.

A maximum first-order degradation rate was calculated for the reduction in chloroform concentrations in groundwater at monitoring well CTMW-01D using the steepest decline of concentrations. The maximum first-order degradation rate for chloroform in the UMCf was -0.002 day^{-1}.

5.1.2.7 Sulfate and Sulfide

Groundwater within the treatability study area has high native sulfate concentrations. Generally, sulfate reduction occurs only under very reducing conditions and after hexavalent chromium, nitrate, perchlorate, and chlorate reduction has occurred. Sulfide is a product of sulfate reduction and measurements of sulfide concentrations in groundwater can be used in conjunction with pH and ORP changes and changes in ferrous iron concentrations to understand if sulfate reduction is occurring.

Shallow Wells

Sulfate results for the shallow monitoring wells are summarized in ***Table 16***. Sulfide concentrations are provided in Appendix G.

Table 16 Summary of Sulfate Groundwater Results in Shallow Wells – Biological Reduction Study

Event	Weeks Following 1st Injection	Sulfate Concentration (mg/L)					
		CTMW-01S	CTMW-02S	CTMW-03S	CTMW-04S	CTMW-05S	CTMW-06S
Baseline	0	1,400	1,500	1,500	1,500	NS	NS
Carbon Substrate Injection Event #1 (4/18/17 – 4/21/17)							
PME #1	2	1,400	1,500	1,600	1,500	NS	NS
PME #2	4	1,200	1,400	1,500	1,400	NS	NS
PME #3	6	1,100	1,500	1,500	1,400	NS	NS
Carbon Substrate Injection Event #2 (6/6/17 – 6/9/17)							
PME #4	9	740	890	1,600	1,500	1,400	950
PME #5	13	140	29	1,600	1,100	1,400	230
Carbon Substrate Injection Event #3 (8/7/17 – 8/11/17)							
PME #6	18	1,000	Dry	1,400	190	1,400	14
PME #7	22	130 U	17	1,500	390 J+	1,300	5.0
PME #8	24	76	6.5 J	1,500	920	1,400	13 U

Notes:

mg/L – milligrams per liter
NS – not sampled; well was not yet installed
Dry – not sampled; well was observed to be dry
PME – Performance Monitoring Event
U – The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit indicated.
J+ – The result is an estimated quantity, but the result may be biased high.
J – The result is an estimated quantity.

The baseline groundwater sampling event in April 2017 indicated sulfate concentrations in groundwater within the Qal between 1,400 mg/L and 1,500 mg/L. Sulfate concentrations in groundwater only decreased slightly at CTMW-01S when compared to baseline during PME #1 through PME #3. Data collected during the subsequent PME #4 and PME #5 continued to show sulfate decreases in groundwater at CTMW-01S. Decreases were also observed in groundwater at CTMW-02S, CTMW-04S, and CTMW-06S, corresponding to the establishment of geochemical conditions favorable for perchlorate reduction during this time period. During the final sampling events (PME #6 through PME #8), sulfate concentrations continued to decrease in groundwater at CTMW-01S, CTMW-02S, and CTMW-06S. Sulfide concentrations (Appendix G) remained relatively low in groundwater within the Qal during the treatability study, with the exception of groundwater at CTMW-01S, where concentrations increased to 3.9 mg/L during PME #3 and at CTMW-06S, where concentrations increased to 7.3 mg/L during PME #5. The decrease in sulfate concentrations in groundwater indicate sulfate reduction was occurring and highly reducing conditions were present in the treatment zone.

Deep Wells

Sulfate results for the deep monitoring wells are summarized in ***Table 17***. Sulfide concentrations are provided in Appendix G.

Table 17 Summary of Sulfate Groundwater Results in Deep Wells – Biological Reduction Study

Event	Weeks Following 1st Injection	Sulfate Concentration (mg/L)					
		CTMW-01D	CTMW-02D	CTMW-03D	CTMW-04D	CTMW-05D	CTMW-06D
Baseline	0	1,900	1,700	1,600	1,700	NS	NS
Carbon Substrate Injection Event #1 (4/18/17 – 4/21/17)							
PME #1	2	1,800	1,700	1,600	1,700	NS	NS
PME #2	4	1,700	1,500	1,500	1,500	NS	NS
PME #3	6	1,600	1,600	1,500	1,600	NS	NS
Carbon Substrate Injection Event #2 (6/6/17 – 6/9/17)							
PME #4	9	1,700	1,600	1,600	1,700	1,400	1,500
PME #5	13	1,700	1,300	1,500	2,200	1,500	1,500
Carbon Substrate Injection Event #3 (8/7/17 – 8/11/17)							
PME #6	18	1,700	1,600	1,500	1,600	1,500	1,400
PME #7	22	1,600	1,400	1,500	1,600	1,500	1,500
PME #8	24	1,600	1,500	1,500	1,500	1,500	1,400

Notes:

mg/L – milligrams per liter
NS – not sampled; well was not yet installed
PME – Performance Monitoring Event

The baseline groundwater sampling event in April 2017 indicated sulfate concentrations in groundwater within the UMCf were between 1,600 and 1,900 mg/L. Based on the sampling data collected during PME #1 through PME #8, sulfate concentrations decreased slightly in groundwater at all of the monitoring wells when compared to baseline or initial sampling conditions, but was likely consistent with natural fluctuation in concentrations. Sulfide was rarely detected in groundwater within the UMCf at a concentration above the laboratory reporting, which correlates with the data indicating that sulfate was not reduced in the UMCf during the study.

5.1.2.8 Metals

As presented in Table 2, a suite of dissolved metals were sampled in groundwater as part of the baseline and performance monitoring events during the treatability study. Total chromium and total manganese (unfiltered) concentrations were also sampled as part of the baseline and performance monitoring events for groundwater, and total iron concentrations were sampled as part of performance monitoring events PME #3 through PME #8. Field measurements for ferrous iron were also collected as part of baseline and performance monitoring events. A focused evaluation of concentration changes of three redox sensitive metals (arsenic, iron, and manganese) is discussed here for the Qal and UMCf. Results of each parameter analyzed are presented in the comprehensive data tables provided in Appendix G.

Arsenic is sometimes released from minerals in the saturated subsurface when reducing conditions are created following the injection of a carbon substrate. The potential release of arsenic and its increase in concentration over time, therefore, were important to the treatability study. The baseline groundwater sampling event conducted in April 2017 indicated that dissolved arsenic concentrations in groundwater within the Qal ranged from 0.065 mg/L to 0.12 mg/L in the treatability study area. Arsenic concentrations in the shallow monitoring wells fluctuated in response to modified geochemical conditions in the aquifer during performance monitoring. At the end of performance monitoring, increases in arsenic concentrations in groundwater that have the potential to be outside of natural fluctuation were observed at CTMW-01S, CTMW-02S, CTMW-04S, and CTMW-05S when compared to baseline concentrations, with the highest groundwater concentration of 0.91 mg/L at CTMW-01S.

The baseline groundwater sampling event conducted in April 2017 indicated that arsenic concentrations in groundwater within the deep monitoring wells ranged from non-detect to 0.100 mg/L in the treatability study area. Arsenic concentrations in deep monitoring wells fluctuated in response to geochemical conditions in the aquifer during performance monitoring. At the end of performance monitoring, increases in arsenic concentrations that have the potential to be outside of natural fluctuation were observed in groundwater at CTMW-02D, CTMW-04D, CTMW-05D, and CTMW-06D when compared to baseline concentrations, with the highest concentration of 0.130 mg/L in groundwater at CTMW-05D.

Generally, increases in arsenic concentrations in groundwater tend to be localized within the area and influence of carbon substrate injection. Once original groundwater conditions return within the reducing area, or when groundwater from the reducing area flows downgradient into areas with no impact, arsenic concentrations tend to return to previous concentrations (The Interstate Technology & Regulatory Council, 2008). Also, when TOC concentrations in the injection area decline, arsenic concentrations in groundwater are expected to decline and minimal arsenic will be released from sediments (Borden, et al., 2015). Therefore, at downgradient locations, where TOC concentrations in groundwater are much lower than at the injection well vicinity, there is much less potential for arsenic release. Furthermore, the presence of sulfate and biogenic sulfide generation under reducing conditions also tend to precipitate and immobilize arsenic over time as metal sulfides (Borden, et al., 2015). Because the area of the biological reduction study is at a considerable distance upgradient of a receiving body of water, it is quite unlikely that temporal increases in arsenic in groundwater in this immediate vicinity will impact arsenic concentrations farther downgradient at critical locations. Supplemental groundwater monitoring is recommended to confirm concentrations of arsenic in groundwater decrease as the geochemical conditions return to baseline conditions.

Under anaerobic conditions, iron can be reduced, mobilized, and precipitated out into the aquifer, a phenomenon that can sometimes decrease hydraulic permeability in the aquifer. For the shallow wells, the baseline groundwater sampling event conducted in April 2017 indicated that dissolved iron concentrations were not detected at a concentration above the laboratory reporting limit. Groundwater collected from each of the six shallow monitoring wells had measurable concentrations of dissolved and total iron that fluctuated throughout the performance monitoring events. The highest concentrations of total and dissolved iron in groundwater were consistently measured at CTMW-01S and CTMW-02S. The highest total iron concentration in groundwater of 25 mg/L was measured in a sample collected from CTMW-01S during PME #5. The highest dissolved iron concentration of 6.8 mg/L was measured in shallow groundwater at CTMW-02S during PME #5. Concentrations of ferrous iron in groundwater samples collected from the shallow monitoring wells generally exhibited a slight increase as performance monitoring progressed with the highest concentrations of >3.00 mg/L (PME #8) and 3.23 mg/L (PME #8) measured in groundwater samples collected from CTMW-01S and CTMW-02S. As further discussed in Section 5.1.5, decreases in hydraulic conductivity were observed in the vicinity of monitoring wells CTMW-01S and CTMW-02S; however, this may be due to other factors such as the reduction in saturated thickness between aquifer test events and/or bioaccumulation associated with the injection events. Additionally, other monitoring wells yielded groundwater samples where iron was observed to have increased, did not show evidence of reductions in hydraulic conductivity; therefore, it seems unlikely that precipitation of iron solids was occurring to a degree that may substantially impact hydraulic conductivity.

Of groundwater samples collected from the deep monitoring wells, dissolved iron was only detected during PME #4 in the sample collected from CTMW-06D at an estimated concentration above the laboratory reporting limit of 0.096 mg/L. Similar to groundwater in Qal, dissolved and total iron concentrations within groundwater of the UMCf at CTMW-01D, CTMW-02D, CTMW-03D, CTMW-04D, and CTMW-05D fluctuated throughout the performance monitoring events, but the magnitude of the fluctuations and concentrations in groundwater within the UMCf was one to two orders of magnitude less than in the shallow groundwater. Dissolved iron concentrations were not detected above the laboratory reporting limit in groundwater collected from CTMW-06D during any of the performance monitoring events, indicating that total iron concentrations in groundwater at CTMW-06D were potentially associated with aquifer solids. The highest dissolved iron concentration of 0.130 mg/L (estimated) was measured in groundwater collected from CTMW-05D during PME #6. The highest total iron concentration of 6.1 mg/L was measured in groundwater at CTMW-02D during PME #7. Concentrations of ferrous iron in groundwater within the UMCf fluctuated during performance monitoring with the highest concentration of 0.27 mg/L measured at CTMW-06D during PME #8. As further discussed in Section 5.1.5, decreases in hydraulic conductivity were observed in the vicinity of monitoring well CTMW-02D; however, this may be due to other factors such as bioaccumulation associated with the injection events. Additionally, other monitoring well locations where iron was observed to have increased, did not show evidence of reductions in hydraulic conductivity; therefore, it seems unlikely that precipitation of iron solids was occurring to a degree that may substantially impact hydraulic conductivity.

Manganese was analyzed to assess the potential for biologically-driven dissolution of manganese oxide coatings on aquifer solids (similar to iron oxides). The baseline groundwater sampling event conducted in April 2017 indicated that dissolved manganese concentrations in groundwater within the Qal ranged from 0.0091 to 0.038 mg/L in the treatability study area. An increasing trend of dissolved and total manganese concentrations in groundwater was observed at CTMW-01S, CTMW-02S, CTMW-03S, CTMW-04S, and CTMW-06S during performance monitoring. The highest dissolved and total manganese concentrations in groundwater of 5.6 mg/L and 7.1 mg/L, respectively, were measured at CTMW-06S during PME #8. As further discussed in Section 5.1.5, decreases in hydraulic conductivity were observed in the vicinity of monitoring wells CTMW-01S and CTMW-02S; however, this may be due to other factors such as the reduction in saturated thickness between aquifer test events and/or bioaccumulation associated with the injection events. Additionally, other monitoring wells where manganese was observed to have increased, did not show evidence of reductions in hydraulic conductivity; therefore, it seems unlikely that dissolution of manganese oxide coatings on aquifer solids was occurring to a degree that may substantially impact hydraulic conductivity.

The baseline groundwater sampling event conducted in April 2017 indicated that dissolved manganese concentrations in groundwater within the UMCf ranged from non-detect to 0.058 mg/L in the treatability study area. An increasing trend of dissolved and total manganese concentrations was observed in groundwater at CTMW-01D, CTMW-02D, CTMW-05D, and CTMW-06D during performance monitoring. A decreasing trend of dissolved and total manganese concentrations was observed in groundwater at CTMW-03D and CTMW-04D. The highest dissolved manganese concentration of 0.400 mg/L was measured in groundwater at CTMW-02D during PME #6 and the highest total manganese concentration of 0.49 mg/L was measured in groundwater at CTMW-02D during PME #7. As further discussed in Section 5.1.5, decreases in hydraulic conductivity were observed in the vicinity of monitoring well CTMW-02D; however, this may be due to other factors such as bioaccumulation associated with the injection events. Additionally, other monitoring wells where manganese concentration in groundwater was observed to have increased, did not show evidence of reductions in hydraulic conductivity; therefore, it seems unlikely that precipitation of manganese solids was occurring to a degree that may substantially impact hydraulic conductivity.

The increases in metal concentrations such as arsenic, iron and manganese, is spatially limited to groundwater at the treatability study wells and concentrations are expected to return to baseline concentrations downgradient and within the treatment zone as the geochemical conditions return to baseline conditions (Borden, et al., 2015).

5.1.2.9 Additional Analytes

Several other parameters were periodically analyzed during the treatability study. A summary of these parameters and their significance are presented below. Results of each parameter analyzed are presented in the comprehensive data tables provided in Appendix G.

- TDS was analyzed to assess the impact of salts on delayed or slower hexavalent chromium biodegradation. TDS values ranged from 7,300 to 20,000 mg/L and 9,600 to 15,000 mg/L in groundwater within the Qal and UMCf, respectively. The field biological reduction treatability study (similar to the bench-scale treatability study) indicated that TDS concentrations at these levels did not hinder microbial activity and hexavalent chromium biodegradation.
- Baseline alkalinity values in groundwater from both the Qal and UMCf were less than 200 mg/L. During the treatability study, groundwater within the Qal exhibited a considerable increase with observed alkalinity concentrations as high as 6,300 mg/L (CTMW-01S). Groundwater within the UMCf exhibited an increase in alkalinity concentrations, with concentrations as high as 920 mg/L (CTMW-01D) at five of the six deep monitoring wells. Alkalinity increases occur due to microbial respiration and production of carbon dioxide, which in solution could combine with native calcium to form calcium carbonate. These increases in groundwater alkalinity compared to baseline concentrations indicate an increased level of microbial activity and serve as an indirect indicator of groundwater undergoing biodegradation.
- An increase in chloride concentrations in groundwater within the Qal at 5 of the 6 shallow wells and within the UMCf at 3 of the 6 deep wells was observed as the treatability study progressed compared to baseline concentrations. The most significant increase in chloride concentrations in groundwater was detected in the Qal at CTMW-04S, where chloride concentrations increased from 780 to 2,300 mg/L. In the UMCf, the most significant increase was at CTMW-06D, where chloride concentrations in groundwater increased from 1,300 to 1,700 mg/L. The reduction of perchlorate should result in an increase in chloride, but chloride may not be a useful indirect indicator of biodegradation because of its high native concentrations at the Site.
- Following carbon substrate injections, methane was periodically detected in groundwater samples collected from both the shallow and deep wells with a general increase in dissolved methane concentrations observed as the treatability study progressed. Most groundwater samples from the Qal and UMCf had methane concentrations well below 1 mg/L. The highest dissolved methane concentration in the Qal of 2.3 mg/L was measured in groundwater collected from CTMW-02S during PME #8, and the highest dissolved methane concentration in the UMCf of 0.29 mg/L was measured in groundwater collected from CTMW-01D during PME #7. Methanogenic conditions (signified by biological methane production) require highly reducing conditions that are generally not mandated for hexavalent chromium biodegradation. Based on dissolved methane concentration data, methanogenesis within the treatability study area was limited. The highest concentrations of dissolved methane in the Qal and UMCf occurred in groundwater that also displayed a favorable response to TOC and hexavalent chromium biodegradation.
- During the treatability study, the total nitrogen concentration increased in groundwater at CTMW-01S, CTMW-02S, and CTMW-06S, which may be related to nutrients introduced in the aquifer as part of the carbon substrate injections.
- Groundwater analytical results from the downgradient shallow monitoring wells show the generation of acetone and methyl ethyl ketone, also known as 2-butanone. High concentrations of carbon substrates in a highly reducing environment can lead to the generation of organic acids and intermediate fermentation-based products such as acetone and methyl ethyl ketone (Fowler et al, 2011). These products act as electron donors in the further degradation of electron acceptors under both aerobic and anaerobic conditions (Fowler et al, 2011). Concentrations of methyl ethyl ketone in groundwater at the closest monitoring wells, CTMW-01S and CTMW-02S, increased from non-detect concentrations to 11,000 µg/L

and 2,000 µg/L, respectively. Acetone concentrations in groundwater at the closest monitoring wells, CTMW-01S and CTMW-02S, increased from non-detect concentrations to 2,800 µg/L and 560 µg/L (estimated by lab), respectively. At the farthest downgradient monitoring well, CTMW-06S, methyl ethyl ketone concentrations in groundwater increased to 4,000 µg/L (estimated by lab) and acetone concentrations decreased from 1,700 µg/L to 620 µg/L (estimated by lab). As demonstrated by the decrease in acetone in groundwater at CTMW-06S, the concentrations of methyl ethyl ketone and other intermediate fermentation-based products are anticipated to similarly decrease in the treatment zone over time. Supplemental groundwater monitoring is recommended to confirm concentration decreases of acetone and methyl ethyl ketone as the geochemical conditions return to baseline conditions.

- VFAs were analyzed during the baseline and performance monitoring groundwater sampling events throughout the treatability study. These acids are produced continually during hydrolysis of the long-chain fatty acids of EOS$_{\text{PRO}}$® and are considered to be more readily available organic compounds for biodegradation. Acetic acid, n-butyric acid, and propionic acid were all detected in Qal and UMCf groundwater samples at concentrations greater than baseline concentrations during the treatability study. The highest concentrations of VFAs in groundwater within the Qal and UMCf generally correlated to wells where substrate propagation was observed based on TOC concentrations. At CTMW-01S, acetic acid, n-butyric acid, and propionic acid concentrations increased in groundwater from non-detectable to 4,400 mg/L, 4,100 mg/L, and 2,000 mg/L, respectively. At CTMW-01D, acetic acid, n-butyric acid, and propionic acid concentrations increased in groundwater from non-detectable to 160 mg/L, 350 mg/L, and 33 mg/L (estimated), respectively.

5.1.3 Field Parameters

5.1.3.1 Dissolved Oxygen

As previously discussed in Section 2.1, hexavalent chromium reduction does not proceed under aerobic conditions. Therefore, DO measurements are a useful parameter to ascertain geochemical conditions in the groundwater and to confirm that anaerobic conditions have been achieved and sustained, which is essential for hexavalent chromium biodegradation. As a result, DO measurements for the shallow and deep wells were made during the baseline and all performance monitoring events.

Shallow Wells

DO readings for the shallow monitoring wells are summarized in ***Table 18***.

Table 18 Summary of Dissolved Oxygen Readings in Shallow Wells – Biological Reduction Study

Event	Weeks Following 1st Injection	Dissolved Oxygen Concentration (mg/L)					
		CTMW-01S	CTMW-02S	CTMW-03S	CTMW-04S	CTMW-05S	CTMW-06S
Baseline	0	1.71	1.56	1.88	1.39	NS	NS
Carbon Substrate Injection Event #1 (4/18/17 – 4/21/17)							
PME #1	2	1.87	7.53*	1.40	1.43	NS	NS
PME #2	4	1.21	1.68	4.75	1.16	NS	NS
PME #3	6	1.05	1.82*	1.14	1.45	NS	NS
Carbon Substrate Injection Event #2 (6/6/17 – 6/9/17)							
PME #4	9	0.56	0.56	0.26	0.36	1.09	0.66
PME #5	13	0.77	0.77*	0.87	1.40	0.82	0.61

Event	Weeks Following 1st Injection	Dissolved Oxygen Concentration (mg/L)					
		CTMW-01S	CTMW-02S	CTMW-03S	CTMW-04S	CTMW-05S	CTMW-06S
Carbon Substrate Injection Event #3 (8/7/17 – 8/11/17)							
PME #6	18	2.06*	Dry	1.53	1.49	0.87	6.50*
PME #7	22	0.15	NA	0.16	0.16	0.17	0.18
PME #8	24	1.09*	0.26*	0.84	0.18	0.66	0.17

Notes:

mg/L – milligrams per liter
NS – not sampled; well was not yet installed
Dry – not sampled; well was observed to be dry
PME – Performance Monitoring Event
NA – Insufficient volume collected for water quality meter reading

* – Denotes well was not purged via low flow method due to insufficient water/recharge; water quality readings, therefore, may be less representative of groundwater conditions than readings obtained via low flow through a flow cell.

The baseline groundwater sampling event in April 2017 indicated an aerobic aquifer with DO concentrations in the Qal between 1.39 and 1.88 mg/L throughout the biological reduction study area. Based on DO readings collected during PME #1 through PME #3, DO concentrations generally were reflective of aerobic conditions, although slight decreases were observed in groundwater at CTMW-01S and CTMW-03S. During PME #4 through PME #5, DO concentrations significantly decreased when compared to baseline concentrations in groundwater at all wells except CTMW-04S. These decreases in DO concentrations generally correlated with the geochemical responses of hexavalent chromium, perchlorate, chlorate, and nitrate and were inversely related to TOC concentrations observed in these wells during the same timeframe. DO concentrations during PME #6 through PME #8 decreased in groundwater at all six monitored wells when compared to baseline concentrations. In addition, strongly anaerobic conditions (DO concentrations less than 0.5 mg/L) were observed in groundwater at all wells during PME #7 and three of the six monitoring wells during PME #8.

Deep Wells

DO readings for the deep monitoring wells are summarized in ***Table 19***.

Table 19 Summary of Dissolved Oxygen Readings in Deep Wells – Biological Reduction Study

Event	Weeks Following 1st Injection	Dissolved Oxygen Concentration (mg/L)					
		CTMW-01D	CTMW-02D	CTMW-03D	CTMW-04D	CTMW-05D	CTMW-06D
Baseline	0	1.55	1.18	3.39	1.10	NS	NS
Carbon Substrate Injection Event #1 (4/18/17 – 4/21/17)							
PME #1	2	1.43	1.21	2.10	3.70	NS	NS
PME #2	4	1.14	3.43	4.31	0.89	NS	NS
PME #3	6	0.83	0.52	0.58	0.34	NS	NS
Carbon Substrate Injection Event #2 (6/6/17 – 6/9/17)							
PME #4	9	0.49	0.41	1.15	0.50	1.59	0.15
PME #5	13	0.36	0.68	0.78	0.71	0.80	0.63
Carbon Substrate Injection Event #3 (8/7/17 – 8/11/17)							
PME #6	18	0.73	0.75	0.74	0.78	0.72	0.90
PME #7	22	0.21	0.12	0.12	0.16	0.22	0.49

Event	Weeks Following 1st Injection	Dissolved Oxygen Concentration (mg/L)					
		CTMW-01D	CTMW-02D	CTMW-03D	CTMW-04D	CTMW-05D	CTMW-06D
PME #8	24	0.28	0.13	1.57	0.16	2.45	0.55

Notes:

mg/L – milligrams per liter
NS – not sampled; well was not yet installed
PME – Performance Monitoring Event

The baseline groundwater sampling event in April 2017 indicated an aerobic aquifer with DO concentrations in the UMCf between 1.10 and 3.39 mg/L throughout the treatability study area. Based on DO readings collected during PME #1 through PME #3, DO concentrations substantially decreased in groundwater at all monitoring wells when compared to baseline. During PME #4 and PME #5, DO concentrations in groundwater continued to decrease or remain low at all deep wells. DO concentrations during the final sampling events (PME #6 through PME #8) remained low in groundwater at the majority of wells during each event, with data indicating strongly reducing conditions. DO concentration reductions in groundwater at CTMW-01D and CTMW-06D correlate with TOC increases, which may be indicative of increased chemical or biological oxygen demand in groundwater at these wells. DO concentrations in groundwater at CTMW-03D and CTMW-05D decreased during PME #6 and PME #7 but increased sharply during PME #8.

5.1.3.2 Oxidation-Reduction Potential

ORP readings sometimes provide a valuable tool to identify the redox conditions in groundwater and ascertain reducing conditions. At some sites, ORP readings correlate well with DO values and, therefore, provide a means to verify the extent of reduction. It should be noted that in aquifers with several electron acceptors and electron pairs, such as iron pairs, nitrogen pairs, perchlorate/chlorate/chloride, and sulfur pairs, it is possible that interference may occur with respect to redox measurements.

Shallow Wells

ORP readings for the shallow monitoring wells are summarized in ***Table 20***.

Table 20 Summary of Oxidation-Reduction Potential Readings in Shallow Wells – Biological Reduction Study

Event	Weeks Following 1st Injection	Oxidation-Reduction Potential (mV)					
		CTMW-01S	CTMW-02S	CTMW-03S	CTMW-04S	CTMW-05S	CTMW-06S
Baseline	0	170	161	161	139	NS	NS
Carbon Substrate Injection Event #1 (4/18/17 – 4/21/17)							
PME #1	2	-166	190*	-3	120	NS	NS
PME #2	4	-298	-43	145	-12	NS	NS
PME #3	6	-157	150*	172	192	NS	NS
Carbon Substrate Injection Event #2 (6/6/17 – 6/9/17)							
PME #4	9	-127	-145	33	-70	113	-125
PME #5	13	-40	-31*	124	-1	115	-120
Carbon Substrate Injection Event #3 (8/7/17 – 8/11/17)							
PME #6	18	-71*	Dry	14	-239	151	-92*
PME #7	22	-72	NA	67	-119	163	-109

Event	Weeks Following 1st Injection	Oxidation-Reduction Potential (mV)					
		CTMW-01S	CTMW-02S	CTMW-03S	CTMW-04S	CTMW-05S	CTMW-06S
PME #8	24	-82*	-107*	120	-242	147	-101

Notes:

mV – millivolts
NS – not sampled; well was not yet installed
Dry – not sampled; well was observed to be dry
PME – Performance Monitoring Event
NA – Insufficient volume collected for water quality meter reading

* – Denotes well was not purged via low flow method due to insufficient water/recharge; DO reading, therefore, may be less representative of well conditions than readings obtained via low flow through a flow cell.

The baseline groundwater sampling event in April 2017 indicated that each of the four shallow monitoring wells sampled had positive ORP readings, indicating aerobic conditions. As with the DO measurements, decreases in ORP measurements were observed throughout the study in groundwater at monitoring wells CTMW-01S, CTMW-02S, CTMW-04S, and CTMW-06S. These measurements were as low as -242 mV during the final event, indicating strongly reducing conditions. Although some decreases/fluctuations of ORP measurements were observed during the study in groundwater at monitoring wells CTMW-03S and CTMW-05S (generally cross-gradient), ORP measurements indicate generally aerobic conditions and retained positive values during this time period.

Deep Wells

ORP readings for the deep monitoring wells are summarized in ***Table 21***.

Table 21 Summary of Oxidation-Reduction Potential Readings in Deep Wells – Biological Reduction Study

Event	Weeks Following 1st Injection	Oxidation-Reduction Potential (mV)					
		CTMW-01D	CTMW-02D	CTMW-03D	CTMW-04D	CTMW-05D	CTMW-06D
Baseline	0	100	120	214	143	NS	NS
Carbon Substrate Injection Event #1 (4/18/17 – 4/21/17)							
PME #1	2	79	125	183	201	NS	NS
PME #2	4	-23	33	167	185	NS	NS
PME #3	6	-14	164	213	181	NS	NS
Carbon Substrate Injection Event #2 (6/6/17 – 6/9/17)							
PME #4	9	-130	-161	-193	-66	142	85
PME #5	13	-120	39	110	-36	140	87
Carbon Substrate Injection Event #3 (8/7/17 – 8/11/17)							
PME #6	18	-162	-163	-28	-69	88	11
PME #7	22	-103	53	71	-96	111	170
PME #8	24	-19	-14	77	-131	142	180

Notes:

mV – millivolts
NS – not sampled; well was not yet installed
PME – Performance Monitoring Event

The baseline groundwater sampling event in April 2017 indicated that groundwater at each of the four deep monitoring wells sampled had positive ORP readings, indicating aerobic conditions.

As with the DO measurements, decreases in ORP measurements were observed throughout the study in groundwater within the UMCf at monitoring wells CTMW-01D, CTMW-02D, CTMW-03D, and CTMW-04D. In general, lower ORP measurements were observed during the performance monitoring event following carbon substrate events #2 and #3, with measurements as low as -193 mV in groundwater at CTMW-03D during PME #4. During the final event, the ORP measurements were as low as -131 mV, indicating reducing conditions were present. ORP measurements fluctuated throughout the study, but groundwater at CTMW-01D and CTMW-04D, showed sustained reducing conditions following the second injection event.

5.1.3.3 pH

Groundwater pH and temperature are common environmental factors that could affect microbial activity, with microorganisms generally preferring a pH between 6 and 8 standard units and warmer temperatures. Biological reduction due to carbon substrate injection often leads to acid production, which then results in lowering of pH and causes potential stress on native microorganisms. Groundwater pH and temperature within the biological reduction study area groundwater in both the Qal and UMCf generally remained within ideal ranges, with pH ranging from 5.05 to 8.71 standard units and temperatures greater than 20 degrees Celsius. Lower pH values were observed in groundwater within the nearest downgradient shallow monitoring wells following the first injection event. For subsequent injection events, sodium bicarbonate was added to the injection solution to help buffer the solution and avoid large fluctuations in pH associated with the low pH industrial sugar wastewater solution and geochemical responses to the microbial activity. The pH values ranged from 5.94 to 7.98 in the downgradient wells following the addition of sodium bicarbonate to the injection solution.

5.1.4 Microbial Results

Bio-Trap® samplers were deployed in select wells to obtain specialized microbial data to gauge the response of the microbial community to the addition of carbon substrate into groundwater and to evaluate biodegradation potential. Bio-Trap® samplers are patented devices available through a specialized microbial firm, Microbial Insights, Inc. in Knoxville, Tennessee. Structurally, they are cylindrical containers with a diameter size small enough to be deployed into a conventional monitoring well for a stipulated period of time (generally 30 to 60 days). The samplers contain a unique sampling matrix, Bio-Sep® beads, which are 2-4 mm in diameter and are an engineered composite of Nomex® and powdered activated carbon. When a Bio-Trap® sampler is deployed in a monitoring well, the Bio-Sep® beads absorb contaminants and nutrients present in the aquifer essentially becoming an in-situ microcosm with a very large surface area (~600 square meter per gram) which is readily colonized by subsurface microorganisms. Once recovered from a monitoring well after deployment, DNA, ribonucleic acid (RNA), or PLFA can be extracted from the beads for CENSUS® or PLFA assays to evaluate the microbial community. In many ways, Bio-Trap® samplers provide an integrated vision of the microbial community rather than a onetime “snapshot” sampling event. Microorganisms colonize the beads and therefore the microbial communities are more likely to represent the active members of the subsurface microbial community.

Four Bio-Trap® samplers were deployed in wells CTIW-01S, CTIW-01D, CTMW-03S, and CTMW-03D within the study area on March 10, 2017 to establish baseline conditions. These wells were selected because they were the first wells installed in the study area and the only wells installed at the time of deployment. The samplers were retrieved and shipped to Microbial Insights for analyses on April 5, 2017. The results for the microbial analysis associated with the baseline groundwater monitoring are provided in ***Table 22*** and the laboratory reports are included in Appendix J.

Table 22 Bio-Trap® Results Collected During Baseline Groundwater Monitoring – Biological Reduction Study

Parameter	**Baseline**			
	CTIW-01S	CTIW-01D	CTMW-03S	CTMW-03D
Sulfate Reducing Bacteria (cells/bead)	<2.50 x 10^2	1.11 x 10^4	<2.50 x 10^2	1.82 x 10^3
Perchlorate Reductase (cells/bead)	6.09 x 10^4	2.80 x 10^5	2.39 x 10^4	4.05 x 10^5
Total Biomass (cells/mL)	3.92 x 10^4	1.43 x 10^5	7.40 x 10^4	1.19 x 10^5
Community Structure (% total PLFA)				
Firmicutes (TerBrSats)	0.00	0.51	0.00	1.26
Proteobacteria (Monos)	76.73	77.33	82.94	72.35
Anaerobic metal reducers (BrMonos)	2.86	6.55	2.03	2.95
SRB/Actinomycetes (MidBrSats)	2.17	0.60	0.00	4.18
General (Nsats)	18.23	13.59	15.02	18.63
Eukaryotes (polyenoics)	0.00	1.40	0.00	0.65
Physiological Status (Proteobacteria Only)				
Slowed growth	1.40	1.96	2.42	1.18
Decreased Permeability	0.00	0.10	0.00	0.05

Table 22 also summarizes the details of the microbial community structure that was determined from PLFA analyses. The large proportion of Proteobacteria (greater than 70% in all wells) indicates a proliferation of the appropriate bacterial community which is gram negative (generally indicative of reducing conditions), has the ability to utilize a variety of carbon sources, has adapted easily to the groundwater environment, and is representative of both aerobic and anaerobic bacteria. On the other hand, the low proportions (less than 10%) of metal reducing bacteria and sulfate reducing bacteria (SRB)/actinomycetes reveal redox conditions that are not overly reducing, thereby limiting and controlling sulfate-reduction. Eukaryotes percentages are also relatively low in all the wells indicating that these scavengers of valuable contaminant-reducing bacteria do not pose a significant threat in this groundwater.

Ratios for slowed growth and for decreased permeability of the cell membrane provide information on the “health” of the gram negative microbial community and how this population is responding to the conditions present in the environment. Higher numbers (i.e., greater than 0.5) are generally reflective of a community that is stressed and has become more toxic and not as supportive of the microbial community, often due to a lack of available carbon substrate. Lower ratios (less than 0.5) generally indicate availability of substrate and the creation of an environment that is supportive of a diverse microbial community. Results of the physiological status indicate that the ratios for slowed growth are on the higher side, indicating an environment that is stressed and under natural conditions could be unfavorable to gram negative Proteobacteria, which are important for biodegradation (particularly anaerobic biodegradation), either due to lack of carbon substrate or due to toxic conditions. However, the ratios of decreased permeability are on the lower side, which indicate that toxicity may not be an inherent issue.

Mid-way through the treatability study, four new Bio-Trap® samplers were deployed in wells CTMW-01S, CTMW-01D, CTMW-03S, and CTMW-03D within the study area on June 22, 2017. CTMW-03S and CTMW-03D were selected since they had previously been selected for microbial analysis as part of the baseline groundwater monitoring. The injection wells CTIW-01S and CTIW-01D were previously selected for microbial analysis as part of the baseline groundwater monitoring, but were not selected for subsequent microbial analysis since carbon substrate injections had recently occurred and the potential for the injection wells to contain higher concentrations of residual injectate may have influenced results. Subsequently, the nearby monitoring wells CTMW-01S and CTMW-01D were selected instead. The samplers were in-place for over 30 days and were retrieved and shipped to Microbial Insights for analyses on July 17, 2017. The results for the microbial analysis associated with PME #5 groundwater monitoring are provided in ***Table 23***.

Table 23 Bio-Trap® Results Collected During PME #5 Groundwater Monitoring – Biological Reduction Study

Parameter	PME #5			
	CTMW-01S	CTMW-01D	CTMW-03S	CTMW-03D
Sulfate Reducing Bacteria (cells/bead)	1.43×10^3	$<2.50 \times 10^2$	$<2.50 \times 10^2$	1.30×10^4
Perchlorate Reductase (cells/bead)	9.09×10^3	3.51×10^4	3.51×10^4	1.35×10^4
Total Biomass (cells/mL)	8.22×10^5	2.70×10^5	2.47×10^6	5.68×10^5
Community Structure (% total PLFA)				
Firmicutes (TerBrSats)	12.09	6.06	2.24	0.00
Proteobacteria (Monos)	49.47	70.94	74.21	74.65
Anaerobic metal reducers (BrMonos)	1.75	3.72	0.46	2.10
SRB/Actinomycetes (MidBrSats)	0.62	0.00	0.37	3.30
General (Nsats)	32.50	17.84	21.31	17.55
Eukaryotes (polyenoics)	3.55	1.43	1.42	2.39
Physiological Status (Proteobacteria Only)				
Slowed growth	1.14	0.81	1.43	1.18
Decreased Permeability	0.64	0.24	0.31	0.49

Microbial biomass (cells per bead) in groundwater at the four wells that were sampled ranged from 2.70×10^5 in well CTMW-01D to 2.47×10^6 in well CTMW-03S. These numbers increased from the prior microbial sampling and are indicative of a robust microbial population in groundwater that could possess the ability to biodegrade the COPCs.

Table 23 also summarizes the details of the microbial community structure that was determined from PLFA analyses. The large proportion of Proteobacteria (greater than 49% at CTMW-01S and greater than 70% at all other wells) indicates a proliferation of the appropriate bacterial community which is gram negative, has the ability to utilize a variety of carbon sources, has adapted easily to the groundwater environment, and is representative of both aerobic and anaerobic bacteria. Generally, these proportions are similar to the previous microbial sampling. The Proteobacteria population at CTMW-01S is considerably lower than at the other wells, but still a large overall proportion. The low proportions (less than 10%) of metal reducing bacteria and sulfate reducing bacteria (SRB)/actinomycetes reveal redox conditions that are not overly reducing, thereby limiting and controlling sulfate-reduction. Additionally, these proportions have decreased compared to the previous microbial sampling. Eukaryotes percentages slightly increased from the previous microbial sampling, but are still relatively low at all the wells, indicating that these scavengers of valuable contaminant-reducing bacteria do not pose a significant threat in this groundwater.

Ratios for slowed growth decreased during the study at all wells indicating that the overall toxicity could have decreased in addition to increased carbon substrate availability. This is indicative of an overall environment favorable to gram negative Proteobacteria, which are important for biodegradation. The ratios for decreased permeability increased slightly, but still remained at levels that are supportive of Proteobacterial growth.

5.1.5 Hydrogeological Evaluation

5.1.5.1 Horizontal and Vertical Groundwater Gradients

Downgradient groundwater monitoring wells within the biological reduction study area were gauged during the baseline monitoring event, during the injection events, and during each performance monitoring event to evaluate changes in both horizontal and vertical groundwater gradients during the treatability study. The groundwater gauging data is provided in Appendix E. Overall, the horizontal groundwater gradient in both the Qal and UMCf ranged from approximately 0.019 to 0.021 ft/ft to the northeast within the biological reduction study area throughout the duration of the treatability study. There was an average downward vertical gradient of 0.018 ft/ft, as evaluated with each well cluster, during the treatability study.

As would be expected, temporary groundwater mounding was observed during injection events within the Qal and the UMCf. For example, during the third injection event, which was performed following the installation of downgradient monitoring wells CTMW-05S/D and CTMW-06S/D, groundwater mounding within the Qal ranged from 2.73 feet at CTMW-02S (located approximately 12 ft from the nearest shallow injection well) to 0.50 ft at CTMW-03S (located approximately 32 ft from the nearest shallow injection well). Groundwater mounding within the UMCf during the third injection event ranged from 7.53 ft at CTMW-01D (located approximately 12 ft from the nearest deep injection well) to 0.87 ft at CTMW-05D (located approximately 45 ft from the nearest deep injection well). As expected, the horizontal and vertical gradients in the immediate vicinity of the injection wells were affected during injections. However, the primary flow direction is horizontal and the groundwater levels returned to baseline conditions within one day following injections. Due to the observed short temporal duration of the mounding, it is highly unlikely that the overall perchlorate plume migration was significantly modified as a result of the injections.

5.1.5.2 Aquifer Testing

As part of the hydrogeological evaluation, aquifer testing was periodically performed in select wells during the treatability study. The objective of the aquifer testing was to estimate aquifer hydraulic conductivity (K) in the study area before and after injection of the substrate. Because the injection of substrate has the potential to decrease hydraulic conductivity, particularly in the vicinity of injection wells, K estimates in the same wells before and after injection were compared. Aquifer testing consisted of specific capacity testing in the shallow wells (due to insufficient water to permit slug testing) and slug testing and specific capacity testing in the deep wells.

As explained in Section 4.1.4, the first round of slug testing was performed in December 2016 (pre-injection test) on wells CTIW-01D and CTMW-03D. Additional pre-injection slug testing was also conducted in April 2017 on the injection and monitoring wells that were installed following the initial slug testing event. Finally, post-injection slug testing was conducted on the all the deep wells in October and November 2017. The slug testing was conducted following the methods described in Section 4.1.4.

Slug testing of the shallow wells was not possible as there was insufficient water in the shallow wells to permit slug testing. As such, specific capacity tests were conducted in shallow and deep wells to estimate location-specific hydraulic conductivity in the Qal, as well as provide a comparison of specific capacity hydraulic conductivity values with the corresponding slug test hydraulic conductivity estimates for the same wells. Pre-injection specific capacity testing was conducted in February 2017 and April 2017 on select wells. Post-injection specific capacity tests were conducted on select wells in October 2017. The methods used to conduct the specific capacity tests are described in Section 4.1.4.

Following the completion of the slug tests and specific capacity tests, the test data were downloaded from the transducer or entered from field data sheets, and analyzed using commercially-available AQTESOLV software (HydroSOLVE, Inc., 2007). The Bouwer and Rice method for analyzing slug tests in an unconfined aquifer was used to estimate hydraulic conductivity (Bouwer & Rice, 1976), while the specific capacity test data were analyzed using the Theis method (Theis, 1935) or the Hantush-Jacob leaky aquifer solution (Hantush, 1955). Results obtained from the slug and specific capacity testing, which includes the AQTESOLV interpretation plots, are provided in Appendix C. If recovery times at each well allowed (i.e. wells with higher K values), multiple tests were conducted and the corresponding hydraulic conductivity estimates were averaged. ***Table 24*** and ***Table 25*** summarize the mean hydraulic conductivities for the shallow and deep wells based on the specific capacity test and slug test results, respectively.

Table 24 Shallow and Deep Specific Capacity Test Results – Biological Reduction Study

Well	Mean Hydraulic Conductivity (feet/day)		
	Pre-Injection (February 2017)	Pre-Injection (April 2017)	Post-Treatability Study (October/November 2017)
CTIW-01S	61	--	--
CTIW-01D	1.5	1.0	--
CTIW-02S	--	30	--
CTIW-02D	--	0.6	--
CTIW-03S	--	53	--
CTIW-03D	--	0.2	--
CTMW-01S	15	--	0.41
CTMW-01D	--	0.5	--
CTMW-02S	--	27	0.51
CTMW-02D	--	0.4	--
CTMW-03S	75	--	128
CTMW-03D	3.0	--	--
CTMW-04S	--	34	22.8
CTMW-04D	--	0.4	--
CTMW-05S	--	--	36
CTMW-06S	--	--	105.1

Table 25 Deep Slug Test Results – Biological Reduction Study

Well	Mean Hydraulic Conductivity (feet/day)		
	Pre-Injection (December 2016)	Pre-Injection (April 2017)	Post-Treatability Study (October/November 2017)
CTIW-01D	1.4	--	0.9
CTIW-02D	--	1.0	0.1
CTIW-03D	--	0.3	0.4
CTMW-01D	--	0.5	0.7
CTMW-02D	--	0.6	0.5
CTMW-03D	2.5	--	3.1
CTMW-04D	--	1.1	1.3

Well	Mean Hydraulic Conductivity (feet/day)		
	Pre-Injection (December 2016)	Pre-Injection (April 2017)	Post-Treatability Study (October/November 2017)
CTMW-05D	--	--	1.5
CTMW-06D	--	--	1.0

Based on the baseline (pre-injection) slug test results, the estimated Ks for are generally consistent with the lithologies observed within the screened interval of the deep wells, which was primarily silt to sandy silt. Prior estimates of the hydraulic conductivity for the UMCf have ranged from less than 0.01 ft/d to more than 10 ft/d. The baseline estimates from the biological reduction study area slug tests ranged from about 0.1 to 3.1 ft/d, which is within the previous estimated range for the deep wells. Results of the specific capacity tests revealed that the specific capacity K estimates in the deep wells are similar to the corresponding slug test K estimates from the same wells. However, the specific capacity test results from the shallow wells are likely to be heavily influenced by saturated thickness, since less than 2 feet of saturated thickness exists in the shallow wells.

Several wells were tested (slug and specific capacity) following the completion of the injection activities to assess whether the injections had potentially influenced K. The K estimates from the pre-injection (December 2016, February 2017, and April 2017) and post-injection (October/November 2017) tests are provided in Appendix C. The hydraulic conductivity was not affected in most of the deep wells; however, the hydraulic conductivity at CTIW-02D decreased from 1.0 to 0.1 ft/d, a change which may be related to bioaccumulation associated with the injection events. Shallow monitoring wells CTMW-01S and CTMW-02S also had significant decreases in hydraulic conductivity from 15 to 0.41 ft/d and from 27 to 0.51 ft/d, respectively. However, the decreases in hydraulic conductivity in these monitoring wells are largely attributed to the reduction in saturated thickness between aquifer test events but may also be related to bioaccumulation associated with the injection events (Appendix C).

5.2 CHEMICAL REDUCTION STUDY

This section presents a summary of the groundwater data collected for the chemical reduction study, which was conducted within the footprint of the AP Area Up and Down Flushing Treatability Study. For the chemical reduction study, the most significant groundwater parameters related to chemical reduction of hexavalent chromium discussed herein are hexavalent chromium, pH, DO, and ORP. Summary tables of additional analytical results are provided in Appendix G. It should be noted that this report focuses on groundwater monitoring conducted prior to and subsequent to chemical injections, which is a subset of the overall data collected as part of the AP Area Up and Down Flushing Treatability Study. As a result, the AP Area Up and Down Flushing Treatability Study report will provide the remaining data collected as part of the AP Area Up and Down Flushing Treatability Study, as well as soil analytical data collected during well installation. A hydrogeological evaluation based on the results of groundwater gauging and aquifer testing is provided in Section 5.2.2.

5.2.1 Groundwater Results

The following subsections present the groundwater results for hexavalent chromium and field parameters, consisting of pH, DO and ORP.

5.2.1.1 Hexavalent Chromium

Hexavalent chromium was analyzed to monitor changes in concentration following injections in the Qal and UMCf to ascertain the effectiveness of chemical reduction. Groundwater results from groundwater monitoring events for shallow, intermediate, and deep monitoring wells are summarized in ***Table 26*** through ***Table 28***, respectively.

Table 26 Hexavalent Chromium Groundwater Results in Shallow Wells – Chemical Reduction Study

Event	Hexavalent Chromium Concentration (mg/L)					
	Plot 1			Plot 2		
	UFMW-01S	UFMW-02S	UFMW-03S	UFMW-04S	UFMW-05S	UFMW-06S
Baseline (August 2016)	0.000025U	0.000025 U	Dry	0.0066	0.000025 U	0.028
Chemical Injection Event (8/7/17 – 8/8/17)						
August 2017	0.00075 J	Dry	Dry	0.011	0.006	0.0045
October 2017	Dry	Dry	Dry	0.002	0.0011 J	0.013 U

Notes:

mg/L – milligrams per liter
Dry – not sampled; well was observed to be dry
U – The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit indicated.
J – The result is an estimated quantity

As presented in ***Table 26***, several of the shallow monitoring wells did not contain much groundwater, with most of the wells in Plot 1 going dry during the performance monitoring events. Water samples from these wells were collected either by using a disposable bailer or peristaltic pump when low flow conditions could not be achieved. The baseline groundwater sampling event indicated that groundwater at three of the five shallow monitoring wells did not have a concentration of hexavalent chromium above the laboratory reporting limit, and hexavalent chromium concentrations in groundwater at wells UFMW-04S and UFMW-06S were 0.0066 and 0.028 mg/L, respectively. Slight fluctuations in the hexavalent chromium concentrations were observed in the shallow wells sampled during the August and October 2017 sampling events, but decreases in hexavalent chromium reduction were limited by the low baseline concentrations in the shallow wells.

Table 27 Hexavalent Chromium Groundwater Results in Intermediate Wells – Chemical Reduction Study

Event	Hexavalent Chromium Concentration (mg/L)					
	Plot 1			Plot 2		
	UFMW-01I	UFMW-02I	UFMW-03I	UFMW-04I	UFMW-05I	UFMW-06I
Baseline (August 2016)	0.019	0.018	0.018	0.026	0.011	0.027
Chemical Injection Event (8/7/17 – 8/8/17)						
August 2017	0.000078 J	0.0052	0.0013 J	0.031	0.022	0.016 J-
October 2017	0.000080 J	0.0042	0.0024	0.0085	0.018	0.0082

Notes:

mg/L – milligrams per liter
J- – The result is an estimated quantity, but the result may be biased low.

Overall, hexavalent chromium concentrations decreased within the intermediate monitoring wells (***Table 27***). The baseline groundwater sampling event data indicated relatively low hexavalent chromium concentrations in the intermediate wells with concentrations ranging from 0.011 to 0.026 mg/L. Reductions in hexavalent chromium concentrations were detected at five of the six intermediate monitoring wells. At Plot 1, hexavalent chromium concentrations decreased in groundwater at monitoring wells UFMW-01I, UFMW-02I, and UFMW-03I by 99%, 77%, and 87%, respectively. At Plot 2, hexavalent chromium concentrations decreased in groundwater adjacent to monitoring wells UFMW-04I and UFMW-06I by 67% and 70%, respectively.

Table 28 Hexavalent Chromium Groundwater Results in Deep Wells – Chemical Reduction Study

Event	**Hexavalent Chromium Concentration (mg/L)**					
	Plot 1			**Plot 2**		
	UFMW-01D	**UFMW-02D**	**UFMW-03D**	**UFMW-04D**	**UFMW-05D**	**UFMW-06D**
Baseline (August 2016)	0.015	0.012	0.029	0.027	0.0058	0.016
Chemical Injection Event (8/7/17 – 8/8/17) Conducted Only in Shallow and Intermediate Wells						
August 2017	0.016	0.013	0.011	0.036	0.022	0.026 J-
October 2017	0.021	0.013	0.0083	0.029	0.018	0.027

Notes:

mg/L – milligrams per liter
J- – The result is an estimated quantity, but the result may be biased low.

As mentioned in Section 4.2.5, no injections were performed in the deep injection wells so they could be used to monitor the potential vertical migration of contaminants from injections into the intermediate injection wells. In general, there was no change in hexavalent chromium concentrations in in groundwater at the deep monitoring wells, with the exception of UFMW-03D, where concentrations decreased from 0.029 mg/L to 0.0083 mg/L. The lack of overall reduction of hexavalent chromium concentrations in the deep wells indicates that there was no significant downward vertical migration of the CPS solution.

5.2.1.2 pH

Field measurements for pH were collected during groundwater sampling to assess changes in pH from baseline and post-injections as pH is an important groundwater quality parameter for assessing changes in geochemical conditions. Within the shallow wells, the baseline pH ranged from 7.15 to 8.14 standard units and decreased slightly during the August 2017 and October 2017 groundwater sampling events with the lowest pH of 5.58 standard units detected in groundwater at well UFMW-05S. The reason for the decrease in pH levels are unknown, but may be partially caused by the decrease in saturated thickness in the shallow wells and application of SLMW to the vadose zone from soil flushing activities occurring as part of the AP Area Up and Down Flushing Treatability Study. The pH levels in both intermediate and deep wells remained generally consistent throughout the study.

5.2.1.3 Dissolved Oxygen

Dissolved oxygen was analyzed to monitor changes in concentration from baseline values to post-injections to evaluate the reducing conditions in the shallow, intermediate, and deep zones. Data for DO can be found in Appendix G.

The baseline groundwater sampling event data indicated that DO concentrations in the shallow groundwater ranged from 0.85 mg/L to 1.91 mg/L. Well UFMW-03S was not sampled during the baseline or subsequent groundwater monitoring events because the well was dry. In groundwater at the shallow groundwater monitoring wells, DO concentrations decreased in groundwater at UFMW-01S, UFMW-04S, UFMW-05S, and UFMW-06S during the August 2017 groundwater sampling event, but DO concentrations rebounded in groundwater at UFMW-05S and UFMW-06S during the October 2017 groundwater sampling event.

In groundwater at the intermediate groundwater monitoring wells, the DO concentrations ranged from 0.32 mg/L to 2.12 mg/L during the baseline sampling event and decreased during the August 2017 groundwater sampling event with non-detect values in groundwater at UFMW-01I through UFMW-05I. However, DO concentrations rebounded during the October 2017 sampling event, with the highest DO concentration of 3.06 mg/L detected in groundwater at UFMW-03I.

Within the UMCf, DO concentrations ranged from 0.55 to 3.54 mg/L during the baseline sampling event and decreased by the August 2017 groundwater sampling event with non-detect values confirmed in samples collected from wells UFMW-02D through UFMW-05D. DO concentrations rebounded during the October 2017 sampling event in groundwater at UFMW-02D through UFMW-05D. However, DO concentrations decreased at in groundwater at UFMW-01D and UFMW-06D by the October 2017 sampling event.

In general, the DO concentrations were highly variable, likely due to the decrease in saturated thickness in the shallow wells and soil flushing activities occurring as part of the AP Area Up and Down Flushing Treatability Study.

5.2.1.4 Oxidation-Reduction Potential

Like DO, ORP was also analyzed to monitor changes from baseline values to post-injections to evaluate the reducing conditions in the shallow, intermediate, and deep zones. Data for ORP can be found in Appendix G.

The baseline groundwater sampling event data indicated that ORP in groundwater at the shallow wells ranged from 31 mV to 219 mV, which is indicative of aerobic conditions. ORP decreased in groundwater at UFMW-01S by the August 2017 groundwater sampling event, but ORP increased in groundwater at UFMW-04S through UFMW-06S by the August 2017 and October 2017 groundwater sampling events.

The baseline groundwater sampling event data indicated that ORP in the intermediate zone of the UMCf ranged from 119 mV to 180 mV, indicative of aerobic conditions. ORP decreased in groundwater at UFMW-01I through UFMW-05I by the August 2017 groundwater sampling event, correlating to decreases in DO concentrations during this time period. ORP values rebounded in groundwater at UFMW-01I through UFMW-05I by the October 2017 groundwater sampling event, but ORP decreased in groundwater at UFMW-06I during this time period.

The baseline groundwater sampling event data indicated that ORP in the deep zone of the UMCf ranged from 93 mV to 180 mV, indicative of aerobic conditions. ORP decreased in groundwater at UFMW-01D through UFMW-04D by the August 2017 groundwater sampling event, correlating to decreases in DO concentrations during this time period. ORP, however, increased slightly in groundwater at UFMW-05D by the August 2017 groundwater sampling event despite a decrease in DO, and ORP also increased slightly in groundwater at UFMW-06D by this time period. ORP values rebounded in groundwater at UFMW-01D through UFMW-04D by the October 2017 groundwater sampling event, but ORP values decreased in groundwater at UFMW-06D by this time period.

Overall, ORP values less than 0 mV were not measured in the shallow, intermediate or deep zones monitored, indicating that strongly anaerobic conditions were not established.

5.2.2 Hydrogeological Evaluation

5.2.2.1 Horizontal and Vertical Groundwater Gradients

Groundwater monitoring wells within the chemical reduction study area were gauged weekly during the chemical reduction study as part of the AP Area Up and Down Flushing Treatability Study. The horizontal and vertical groundwater gradients within the chemical reduction study area are significantly influenced by nearby soil flushing and groundwater extraction activities. In general, the horizontal groundwater gradient was to the north within the shallow, intermediate, and deep wells with an average gradient of 0.024 ft/ft, 0.033 ft/ft, and 0.023 ft/ft, respectively. Vertical groundwater gradients varied between well clusters and ranged from a downward gradient of 0.0064 ft/ft to an upward gradient of 0.0164 ft/ft from the shallow to intermediate wells and from a downward gradient of 0.0546 ft/ft to an upward gradient of 0.0073 ft/ft from the intermediate to deep wells. Potential temporary effects on horizontal or vertical gradients resulting from the CPS solution injections are undiscernible due to effects from the nearby soil flushing and groundwater extraction activities as part of the AP Area Up and Down Flushing Treatability Study.

5.2.2.2 Aquifer Testing

As part of the hydrogeological evaluation, aquifer slug testing was periodically performed in select wells during the treatability study. The objective of the slug testing was to estimate aquifer K in the study area before and after injection of the substrate. Because the injection of substrate has the potential to decrease hydraulic conductivity, particularly in the vicinity of injection wells, K estimates in the same wells before and after injection were compared.

As explained in Section 4.2.4, the first round of slug testing was performed in August/September 2016 and April 2017 on select wells. Finally, post-injection slug testing was conducted on select intermediate injection wells and intermediate and deep monitoring wells in October and November 2017. The slug testing was conducted following the methods described in Section 4.2.4.

Slug testing of the shallow wells was not possible as there was insufficient water in the shallow wells to permit slug testing. As such, specific capacity tests were conducted in select shallow and intermediate wells (UFIW-06S, UFIW-06I, UFMW-05S, and UFMW-06S) to estimate location-specific hydraulic conductivity in the Qal, as well as provide a comparison of specific capacity hydraulic conductivity values with corresponding slug test hydraulic conductivity estimates. Pre-injection specific capacity testing was conducted in September 2016 on wells UFIW06S, UFIW-06I and post-injection specific capacity tests were conducted on wells UFMW-05S, and UFMW-06S in October 2017 (***Table 29***). Post-injection testing was limited to monitoring wells as injection wells had affixed wellheads fittings that would not allow pump placement that is required for the specific capacity testing. The methods used to conduct the specific capacity tests are described in Section 4.2.4.

Following the completion of the slug tests and specific capacity tests, the test data were downloaded from the transducer or entered from field data sheets, and analyzed using AQTESOLV software (HydroSOLVE, Inc., 2007). The Bouwer and Rice method for analyzing slug tests in an unconfined aquifer was used to estimate hydraulic conductivity (Bouwer & Rice, 1976), while the specific capacity test data was were analyzed using the Theis method (Theis, 1935), Hantush-Jacob leaky aquifer solution (Hantush, 1955) or Cooper-Jacob unconfined solution (Cooper, 1946). Results obtained from the slug and specific capacity testing, which includes the AQTESOLV interpretation plots, are provided in Appendix C. If recovery times at each well allowed (i.e. wells with higher K values), multiple tests were conducted and the corresponding hydraulic conductivity estimates were averaged. ***Table 29*** and ***Table 30*** summarize the mean hydraulic conductivities for the shallow, intermediate and deep wells based on the specific capacity test and slug test results, respectively.

Table 29 Shallow Specific Capacity Test Results – Chemical Reduction Study

Well	Mean Hydraulic Conductivity (feet/day)	
	Pre-Injection (September 2016)	Post-Treatability Study (October 2017)
UFIW-06S	8.0	--
UFIW-06I	0.8	--
UFMW-05S	--	16.8
UFMW-06S	--	15.6

Table 30 Intermediate and Deep Slug Test Results – Chemical Reduction Study

Well	Mean Hydraulic Conductivity (feet/day)		
	Pre-Injection (December 2016)	Pre-Injection (April 2017)	Post-Treatability Study (October/November 2017)
UFIW-01I	9.7	0.3	1.4
UFIW-01D	1.9	--	--
UFIW-02I	1.0	--	--
UFIW-02D	1.4	--	--
UFIW-03I	11.3	--	--
UFIW-03D	7.3	--	--
UFIW-04I	12.9	1.3	1.9
UFIW-04D	4.6	--	--
UFIW-05I	4.9	2.2	0.9
UFIW-05D	0.5	--	--
UFIW-06I	2.5	--	--
UFIW-06D	0.9	--	--
UFIW-07I	3.7	--	--
UFIW-07D	2.1	--	--
UFIW-08I	2.7	0.4	0.4
UFIW-08D	1.2	--	--
UFMW-01I	1.3	1.9	1.9
UFMW-01D	1.8	--	3.0
UFMW-02I	1.0	--	1.1
UFMW-02D	1.1	--	1.4
UFMW-03I	1.8	1.6	1.8
UFMW-03D	1.5	--	1.8
UFMW-04I	2.6	3.4	4.8
UFMW-04D	4.6	--	5.4
UFMW-05I	1.1	--	1.9
UFMW-05D	4.3	--	5.1
UFMW-06I	3.2	3.1	4.8
UFMW-06D	1.2	--	1.0

Based on the slug test results, the estimated Ks are generally consistent with the lithologies observed within the screened interval of the wells: primarily silty sand to sandy silt. Prior estimates of the hydraulic conductivity for the UMCf have ranged from less than 0.01 ft/d to more than 10 ft/d. The estimates from the chemical reduction study area slug tests ranged from 0.3 to 12.9 ft/d, which are consistent with the previous estimated range for the UMCf. In addition, data from the injection testing in the chemical reduction study area confirmed that many of the wells were capable of sustaining injection rates of 1-3 gallons per minute each (Section 4.2.5), which is consistent with likely injection rates based on the hydraulic conductivity range estimated from slug testing. Results of the specific capacity tests revealed that the specific capacity K estimates in intermediate well UFIW-06I are similar to the corresponding slug test K estimates from the same well. Additionally, the specific capacity test results from the shallow wells are likely to be heavily influenced by saturated thickness, since less than 2 feet of saturated thickness exists in the shallow wells. Therefore, the specific capacity K estimates from the shallow wells are not likely representative of the overall K of the Qal.

Based on the data, a decrease in K was observed in several injection wells, including UFIW-01I, UFIW-04I, UFIW-05I, and UFIW-08I, where post-injection K values were calculated to be approximately an order of magnitude lower (UFIW-01I and UFIW-04I) than pre-injection K values. Post-injection K values for wells UFIW-05I and UFIW-08I also showed small decreases compared with the corresponding pre-injection K values. However, no significant changes were observed between the K estimates before and after injection occurred in the monitoring wells tested, indicating any decreases in K associated with injection testing were likely limited to the immediate vicinity of the injection wells.

6.0 SUMMARY OF KEY FINDINGS

This section presents a summary of the key findings of the biological and chemical reduction studies and also provides considerations for large-scale implementation of in-situ remediation of hexavalent chromium and other COPCs within the treatability study areas.

6.1 BIOLOGICAL REDUCTION STUDY

The following list provides several key findings of the biological reduction study.

- Carbon substrates can be successfully injected into the Qal through the use of permanent injection wells. Within the Qal, injection flow rates ranged from 1.3 to 4.7 gpm and injection pressures ranged from 0 to 20 psig. Injection rates and pressures did not significantly change at the injection wells between the three injection events.
- Carbon substrates can be successfully injected into the UMCf through the use of permanent injection wells. Within the UMCf, injection flow rates ranged from 1.2 to 8.6 gpm and injection pressures ranged from 0 to 16 psig. Injection rates and pressures did not significantly change at the injection wells between the three injection events.
- Aquifer testing did not indicate a significant change in hydraulic conductivity at the injection or downgradient monitoring wells, with the exception of CTIW-02D, which decreased from approximately 1 ft/d to 0.1 ft/d, and CTMW-01S and CTMW-02S, where decreases were largely attributed to a decrease in saturated thickness.
- The biological reduction study demonstrated effective and rapid reduction of hexavalent chromium in groundwater within the Qal (maximum first-order degradation rate of -0.37 day^{-1}). Hexavalent chromium concentrations decreased from approximately 11 mg/L to below 0.01 mg/L in groundwater at four of the six monitoring wells, located up to 34 feet downgradient of the injection wells within approximately 2 months (CTMW-01S, CTMW-02S, CTMW-04S, and CTMW-06S). The hexavalent chromium concentrations in groundwater at four shallow monitoring wells remained below 0.01 mg/L through the end of the treatability study, approximately 6 months following the initial injection event. The significant reduction in hexavalent chromium reduction in groundwater within the Qal is largely attributed to the relatively fast groundwater flow velocity of approximately 5.6 to 13.2 ft/d and the ability to rapidly create and maintain reducing conditions. Monitoring wells CTMW-03S and CTMW-05S, located slightly cross-gradient of the injection wells based on projected groundwater flow directions and therefore apparently located at the western edge of injection influence, did not exhibit the same level of reduction as the other monitoring wells (Figure 7a; Appendix G).
- The biological reduction study also achieved reductions of hexavalent chromium in groundwater within the UMCf. However, these reductions were much slower than and not as extensive as for groundwater within the Qal (maximum first-order degradation rate of -0.005 day^{-1}). At the end of the biological reduction study, approximately 6 months following the initial injection event, the concentrations of hexavalent chromium were still trending downwards in groundwater at several downgradient deep monitoring wells that showed influence of increased TOC (CTMW-01D, CTMW-02D, and CTMW-06D) (Figure 7b; Appendix G). However, groundwater adjacent to the remaining deep wells (CTMW-03D, CTMW-04D, and CTMW-05D) did not show evidence of reductions in hexavalent chromium concentrations. This is likely a result of the slow and non-uniform movement of groundwater within the UMCf at an estimated groundwater flow velocity of approximately 0.14 to 0.46 ft/d.
- In addition to the observed chromium reductions, the biological reduction study achieved effective reduction of perchlorate, chlorate and chloroform in groundwater within the Qal (maximum first-order degradation rates of -0.05 day^{-1}, -0.10 day^{-1}, and -0.02 day^{-1}, respectively). As described above, the rapid

movement of groundwater and TOC in the Qal led to the creation of reducing conditions in groundwater at four of the downgradient monitoring wells (CTMW-01S, CTMW-02S, CTMW-04S, and CTMW-06S) that corresponded to decreases of perchlorate, chlorate, and chloroform in groundwater adjacent to these wells. Groundwater adjacent to wells CTMW-03S and CTMW-05S, located slightly cross-gradient of the injection wells based on projected groundwater flow directions and therefore apparently located at the western edge of the injection influence, did not exhibit the same level of reduction as the other monitoring wells (Figure 8a; Appendix G).

- The biological reduction study also demonstrated some reductions of chlorate and chloroform in groundwater within the UMCf. However, these reductions were not as rapid or as extensive as they were for groundwater within the Qal (maximum first-order degradation rates of -0.002 day^{-1} and -0.002 day^{-1}, respectively). At the end of the biological reduction study, the concentrations of chlorate were still trending downwards in groundwater adjacent to three deep monitoring wells (CTMW-01D, CTMW-02D, and CTMW-06D), all of which showed an influence of increased TOC from the study. It is anticipated the perchlorate and chloroform would degrade following hexavalent chromium, nitrate, and chlorate degradation. Groundwater adjacent to the remaining monitoring wells (CTMW-03D, CTMW-04D, and CTMW-05D) did not show increased TOC concentrations and did not exhibit reduction of chlorate, perchlorate, or chloroform, likely due to being located at the western edge of the injection influence (Figure 8b; Appendix G).

6.2 CHEMICAL REDUCTION STUDY

The following are key findings of the chemical reduction study:

- CPS (10% solution by weight) can be successfully injected into the Qal and UMCf through the use of permanent injection wells. Within the Qal, injection flow rates ranged from 4.5 to 4.6 gpm and injection pressures ranged from 5 to 22 psig. Within the UMCf, injection flow rates ranged from 4.1 to 5.6 gpm and injection pressures ranged from 1 to 17 psig.
- The chemical reduction study demonstrated hexavalent chromium reduction in groundwater within the UMCf but not within the Qal. Within the UMCf, hexavalent chromium concentrations decreased by 67% to 99% in groundwater at five of the six intermediate monitoring wells when compared to baseline concentrations. Within the Qal, hexavalent chromium concentrations were reduced in groundwater at only one of the six shallow monitoring wells when compared to baseline concentrations. The limited reduction in hexavalent chromium concentrations within the Qal is largely attributed to the limited water present in the Qal, with three of the six shallow monitoring wells going dry by the final sampling event conducted in October 2017, as well as the low baseline concentrations.

6.3 COST CONSIDERATIONS FOR IMPLEMENTATION

The In-situ Chromium Treatability Study provided information useful for developing preliminary indications of the costs of future implementation. As requested by NDEP, these preliminary indications are presented in the following subsections, but are subject to significant revision during the Feasibility Study (FS). During the FS, NERT will evaluate the applicability of a variety of remedial technologies in order to achieve the RAOs established for the Site. If in-situ biological reduction of hexavalent chromium and other COPCs is selected as a component of the Final Remedy, a detailed cost estimate will be prepared.

6.3.1 Treatability Study Cost Summary

Table 31 provides a high-level cost summary for implementation of this treatability study which was completed within the approved budget. It should be noted that costs for treatability studies can vary tremendously and are directly related to the type of study, extent of monitoring, and length of the study. Data obtained and costs incurred during the treatability study will be used to inform the development of alternative costs in the FS; however, due to the nature of treatability studies, costs are inherently higher than likely larger scale operations, and cannot be easily extrapolated to represent larger-scale system design, installation, and operational costs. These costs for implementing the treatability study should not be used for developing full-scale implementation costs on a per-well basis. For example, treatment footprints, durations, and associated operational costs will vary significantly depending on the specific risk-based remedial action goals established during the FS and other alternative implementation and operational variables that have not yet been defined.

Table 31 In-Situ Chromium Treatability Study Cost Summary

Task	Approximate Cost
Work Plan Preparation	$100,000
Initial Field and Bench-Scale Studies	$300,000
Design and Permitting	$100,000
Injection and Monitoring Well Installation	$250,000
Carbon Substrate Injections	$250,000
Groundwater Monitoring and Aquifer Testing	$250,000
Data Analysis and Reporting	$200,000
Well Abandonment	$50,000
Total	**$1,500,000**

6.3.2 Preliminary Indications of Costs for In-situ Biological Reduction

Based on the findings of this treatability study, an in-situ biological approach would be preferred over a chemical reduction approach. Accordingly, the preliminary indications of costs provided in this section represent estimates for the implementation of in-situ biological reduction and should not be considered highly accurate remediation cost estimates.

Detailed costs will vary significantly depending on the RAOs for the Site and other variables of the final remedy that have not yet been defined. These include, but are not limited to, the following:

- Extent of areas selected for in-situ biological reduction;
- Depths in each area selected for in-situ biological reduction;
- Presence of buildings or other surface structures in the selected areas which make the installation of and access to injection wells more difficult; and,
- Extent to which soil flushing will be implemented in the selected areas, which will tend to reduce the cost of remediation of the Qal.

As discussed above, there are many factors that require further analysis in order to more accurately estimate the cost of implementing in-situ biological reduction of hexavalent chromium and other COPCs at the NERT site. Similarly, it is not traditionally the objective of a treatability study to estimate the cost of a remedial technology. NERT is still conducting the Remedial Investigation, and the FS has not begun. During the FS, NERT will evaluate the applicability of a variety of remedial technologies in order to achieve the RAOs established for the Site. Accordingly, the cost estimates provided in this section are subject to significant revision during the FS. The cost estimates provided herein are considered to have an accuracy range of approximately -50% / +100%, typical of conceptual-level estimates. All estimates are in 2017 dollars.

As described, there are several important considerations with respect to the implementation and costs for in-situ biological reduction of hexavalent chromium and other COPCs. The most important considerations relate to the final RAOs and the implementation configuration, areal extent and depths.

For the configuration of in-situ biological reduction transects designed to contain downgradient migration, it is estimated that the design, installation, and startup costs per 1,000 linear feet of transect could be approximately $300,000 to $1,200,000, and the operating costs could be approximately $150,000 to $600,000 per year per 1,000 linear feet of transect. The duration of the operations would be influenced by the number of transects. For example, a single transect might have an indefinite period of operations, because its duration would be controlled by the very slow rate at which COPCs would naturally leach through and out of the UMCf. On the other hand, if transects were installed at varying distances, such as every 100 feet across the plume, the duration of operation might be reduced.

These estimates are based on the following design concepts and assumptions:

- Maximum well depth of 60 feet bgs;
- Twenty to thirty injection wells installed at shallow and deep depths;
- Two batch injections per year (after initial year which will have four injections); and,
- Groundwater sampling conducted at five wells every quarter.

For the configuration of an in-situ biological reduction grid-type design intended to emphasize source control or reduction in addition to plume containment, it is estimated that the design, installation and start-up costs could be approximately $400,000 to $1,200,000 per acre and the operating costs could be approximately $100,000 to $400,000 per year per acre. The annual costs would tend to be higher initially and then stabilize once a biologically activated zone is established in the subsurface and less frequent re-injections are needed. The duration of the operation would be influenced by the RAO expectations for source control or reduction. It would also be influenced by whether the grid design is applied extensively enough to eliminate COPCs from migrating from upgradient into areas treated by the grid.

These estimates are based on the following design concepts and assumptions:

- Maximum well depth of 60 feet bgs;
- 27 injection wells installed at shallow and deep depths per acre (approximately 40-foot spacing);
- Two batch injections per year (after initial year which will have four injections);
- Groundwater sampling conducted at two wells every quarter per acre; and
- 50 or more acres.

An alternate configuration of implementing a hybrid in-situ biological reduction and groundwater extraction approach to enhance in-situ mixing of carbon substrate and COPCs in groundwater, such as what is being evaluated as part of the Unit 4 Source Area In-Situ Bioremediation Treatability Study, could significantly improve the effectiveness of in-situ biological reduction in the UMCf and reduce its duration of operation and overall cost. However, this concept is outside the scope of the cost projections provided above.

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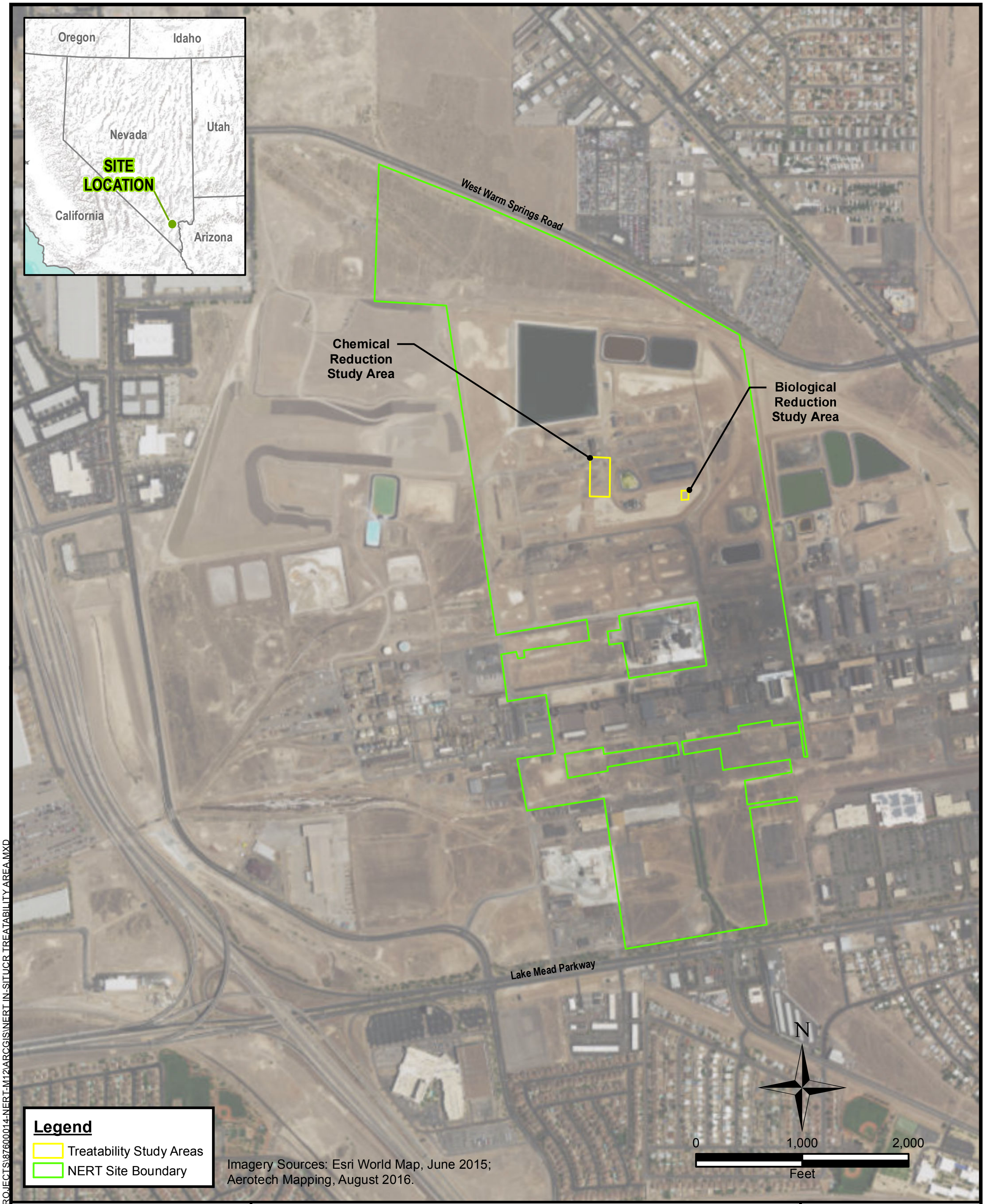
Figures



Imagery Sources: Esri World Map, June 2015;
Aerotech Mapping, August 2016.

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NEVADA ENVIRONMENTAL RESPONSE TRUST SITE

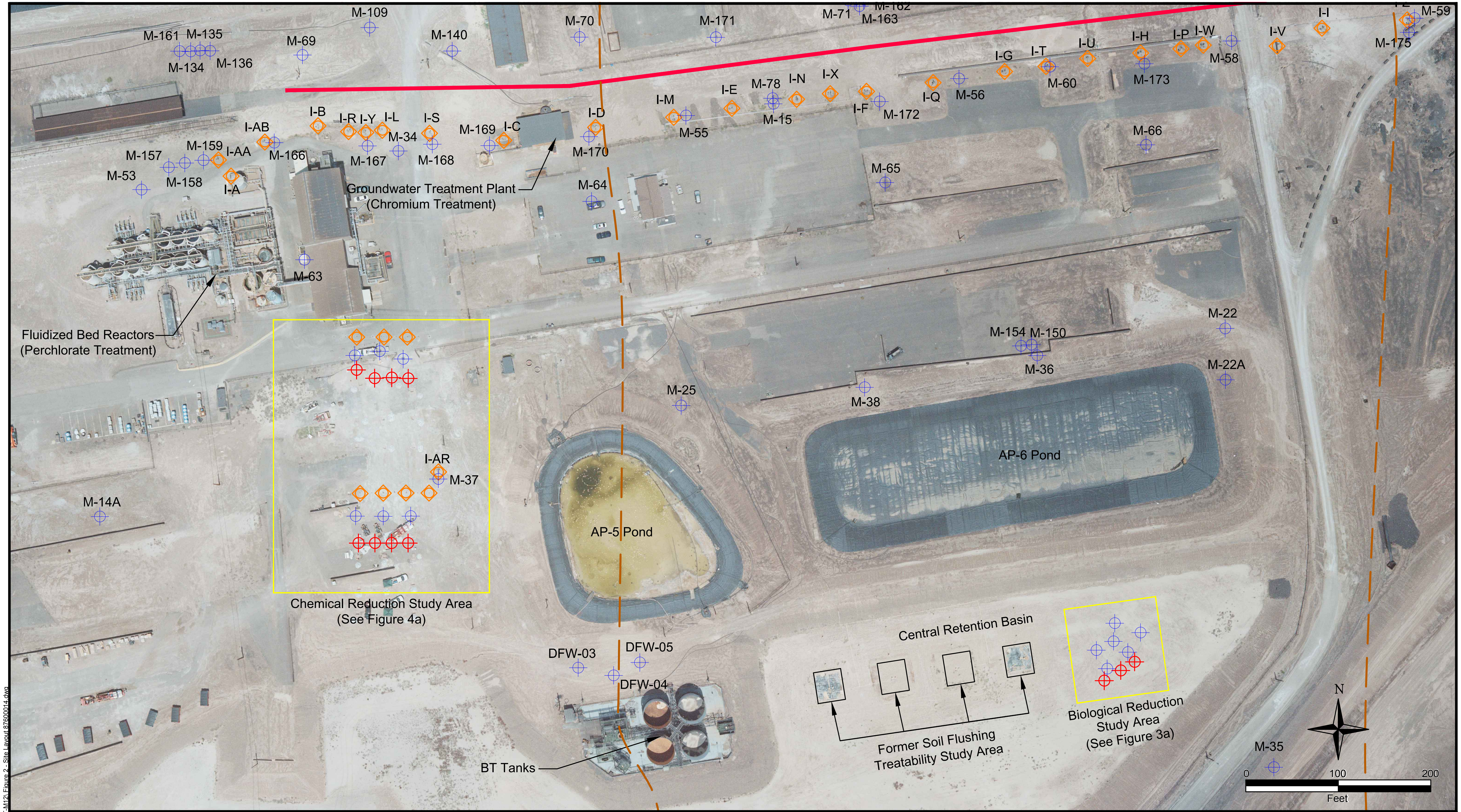
IN-SITU CHROMIUM TREATABILITY STUDY

SITE LOCATION MAP

Project No.: 87600014
Date: NOVEMBER 17, 2017
Designed By: KL

Figure No.
1

\\TTS318FS1.TT.LOCAL\GIS\PROJECTS\87600014-NERT-M12\ARCGIS\NERT IN-SITUCR TREATABILITY AREA.MXD



Legend

⌖	Monitoring Well	—	Treatability Study Areas
⌖	Injection Well Cluster		
◇	Extraction Well		
▬	Groundwater Barrier Wall		
- - -	Approximate Location of Paleochannels (Ramboll Environ, 2015)		

Note:
1. Imagery Source: Aerotech Mapping, August 2016.

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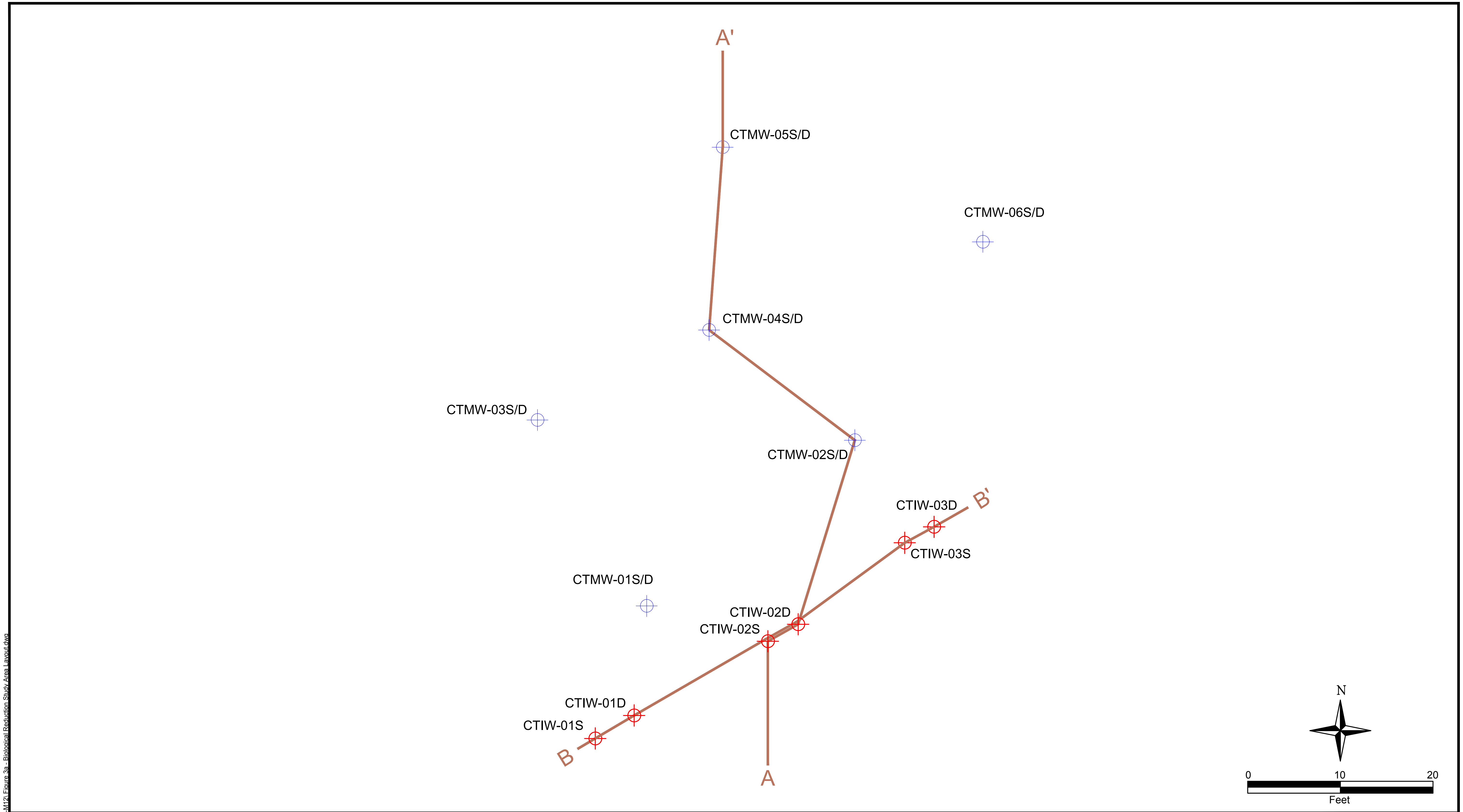
NEVADA ENVIRONMENTAL RESPONSE TRUST SITE

IN-SITU CHROMIUM TREATABILITY STUDY

SITE LAYOUT

Project No:	87600014
Date:	NOVEMBER 17, 2017
Designed By:	DVK
Figure No.	2

\\tts318fs3\.tt.local\ces\87600014-NERT-M12\ Figure 2 - Site Layout 87600014.dwg



Legend

CTMW-03S/D ⌖	Monitoring Well (Dual Completion)	Qal	Quaternary Alluvium
CTIW-01D ⌖	Injection Well (Single Completion)	UMCf	Upper Muddy Creek Formation
S	Shallow Well (Screened in Qal)		
D	Deep Well (Screened in UMCf)		
A——A'	Cross-section Line		

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NEVADA ENVIRONMENTAL RESPONSE TRUST SITE

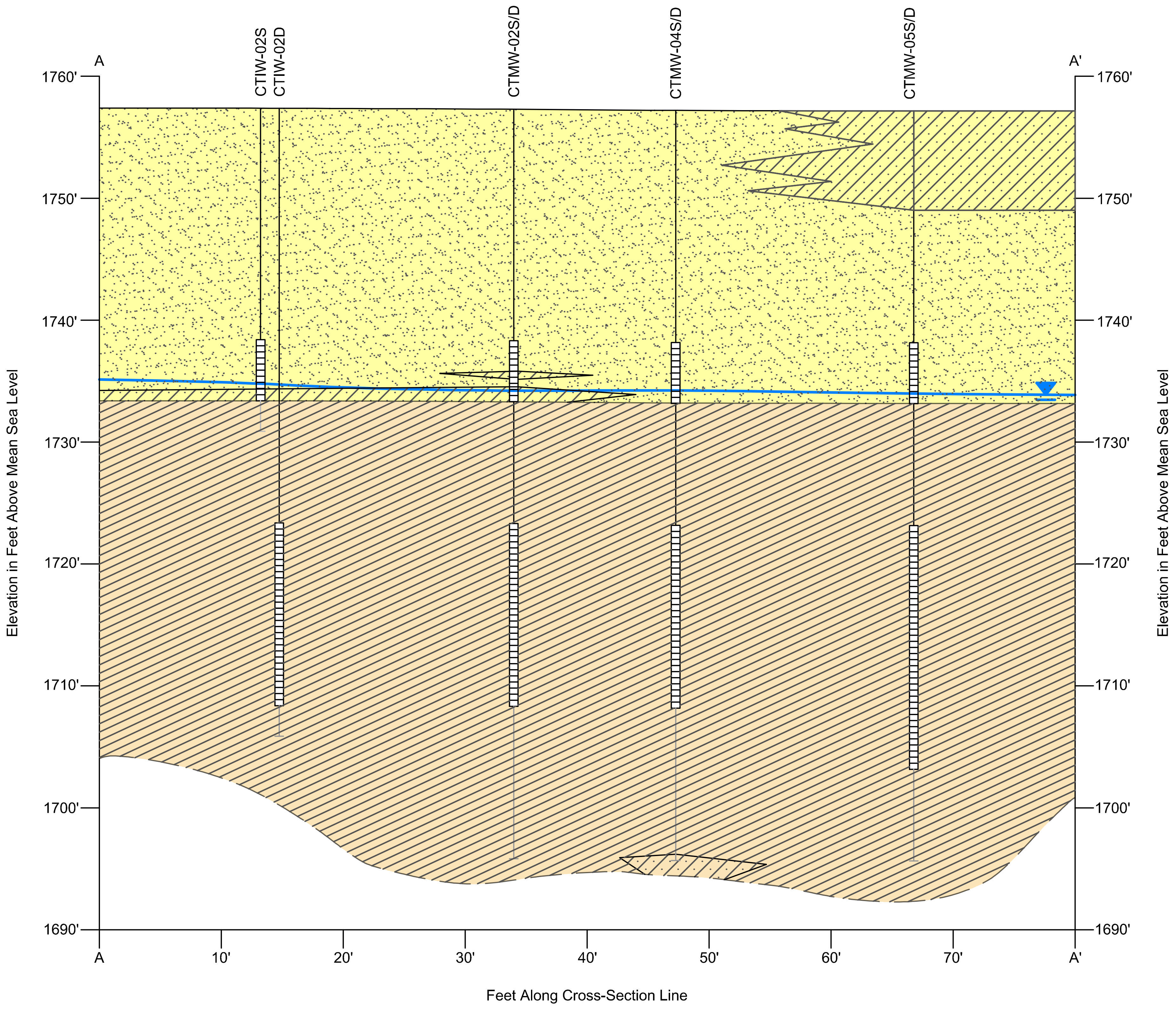
IN-SITU CHROMIUM TREATABILITY STUDY

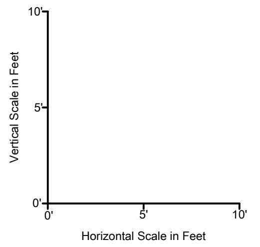
BIOLOGICAL REDUCTION STUDY AREA LAYOUT

Project No:	87600014
Date:	NOVEMBER 17, 2017
Designed By:	DVK

Figure No.
3a

\\tts318fs3\.tt.local\ces\87600014-NERT-M12\ Figure 3a - Biological Reduction Study Area Layout.dwg



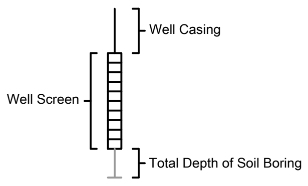


Legend

🟨	Quaternary Alluvium (Qal)
🟧	Upper Muddy Creek Formation (UMCf)
⬛	Sand
▨	Silty Sand
▨	Silt

▼	Groundwater Elevation
S	Shallow Well (Screened in Qal)
D	Deep Well (Screened in UMCf)

Injection / Monitoring Well



Note:

1. Groundwater elevations shown were measured in October 2017 as part of the Performance Monitoring Event #8; baseline groundwater elevations not depicted because the third phase of monitoring wells had not yet been installed.

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NEVADA ENVIRONMENTAL RESPONSE TRUST SITE

IN-SITU CHROMIUM TREATABILTY STUDY

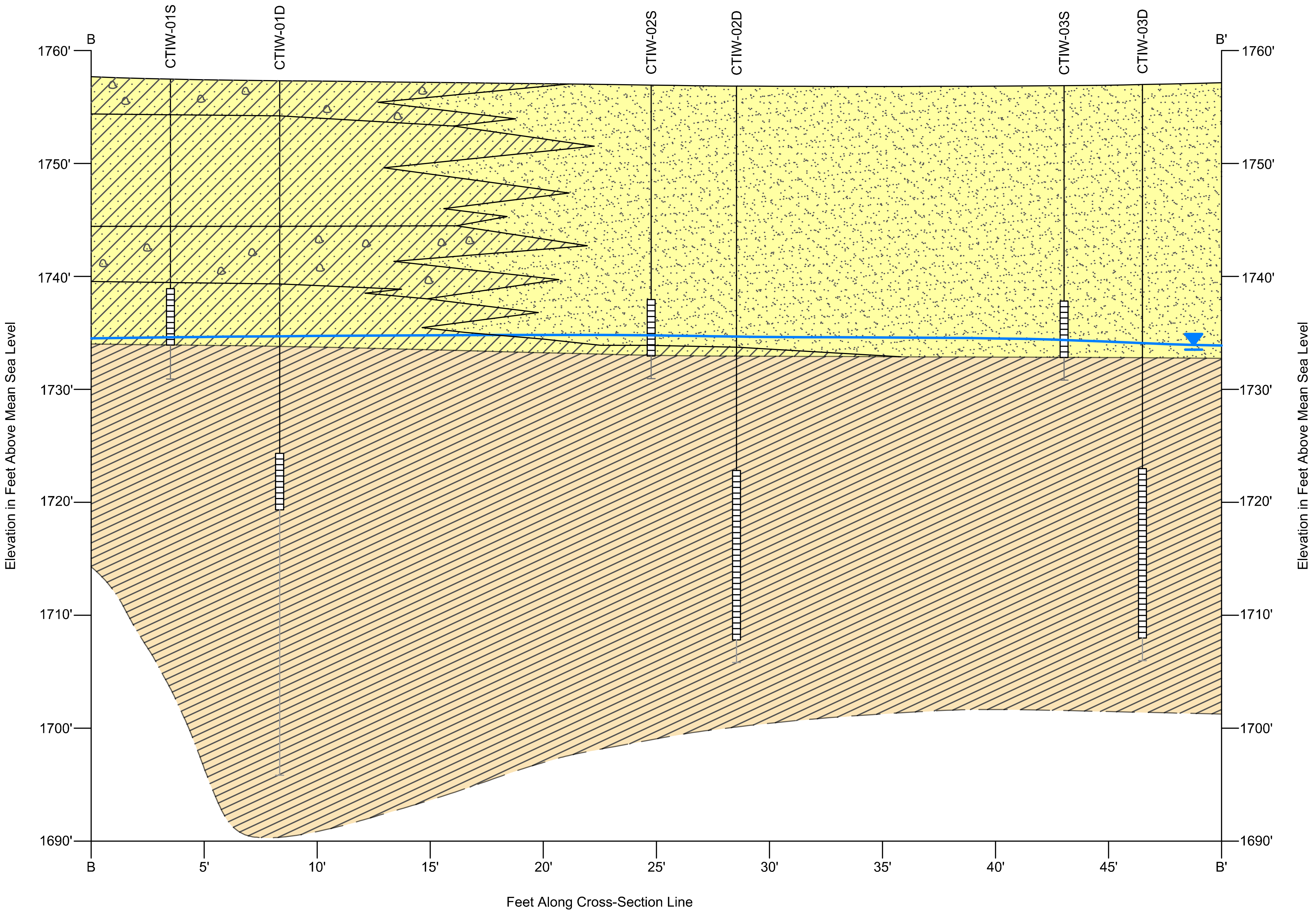
BIOLOGICAL REDUCTION STUDY AREA CROSS-SECTION A-A'

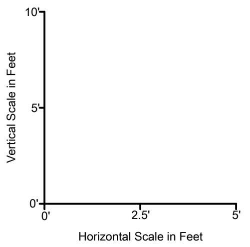
Project No:	87600014
Date:	JUNE 19, 2018
Designed By:	JRL

Figure No.

3b

\\tts318fs1\.tt.local\ces\ 87600015-NERT\ Figure 3b - Biological Reduction Study Area Cross-Section A-A' 87600014.dwg

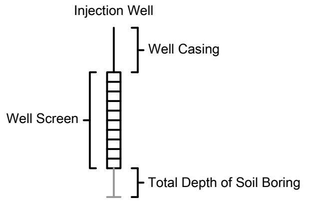




Legend

🟨	Quaternary Alluvium (Qal)
🟧	Upper Muddy Creek Formation (UMCf)
■	Sand
▨	Silty Sand
▨	Silt
▨	Silty Sand with Gravel

▼	Groundwater Elevation
S	Shallow Well (Screened in Qal)
D	Deep Well (Screened in UMCf)



Note:

1. Groundwater elevations shown were measured in October 2017 as part of the Performance Monitoring Event #8; baseline groundwater elevations not depicted because the third phase of monitoring wells had not yet been installed.

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NEVADA ENVIRONMENTAL RESPONSE TRUST SITE

IN-SITU CHROMIUM TREATABILTY STUDY

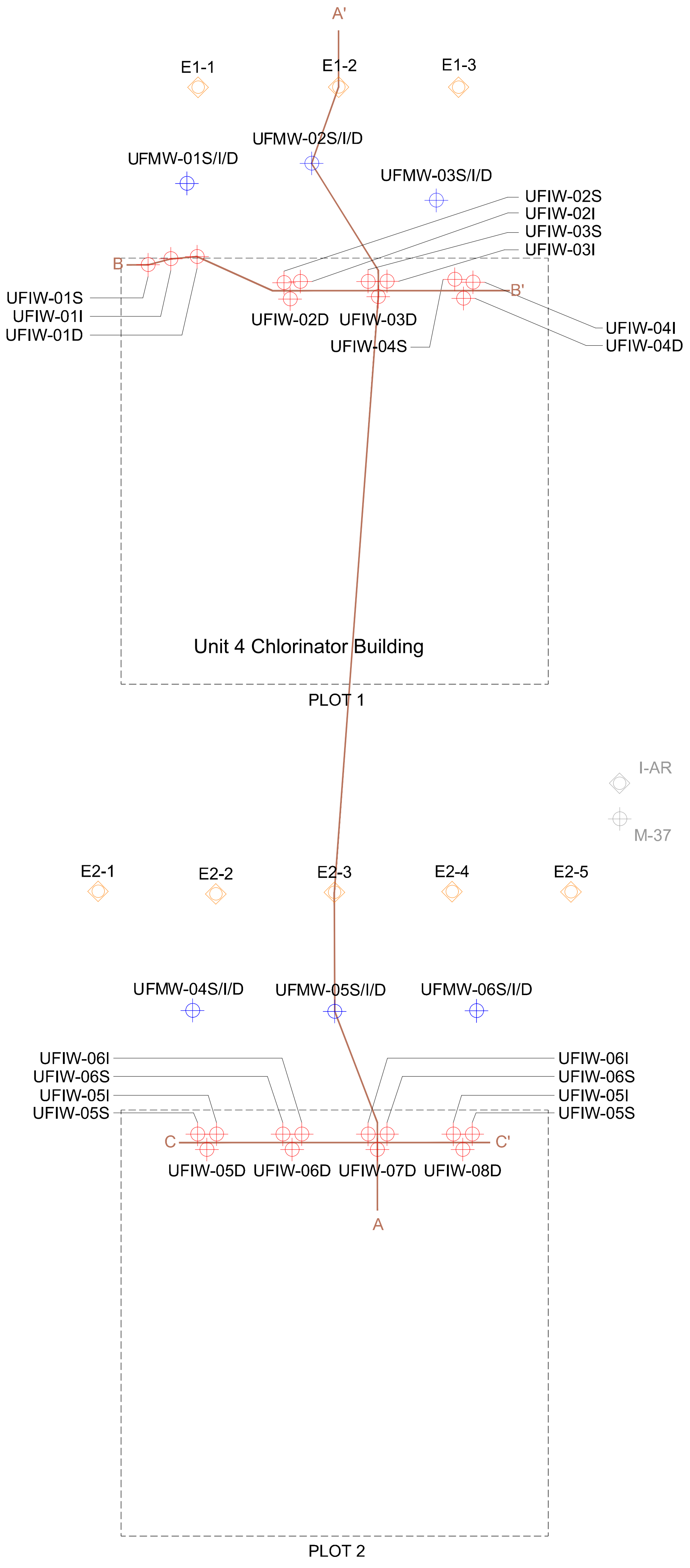
BIOLOGICAL REDUCTION STUDY AREA CROSS-SECTION B-B'

Project No:	87600014
Date:	JUNE 19, 2018
Designed By:	JRL

Figure No.

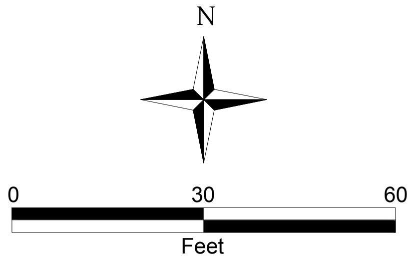
3c

\\tts318fs1\ tt.local\ces\ 87600015-NERT\ Figure 3c - Biological Reduction Study Area Cross-Section B-B' 87600014.dwg



Legend

UFMW-02S/I/D ⊕	Monitoring Well (Triple Completion)
CTIW-01D ⊕	Injection Well (Single Completion)
E1-2 ◇	Extraction Well (Not Associated with Chemical Reduction Test)
M-37 ⊕	Monitoring Well (Not Associated with Chemical Reduction Test)
I-AR ◇	IWF Extraction Well (Not Associated with Chemical Reduction Test)
A—A'	Cross-section Line
S	Shallow Well (Screened in Qal)
I	Intermediate Well (Screened in UMCf)
D	Deep Well (Screened in UMCf)
Qal	Quaternary Alluvium
UMCf	Upper Muddy Creek Formation



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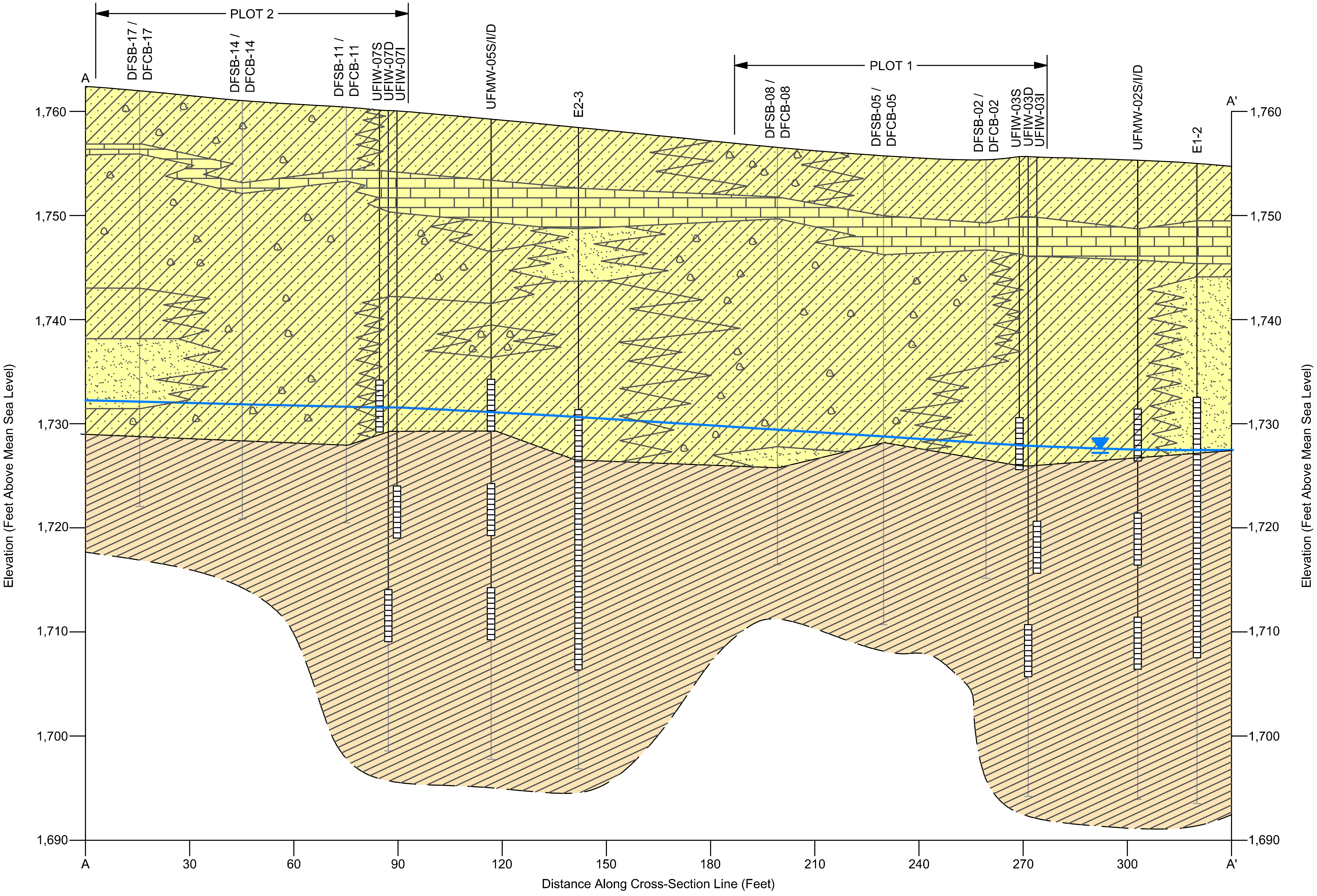
NEVADA ENVIRONMENTAL RESPONSE TRUST SITE

IN-SITU CHROMIUM TREATABILITY STUDY

CHEMICAL REDUCTION STUDY AREA LAYOUT

Project No:	87600014
Date:	NOVEMBER 17, 2017
Designed By:	DVK
Figure No.	**4a**

\\tts318fs3\tt.local\ces\87600014-NERT-M12\ Figure 4a - Chemical Reduction Study Area Layout 87600014.dwg



Legend

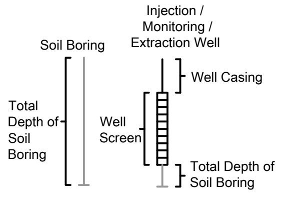
- ▭ Quaternary Alluvium (Qal)
- ▭ Upper Muddy Creek Formation (UMCf)
- ▦ Caliche
- ▨ Silty Sand with Gravel
- ▨ Silty Sand
- ▨ Silt
- ⁘ Sand

Groundwater Elevation

S Shallow Well (Screened in Qal)

I Intermediate Well (Screened in UMCf)

D Deep Well (Screened in UMCf)



Note:

1. Groundwater elevations shown were measured in August 2016 as part of the baseline groundwater monitoring event; recent groundwater elevations not depicted because ongoing groundwater extraction and soil down flushing activities as part of the treatability study have created conditions that are not representative of natural groundwater elevations.
2. AMSL = above mean sea level.
3. 3x Vertical Exageration.

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NEVADA ENVIRONMENTAL RESPONSE TRUST SITE

IN-SITU CHROMIUM TREATABILITY STUDY

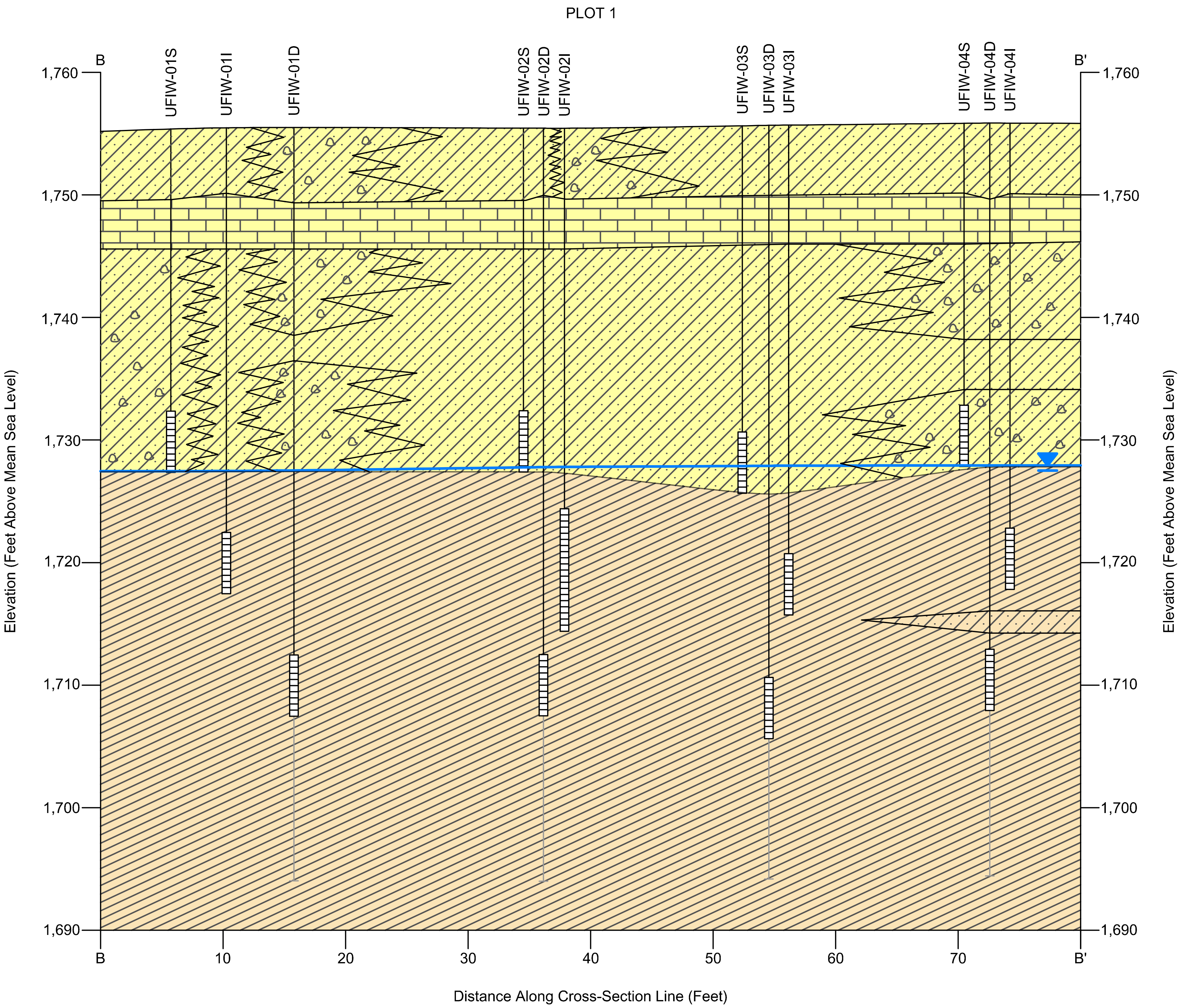
CHEMICAL REDUCTION STUDY AREA CROSS-SECTION A-A'

Project No:	117-7502018
Date:	JUNE 19, 2018
Designed By:	JRL

Figure No.

4b

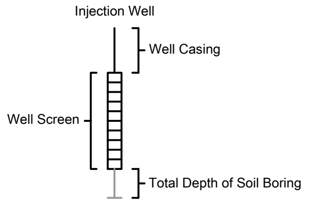
\\tts318fs1\.tt.local\ces\ 87600015-NERT\ FIGURE 4B - GEOLOGICAL CROSS-SECTION A-A' R.dwg



Legend

🟨	Quaternary Alluvium (Qal)
🟧	Upper Muddy Creek Formation (UMCf)
▦	Caliche
▨	Silty Sand with Gravel
▨	Silty Sand
▨	Silt

▼	Groundwater Elevation
S	Shallow Well (Screened in Qal)
I	Intermediate Well (Screened in UMCf)
D	Deep Well (Screened in UMCf)



Note:

1. Groundwater elevations shown were measured in August 2016 as part of the baseline groundwater monitoring event; recent groundwater elevations not depicted because ongoing groundwater extraction and soil down flushing activities as part of the treatability study have created conditions that are not representative of natural groundwater elevations.
2. AMSL = above mean sea level.
3. 3x Vertical Exageration.

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NEVADA ENVIRONMENTAL RESPONSE TRUST SITE

IN-SITU CHROMIUM TREATABILITY STUDY

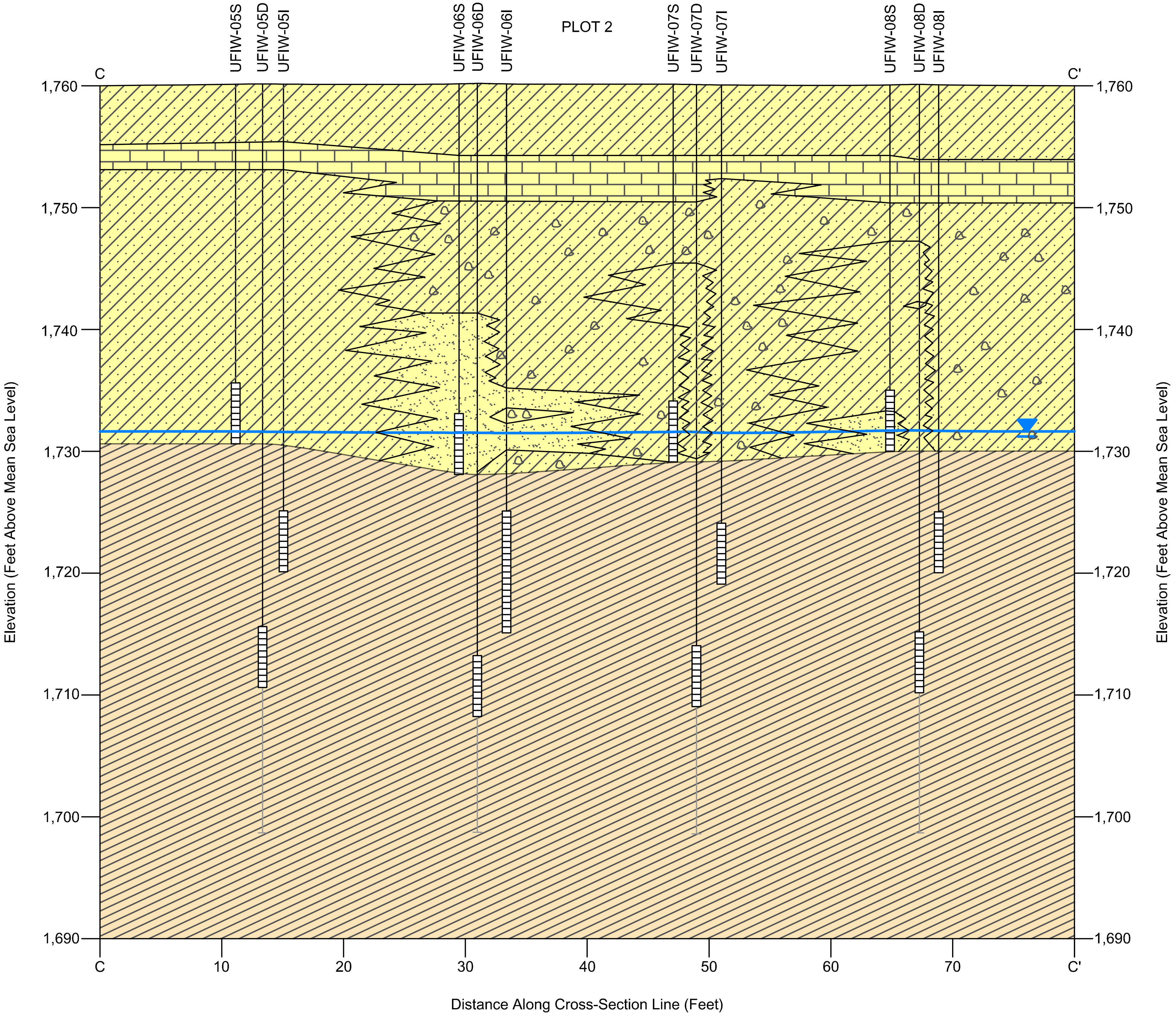
CHEMICAL REDUCTION STUDY AREA CROSS-SECTION B-B'

Project No:	117-7502018
Date:	JUNE 19, 2018
Designed By:	JRL

Figure No.

4c

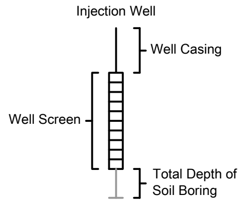
\\tts318fs1\.tt.local\ces\ 87600015-NERT\ FIGURE 4C - GEOLOGICAL CROSS-SECTION B-B'.dwg



\\tts318fs1\.tt.local\ces\ 87600015-NERT\ FIGURE 4D - GEOLOGICAL CROSS-SECTION C-C'.dwg

Legend

🟨	Quaternary Alluvium (Qal)
🟧	Upper Muddy Creek Formation (UMCf)
▦	Caliche
▨	Silty Sand with Gravel
▨	Silty Sand
▨	Silt
⛶	Sand
▢	Gravel
▼	Groundwater Elevation
S	Shallow Well (Screened in Qal)
I	Intermediate Well (Screened in UMCf)
D	Deep Well (Screened in UMCf)



Note:

1. Groundwater elevations shown were measured in August 2016 as part of the baseline groundwater monitoring event; recent groundwater elevations not depicted because ongoing groundwater extraction and soil down flushing activities as part of the treatability study have created conditions that are not representative of natural groundwater elevations.
2. AMSL = above mean sea level.
3. 3x Vertical Exageration.

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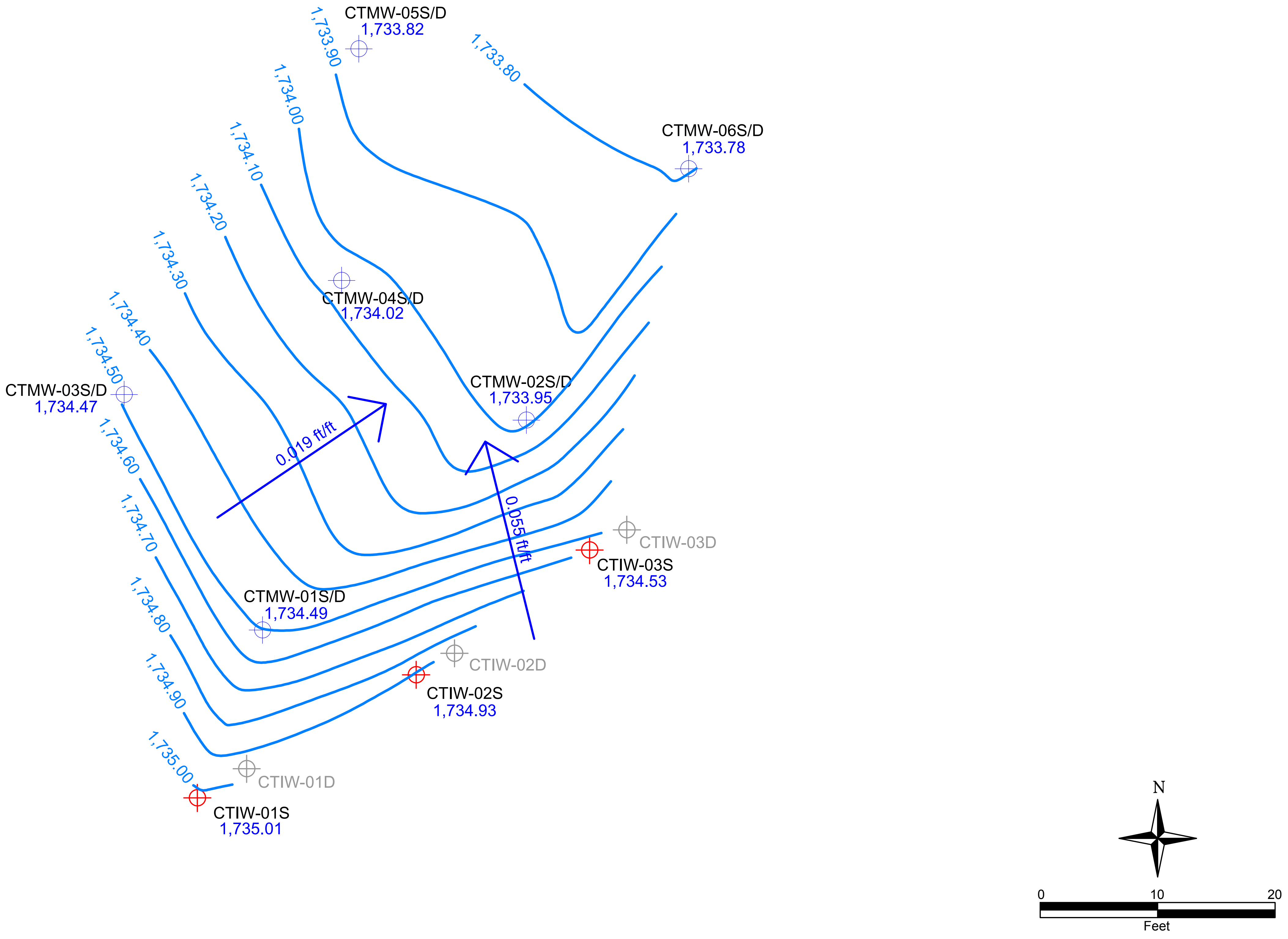
NEVADA ENVIRONMENTAL RESPONSE TRUST SITE

IN-SITU CHROMIUM TREATABILTY STUDY

CHEMICAL REDUCTION STUDY AREA CROSS-SECTION C-C'

Project No:	117-7502018
Date:	JUNE 19, 2018
Designed By:	JRL

Figure No.
4d



Legend

CTMW-03S/D ⊕	Monitoring Well (Dual Completion)	1,735.01	Groundwater Elevation (feet amsl)
CTIW-01S ⊕	Injection Well (Single Completion)	1,735.00 〜	Groundwater Elevation Contour (feet amsl)
CTIW-01D ⊕	Injection Well (Not used for contouring)	0.019 ft/ft →	Flow Direction and Hydraulic Gradient (ft/ft)
S	Shallow Well (Screened in Qal)	Qal	Quaternary Alluvium
D	Deep Well (Screened in UMCf)	UMCf	Upper Muddy Creek Formation
		amsl	Above Mean Sea Level
		ft/ft	Feet per Foot

Notes:

1. Only shallow wells used to develop shallow groundwater contours.
2. Groundwater elevations shown were measured in October 2017 as part of the Performance Monitoring Event #8; baseline groundwater elevations not depicted because the third phase of monitoring wells had not yet been installed.

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NEVADA ENVIRONMENTAL RESPONSE TRUST SITE

IN-SITU CHROMIUM TREATABILITY STUDY

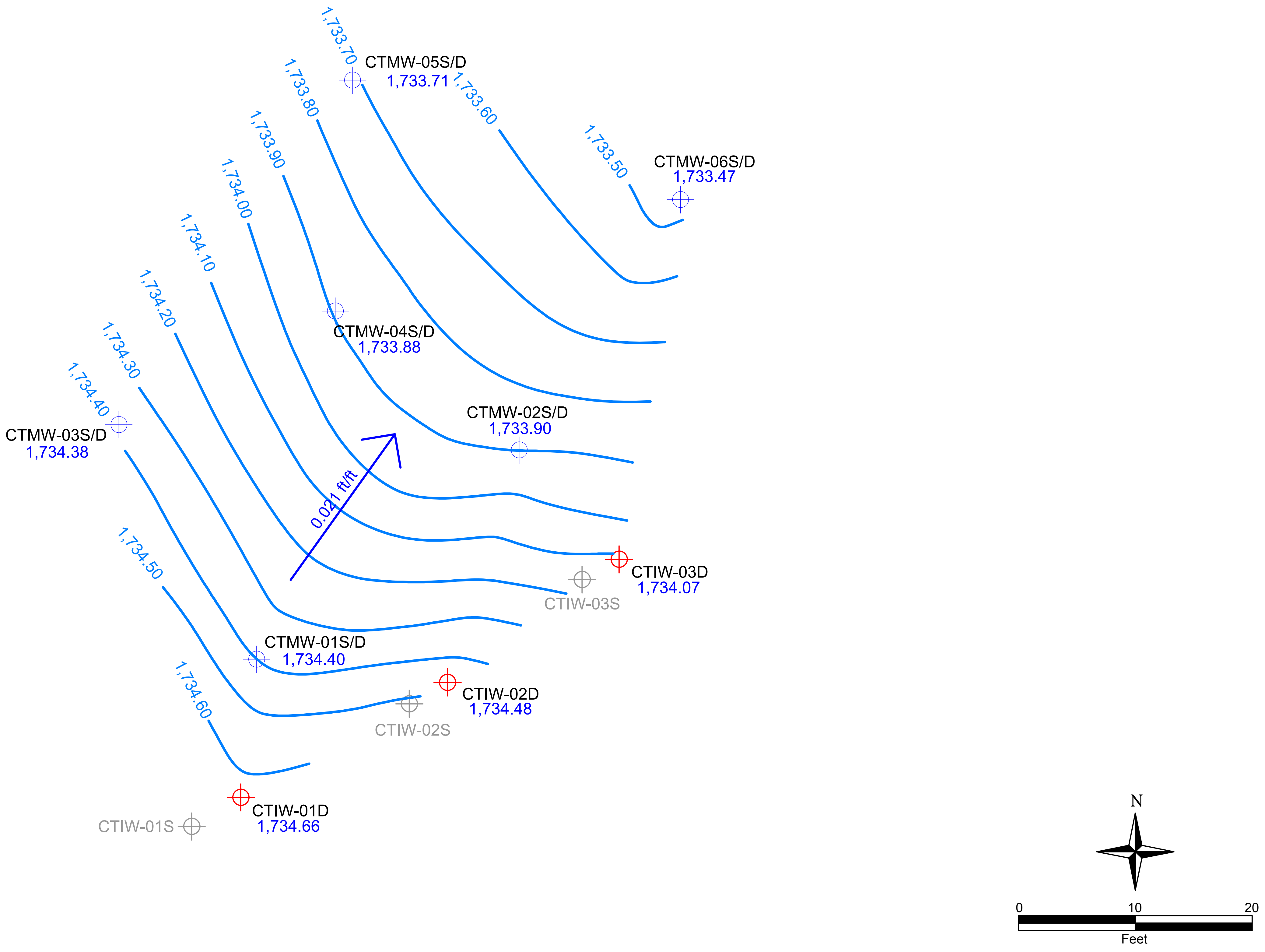
GROUNDWATER CONTOURS AND FLOW DIRECTION - SHALLOW WELLS
OCTOBER 2017
(BIOLOGICAL REDUCTION STUDY AREA)

Project No:	87600014
Date:	NOVEMBER 17, 2017
Designed By:	DVK

Figure No.

5a

\\tts318fs3\.tt.local\ces\87600014-NERT-M12\ Figure 5a - Groundwater Contours and Flow Direction in Shallow Wells - October 2017 (Biological Reduction Study Area).dwg



Legend

CTMW-03S/D	Monitoring Well (Dual Completion)	1,735.01	Groundwater Elevation (feet amsl)
CTIW-01D	Injection Well (Single Completion)	1,735.00	Groundwater Elevation Contour (feet amsl)
CTIW-01S	Injection Well (Not used for contouring)	0.019 ft/ft	Flow Direction and Hydraulic Gradient (ft/ft)
S	Shallow Well (Screened in Qal)	Qal	Quaternary Alluvium
D	Deep Well (Screened in UMCf)	UMCf	Upper Muddy Creek Formation
		amsl	Above Mean Sea Level
		ft/ft	Feet per Foot

Notes:
1. Only deep wells used to develop deep groundwater contours.
2. Groundwater elevations shown were measured in October 2017 as part of the Performance Monitoring Event #8; baseline groundwater elevations not depicted because the third phase of monitoring wells had not yet been installed.

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NEVADA ENVIRONMENTAL RESPONSE TRUST SITE

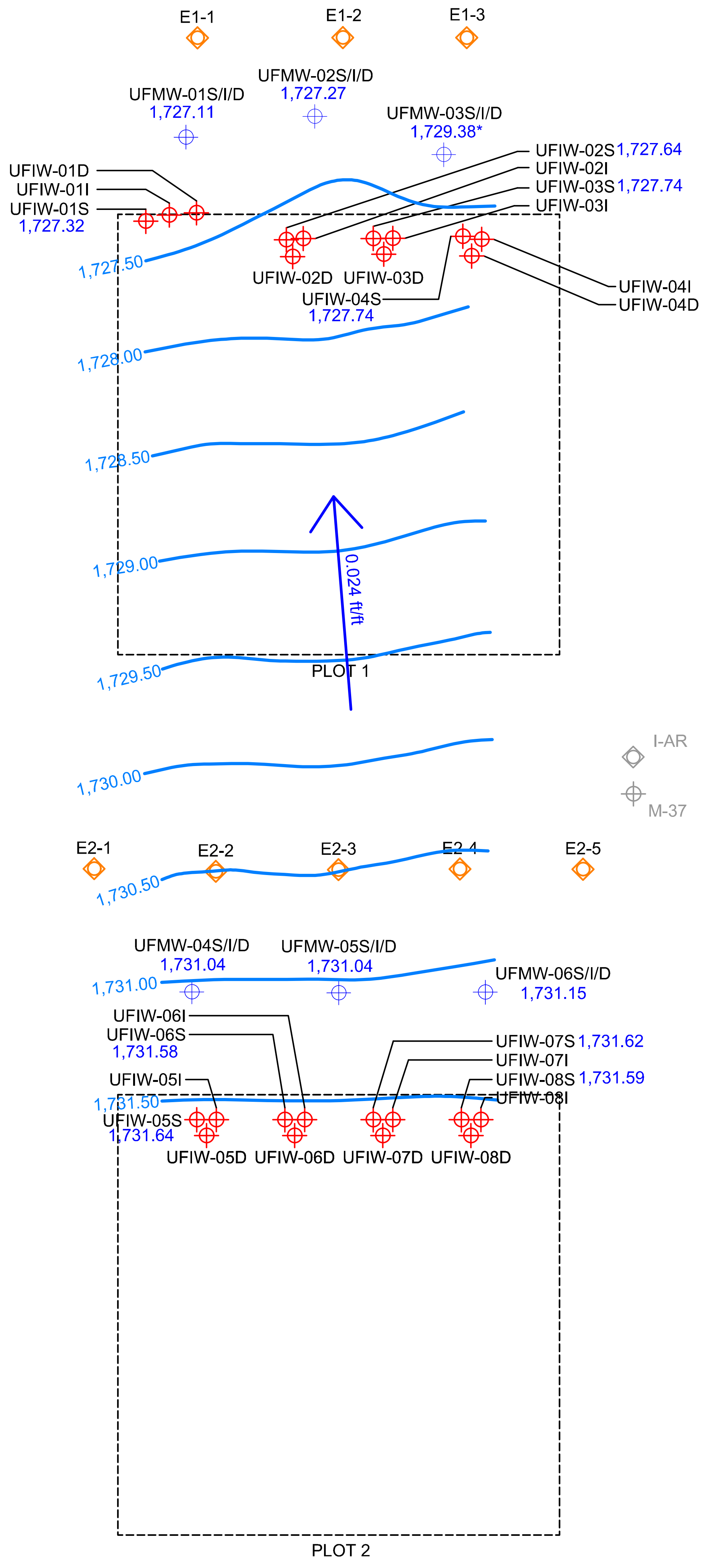
IN-SITU CHROMIUM TREATABILITY STUDY

GROUNDWATER CONTOURS AND FLOW DIRECTION - DEEP WELLS
OCTOBER 2017
(BIOLOGICAL REDUCTION STUDY AREA)

Project No:	87600014
Date:	NOVEMBER 17, 2017
Designed By:	DVK

Figure No.
5b

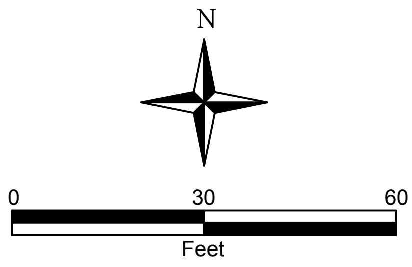
\\tts318fs3\.tt.local\ces\87600014-NERT-M12\ Figure 5b - Groundwater Contours and Flow Direction in Deep Wells - October 2017 (Biological Reduction Study Area).dwg



Legend

UFMW-02S/I/D ⌖	Monitoring Well (Triple Completion)
CTIW-01S ⌖	Injection Well (Single Completion)
E1-2 ◇	Extraction Well (Not Associated with Chemical Reduction Study)
M-37 ⌖	Monitoring Well (Not Associated with Chemical Reduction Study)
I-AR ◇	IWF Extraction Well (Not Associated with Chemical Reduction Study)
1,731.64	Groundwater Elevation (feet amsl)
1,731.50 ∼	Groundwater Elevation Contour (feet amsl)
0.024 ft/ft →	Flow Direction and Hydraulic Gradient (ft/ft)
S	Shallow Well (Screened in Qal)
I	Intermediate Well (Screened in UMCf)
D	Deep Well (Screened in UMCf)
Qal	Quaternary Alluvium
UMCf	Upper Muddy Creek Formation
amsl	Above Mean Sea Level
ft/ft	Feet per Foot
*	Groundwater elevation not used in developing contours

Notes:
1. Only shallow wells were used to develop shallow groundwater contours.
2. Groundwater elevations shown were measured in August 2016; recent groundwater elevations not depicted because ongoing groundwater extraction and soil flushing activities as part of the AP Area Treatability Study have created conditions that are not as representative of natural groundwater elevations.



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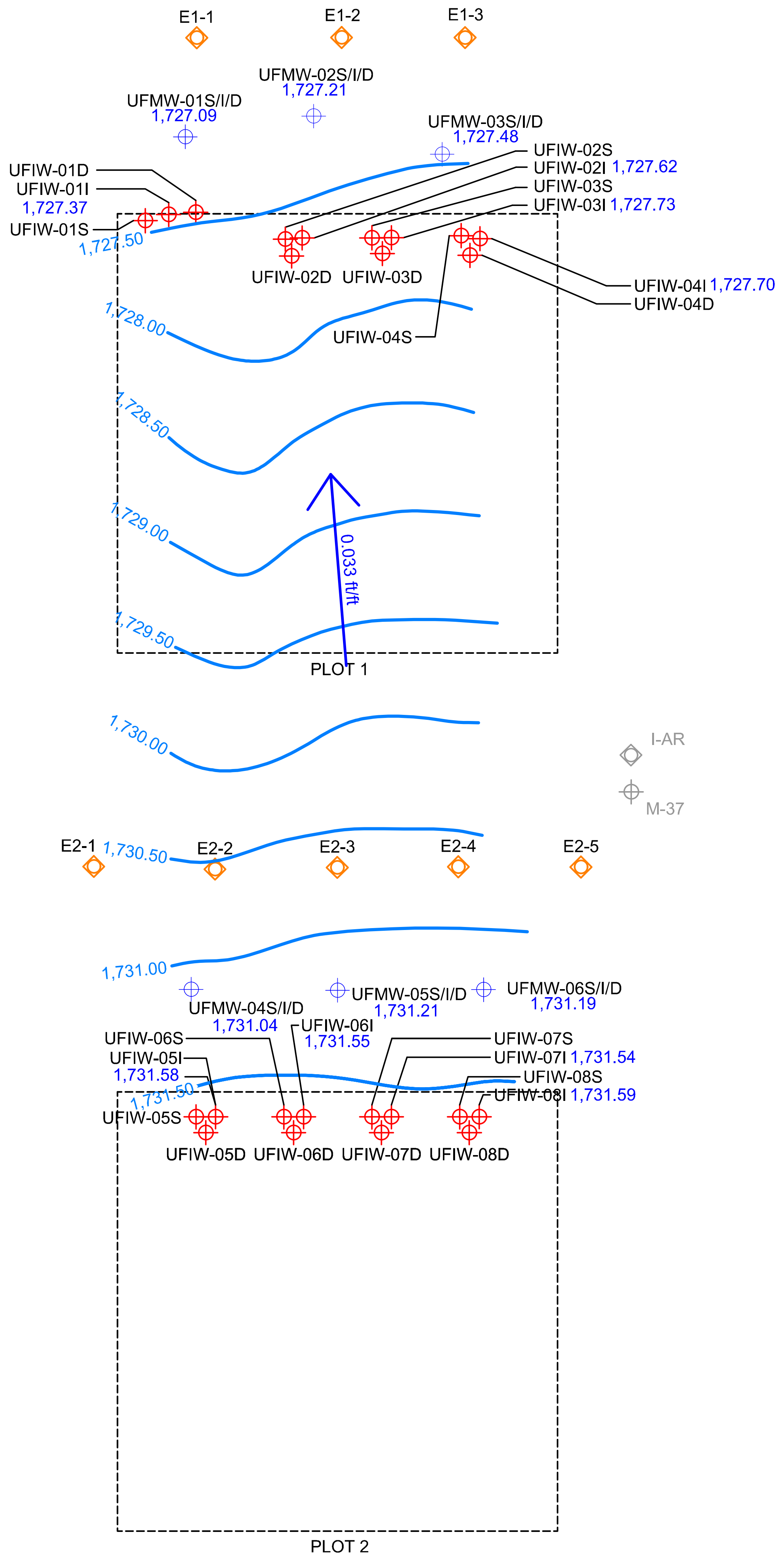
NEVADA ENVIRONMENTAL RESPONSE TRUST SITE

IN-SITU CHROMIUM TREATABILITY STUDY

GROUNDWATER CONTOURS AND FLOW DIRECTION - SHALLOW WELLS
AUGUST 2016
(CHEMICAL REDUCTION STUDY AREA)

Project No: 87600014
Date: NOVEMBER 17, 2017
Designed By: DVK
Figure No.
6a

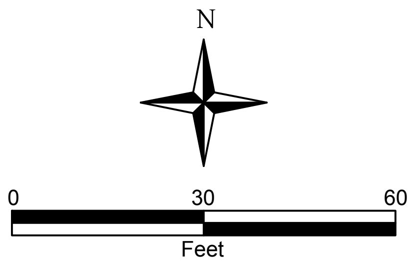
\\tts318fs3\tt.local\ces\87600014-NERT-M12\ Figure 6a - Groundwater Contours and Flow Direction - Shallow Wells - August 2016 (Chemical Reduction Study)_recover.dwg



Legend

UFMW-02S/I/D ⊕	Monitoring Well (Triple Completion)
CTIW-01S ⊕	Injection Well (Single Completion)
E1-2 ◇	Extraction Well (Not Associated with Chemical Reduction Study)
M-37 ⊕	Monitoring Well (Not Associated with Chemical Reduction Study)
I-AR ◇	IWF Extraction Well (Not Associated with Chemical Reduction Study)
1,731.58	Groundwater Elevation (feet amsl)
1,731.50 ~	Groundwater Elevation Contour (feet amsl)
0.033 ft/ft →	Flow Direction and Hydraulic Gradient (ft/ft)
S	Shallow Well (Screened in Qal)
I	Intermediate Well (Screened in UMCf)
D	Deep Well (Screened in UMCf)
Qal	Quaternary Alluvium
UMCf	Upper Muddy Creek Formation
amsl	Above Mean Sea Level
ft/ft	Feet per Foot

Notes:
1. Only intermediate wells were used to develop intermediate groundwater contours.
2. Groundwater elevations shown were measured in August 2016; recent groundwater elevations not depicted because ongoing groundwater extraction and soil flushing activities as part of the AP Area Treatability Study have created conditions that are not as representative of natural groundwater elevations.



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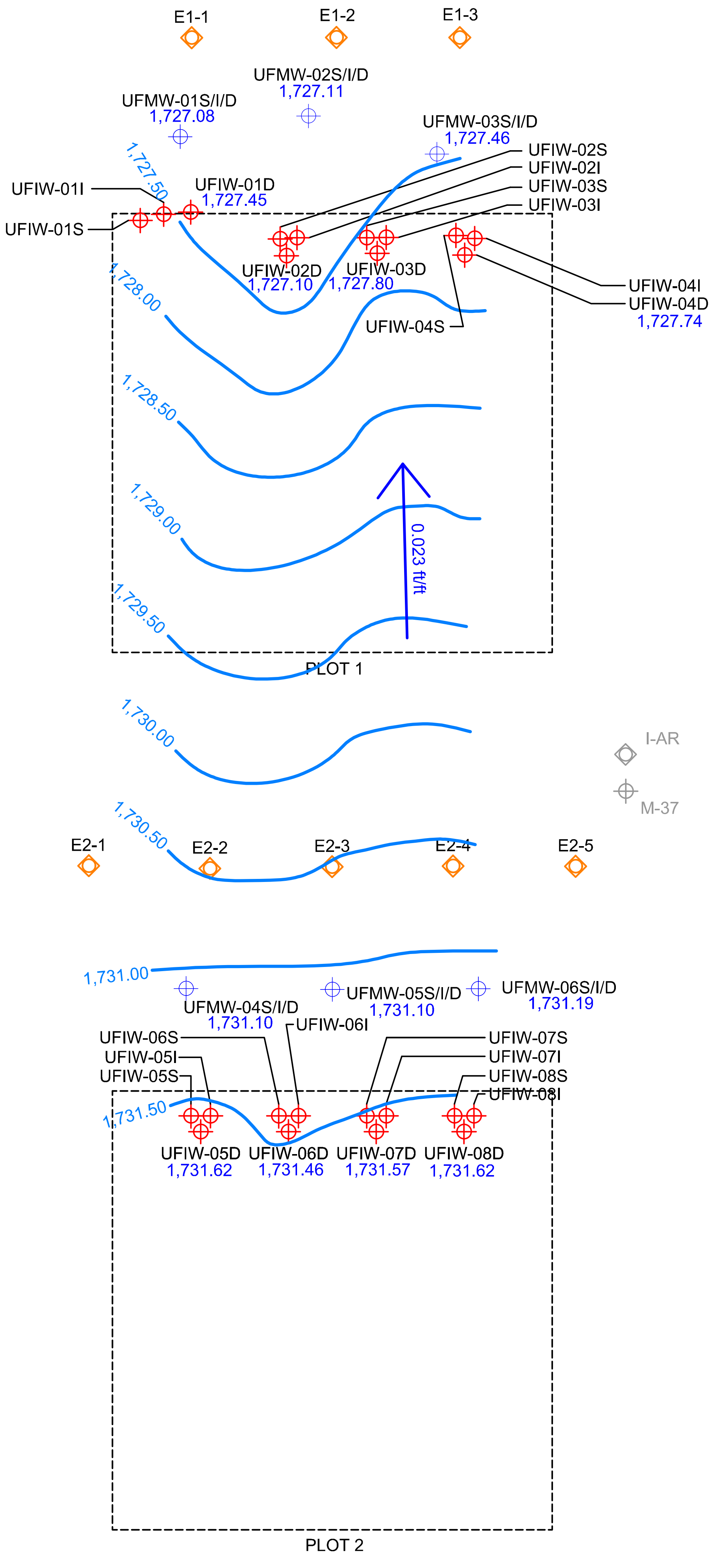
NEVADA ENVIRONMENTAL RESPONSE TRUST SITE

IN-SITU CHROMIUM TREATABILITY STUDY

GROUNDWATER CONTOURS AND FLOW DIRECTION - INTERMEDIATE WELLS
AUGUST 2016
(CHEMICAL REDUCTION STUDY AREA)

Project No:	87600014
Date:	NOVEMBER 17, 2017
Designed By:	DVK
Figure No.	6b

\\tts318fs3\.tt.local\ces\87600014-NERT-M12\ Figure 6b - Groundwater Contours and Flow Direction - Intermediate Wells - August 2016 (Chemical Reduction Study).dwg

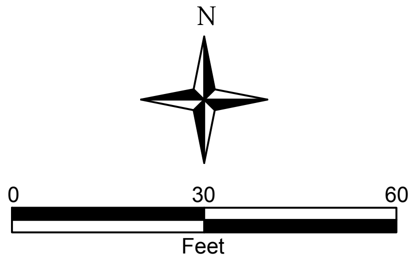


Legend

UFMW-02S/I/D ⊕	Monitoring Well (Triple Completion)
CTIW-01S ⊕	Injection Well (Single Completion)
E1-2 ◇	Extraction Well (Not Associated with Chemical Reduction Study)
M-37 ⊕	Monitoring Well (Not Associated with Chemical Reduction Study)
I-AR ◇	IWF Extraction Well (Not Associated with Chemical Reduction Study)
1,731.62	Groundwater Elevation (feet amsl)
1,731.50 ～	Groundwater Elevation Contour (feet amsl)
0.023 ft/ft →	Flow Direction and Hydraulic Gradient (ft/ft)
S	Shallow Well (Screened in Qal)
I	Intermediate Well (Screened in UMCf)
D	Deep Well (Screened in UMCf)
Qal	Quaternary Alluvium
UMCf	Upper Muddy Creek Formation
amsl	Above Mean Sea Level
ft/ft	Feet per Foot

Notes:

1. Only deep wells were used to develop deep groundwater contours.
2. Groundwater elevations shown were measured in August 2016; recent groundwater elevations not depicted because ongoing groundwater extraction and soil flushing activities as part of the AP Area Treatability Study have created conditions that are not representative of natural groundwater elevations.



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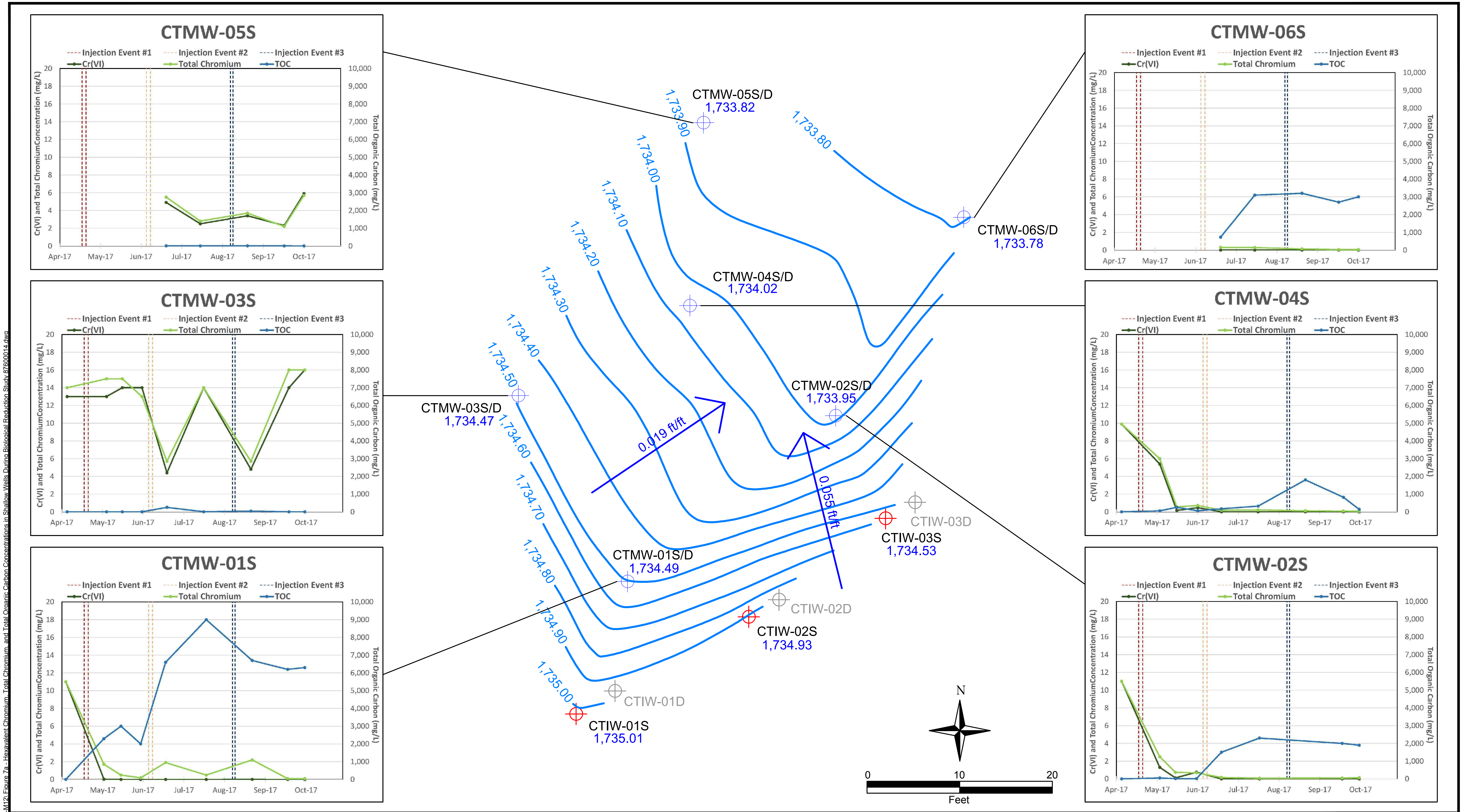
NEVADA ENVIRONMENTAL RESPONSE TRUST SITE

IN-SITU CHROMIUM TREATABILITY STUDY

GROUNDWATER CONTOURS AND FLOW DIRECTION - DEEP WELLS
AUGUST 2016
(CHEMICAL REDUCTION STUDY AREA)

Project No: 87600014
Date: NOVEMBER 17, 2017
Designed By: DVK
Figure No.
6c

\\tts318fs3\tt.local\ces\87600014-NERT-M12\ Figure 6c - Groundwater Contours and Flow Direction - Deep Wells - August 2016 (Chemical Reduction Study).dwg



Legend

CTMW-03S/D ⌖	Monitoring Well (Dual Completion)	1,735.01	Groundwater Elevation (feet amsl)
CTIW-01S ⌖	Injection Well (Single Completion)	〜	Groundwater Elevation Contour (feet amsl)
CTIW-01D ⌖	Injection Well (Not used for contouring)	→	Flow Direction and Hydraulic Gradient (ft/ft)
S	Shallow Well (Screened in Qal)	Qal	Quaternary Alluvium
D	Deep Well (Screened in UMCf)	UMCf	Upper Muddy Creek Formation
mg/L	Milligrams per liter	amsl	Above Mean Sea Level
		ft/ft	Feet per Foot

Notes:

1. Only shallow wells used to develop shallow groundwater contours.
2. Groundwater elevations shown were measured in October 2017 as part of the Performance Monitoring Event #8; baseline groundwater elevations not depicted because the third phase of monitoring wells had not yet been installed.
3. CTMW-05S & CTMW-06S installed June 2017.

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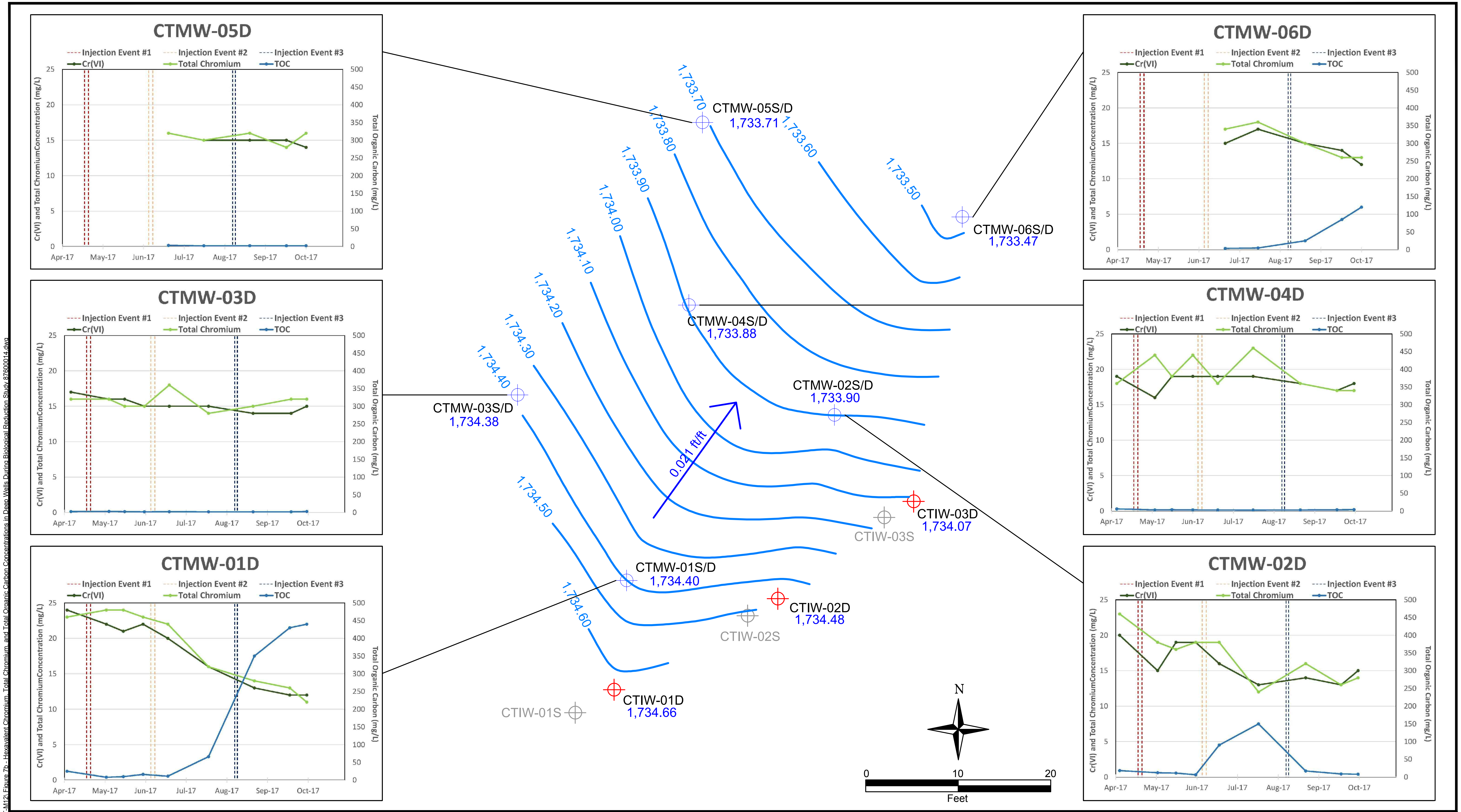
IN-SITU CHROMIUM TREATABILITY STUDY

HEXAVALENT CHROMIUM, TOTAL CHROMIUM, AND TOTAL ORGANIC CARBON CONCENTRATIONS IN SHALLOW WELLS DURING BIOLOGICAL REDUCTION STUDY

Project No: 87600014
Date: NOVEMBER 17, 2017
Designed By: DVK
Figure No.
7a

\\tts318fs3\.tt.local\ces\87600014-NERT-M12\ Figure 7a - Hexavalent Chromium, Total Chromium, and Total Organic Carbon Concentrations in Shallow Wells During Biological Reduction Study 87600014.dwg



Legend

CTMW-03S/D ⌖	Monitoring Well (Dual Completion)
CTIW-01D ⌖	Injection Well (Single Completion)
CTIW-01S ⌖	Injection Well (Not used for contouring)
S	Shallow Well (Screened in Qal)
D	Deep Well (Screened in UMCf)
mg/L	Milligrams per liter
1,735.01	Groundwater Elevation (feet amsl)
1,735.00	Groundwater Elevation Contour (feet amsl)
0.019 ft/ft →	Flow Direction and Hydraulic Gradient (ft/ft)
Qal	Quaternary Alluvium
UMCf	Upper Muddy Creek Formation
amsl	Above Mean Sea Level
ft/ft	Feet per Foot

Notes:
1. Only deep wells used to develop deep groundwater contours.
2. Groundwater elevations shown were measured in October 2017 as part of the Performance Monitoring Event #8; baseline groundwater elevations not depicted because the third phase of monitoring wells had not yet been installed.
3. CTMW-05D & CTMW-06D installed June 2017.

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NEVADA ENVIRONMENTAL RESPONSE TRUST SITE

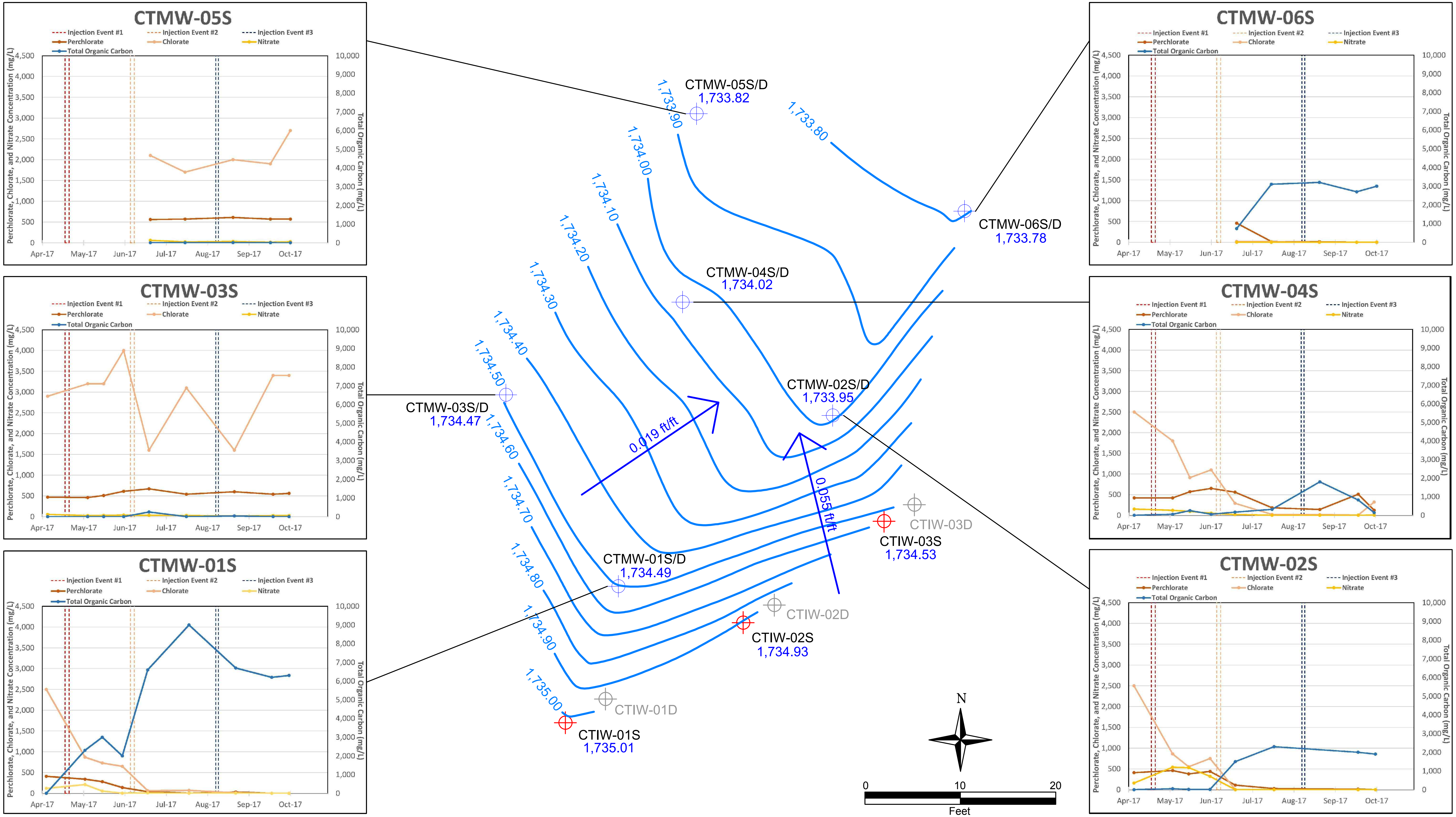
IN-SITU CHROMIUM TREATABILITY STUDY

HEXAVALENT CHROMIUM, TOTAL CHROMIUM, AND TOTAL ORGANIC CARBON CONCENTRATIONS IN DEEP WELLS DURING BIOLOGICAL REDUCTION TEST

Project No: 87600014
Date: NOVEMBER 2, 2017
Designed By: DVK

Figure No.
7b

\\tts318fs3\.tt.local\ces\87600014-NERT-M12\ Figure 7b - Hexavalent Chromium, Total Chromium, and Total Organic Carbon Concentrations in Deep Wells During Biological Reduction Study 87600014.dwg



Legend

CTMW-03S/D ⊕	Monitoring Well (Dual Completion)	1,735.01	Groundwater Elevation (feet amsl)
CTIW-01S ⊕	Injection Well (Single Completion)	1,735.00 ～	Groundwater Elevation Contour (feet amsl)
CTIW-01D ⊕	Injection Well (Not used for contouring)	0.019 ft/ft →	Flow Direction and Hydraulic Gradient (ft/ft)
		Qal	Quaternary Alluvium
S	Shallow Well (Screened in Qal)	UMCf	Upper Muddy Creek Formation
D	Deep Well (Screened in UMCf)	amsl	Above Mean Sea Level
mg/L	Milligrams per liter	ft/ft	Feet per Foot

Notes:

1. Only shallow wells used to develop shallow groundwater contours.
2. Groundwater elevations shown were measured in October 2017 as part of the Performance Monitoring Event #8; baseline groundwater elevations not depicted because the third phase of monitoring wells had not yet been installed.
3. CTMW-05S & CTMW-06S installed June 2017.

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NEVADA ENVIRONMENTAL RESPONSE TRUST SITE

IN-SITU CHROMIUM TREATABILITY STUDY

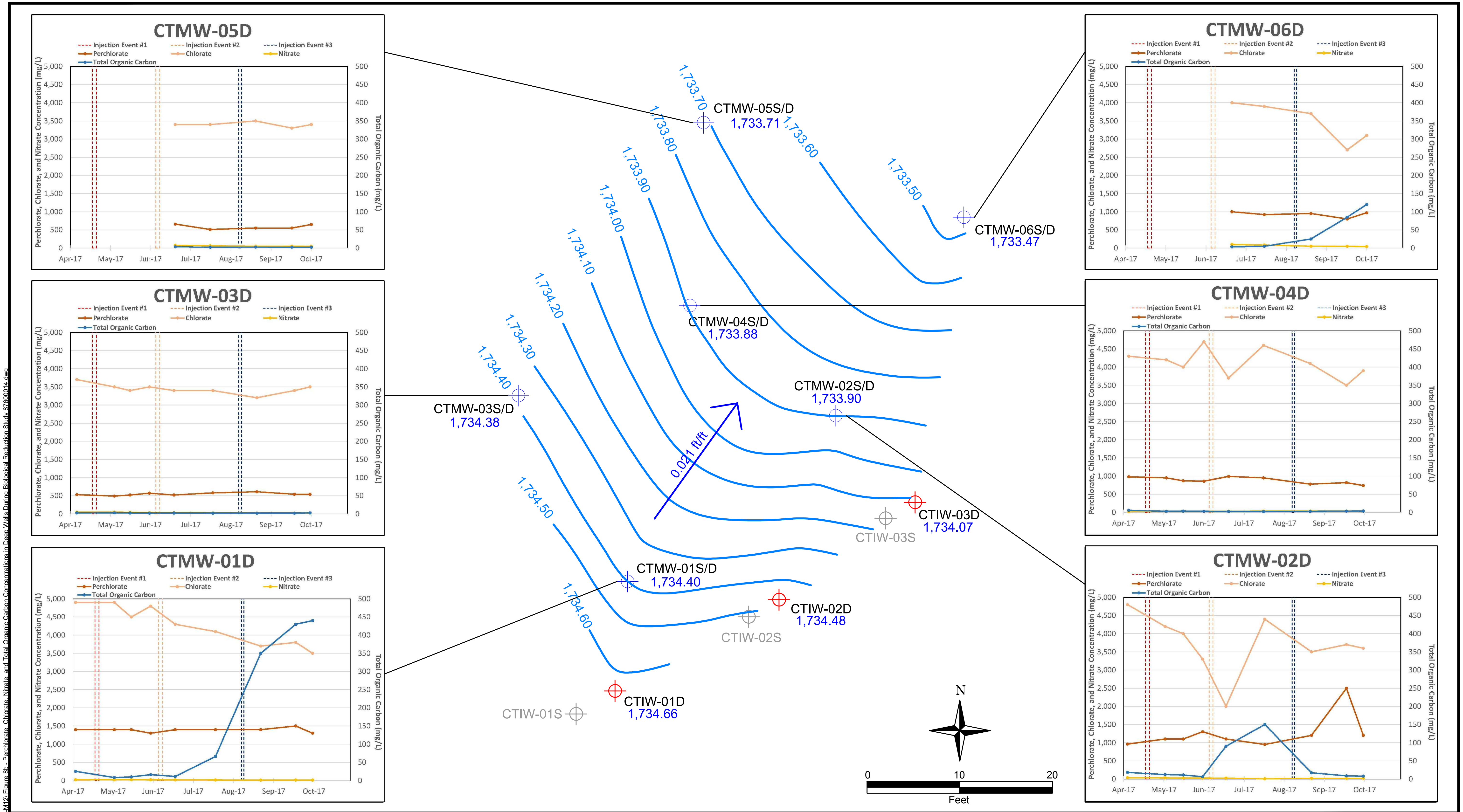
PERCHLORATE, CHLORATE, NITRATE, AND TOTAL ORGANIC CARBON CONCENTRATIONS IN SHALLOW WELLS DURING BIOLOGICAL REDUCTION TEST

Project No:	87600014
Date:	NOVEMBER 17, 2017
Designed By:	DVK

Figure No.

8a

\\tts318fs3\tt.local\ces\87600014-NERT-M12\ Figure 8a - Perchlorate, Chlorate, Nitrate, and Total Organic Carbon Concentrations in Shallow Wells During Biological Reduction Study 87600014.dwg



Legend

CTMW-03S/D ⌖	Monitoring Well (Dual Completion)	1,735.01	Groundwater Elevation (feet amsl)
CTIW-01D ⌖	Injection Well (Single Completion)	1,735.00 ～	Groundwater Elevation Contour (feet amsl)
CTIW-01S ⌖	Injection Well (Not used for contouring)	0.019 ft/ft →	Flow Direction and Hydraulic Gradient (ft/ft)
S	Shallow Well (Screened in Qal)	Qal	Quaternary Alluvium
D	Deep Well (Screened in UMCf)	UMCf	Upper Muddy Creek Formation
mg/L	Milligrams per liter	amsl	Above Mean Sea Level
		ft/ft	Feet per Foot

Notes:
1. Only deep wells used to develop deep groundwater contours.
2. Groundwater elevations shown were measured in October 2017 as part of the Performance Monitoring Event #8; baseline groundwater elevations not depicted because the third phase of monitoring wells had not yet been installed.
3. CTMW-05D & CTMW-06D installed June 2017.

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NEVADA ENVIRONMENTAL RESPONSE TRUST SITE

IN-SITU CHROMIUM TREATABILITY STUDY

PERCHLORATE, CHLORATE, NITRATE, AND TOTAL ORGANIC CARBON CONCENTRATIONS IN DEEP WELLS DURING BIOLOGICAL REDUCTION TEST

Project No:	87600014
Date:	NOVEMBER 17, 2017
Designed By:	DVK

Figure No.

8b

\\tts318fs3\tt.local\ces\87600014-NERT-M12\ Figure 8b - Perchlorate, Chlorate, Nitrate, and Total Organic Carbon Concentrations in Deep Wells During Biological Reduction Study 87600014.dwg

Appendix A

UNLV Bench-Scale Report

FINAL REPORT

Bench-Scale Investigation: Chemical and Biological Reduction of Hexavalent Chromium and Co-Contaminants at the Ammonium Perchlorate (AP) Area of the NERT Site, Henderson, Nevada.

By

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November 13, 2017

EXECUTIVE SUMMARY

Background and Objectives

Tetra Tech, on behalf of the Nevada Environment Response Trust (NERT), has proposed to perform pilot testing to evaluate in-situ groundwater remediation of hexavalent Cr (VI) and other co-contaminants (i.e., nitrate, chlorate, and perchlorate) in the AP area of the site. Currently, the contaminated groundwater from this area is treated by a chemical precipitation unit with ferrous sulfate to remove Cr (VI) and fluidized bed reactors (FBRs) to biologically reduce nitrate, chlorate, and perchlorate. To support the field pilot-scale investigation, bench-scale investigations were performed at the University of Nevada Las Vegas (UNLV) to examine chemical and biological reduction of Cr (VI) and biological reduction of the co-contaminants.

The objectives of the bench-scale tests were:

(1) To evaluate whether calcium polysulfide (CaSx), a reducing agent commonly used in the winery industry, will be effective in chemically reducing Cr (VI) in-situ at the NERT site;

(2) To compare the removal effectiveness of Cr (VI) with CaSx, with that of ferrous sulfate, the reducing agent currently used at NERT in the ex-situ treatment unit.;

(3) To investigate the potential for in-situ biological reduction of Cr (VI) and co-contaminants using various types of substrate as electron donors.

This report describes the bench-scale investigations performed at UNLV to support in-situ treatment of Cr (VI) and co-contaminants in the AP area of the NERT site.

Experimental Approach

Both batch and column tests were performed and biological and chemical reductions were investigated. The testing used soil and groundwater extracted from the quaternary alluvial (QAL) and the Upper Muddy Creek Formation (UMCf) zones of the AP area of NERT.

Soil and groundwater were obtained from boreholes drilled at the site by Tetra Tech from three depth intervals 23 - 48 feet below ground surface (ft bgs). Soil samples were collected from wells UFIW-02S (QAL, 23-28 ft bgs) UFIW-02I (intermediate, 31-36 ft bgs), and UFIW-02D (UMCf, 43-48 ft bgs). In addition, soil samples were collected from wells CTMW-03S (QAL, 18 to 23 feet bgs) and CTIW-01D (UMCf, 33 to 38 ft bgs) for the biological reduction tests. Groundwater samples were collected from well UFIW-06S (QAL, 25-30 ft bgs) and well UFIW-06I (UMCf, 35-40 ft bgs). In later tests, groundwater samples were also collected from wells UFIW-03, CTIW-01, and CTMW-03.

Both microcosm and column tests were performed on a composite sample of soil. Composite samples were generated by blending equal volumes of soil from different depths, but from the same well and within the same site designation (QAL or UMCf).

Wet blended soils were used for chemical soil analysis and biological batch microcosm tests. For column testing, soils were sun dried (105^{0}F) and packed into two-inch diameter columns to mimic the groundwater aquifer with flow velocity and permeability similar to that found in the field.

All microcosm tests were performed using 125 mL borosilicate glass bottles with thirty grams of wet soil and a total of 100 mL of groundwater, nutrients, and desired amount of substrate were added. EOS-Pro emulsified oil, molasses, sugar, and Industrial Sugar Wastewater were used as carbon substrates in biological microcosms and columns. When needed, phosphate and ammonium wer added as nutrients in the form of sodium phosphate or di-ammonium phosphate.

For the biological reduction of Cr (VI) and co-contaminants, four columns were used: two with QAL and two with UMCf soil. The columns were 2 inches in diameter and 50 inches long. Because of the low permeability of the formation in the AP area, the QAL columns were pressurized to 5 psi and the UMCf columns were pressurized at 10 psi. An in-house built pressure valve was used to pressurize the soil columns along with an Aquatec CDP6800 booster pump. Columns were fed with groundwater from CTMW-03S well for QAL and CTMW-03D for UMCf.

Major Findings

Soil Characterization and Groundwater Contaminant Concentrations

The QAL soil samples were visibly granular and dry, while the two lower depth intervals—Intermediate and UMCf—were clayey with very high moisture content. The moisture content in soil samples were 12.01 ±0.58 % in the QAL and 42.26 ±3.55% in UMCf. The sieve analysis shows that the majority of the grains were between 0.425 mm to 0.075 mm (>45%). The second highest percentages were: for QAL particles size between 4.75 and 0.85 mm, (26.44%), and for UMCf particles < 0.075mm (35.70%).

The Cr (VI) concentrations in soils varied from 150 μg/kg in QAL to 300 μg/kg in UMCf. Nitrate and perchlorate varied from 70-466 μg NO3/kg to 47.3 - 530 μg ClO4 /kg in QAL and UMCf, respectively.

QAL groundwater quality fed to the column on average contained chlorate concentrations of about 3,450 mg/L, perchlorate about 620 mg/L, and Cr (VI) about 16,500 μg/L. The UMCf groundwater contained higher concentrations of chlorate at about 3,800 mg/L, perchlorate about 840 mg/L, and Cr (VI) about 18,000 μg/L.

Chemical Reduction of Cr (VI)

Batch precipitation tests with groundwater containing ~10,000 μg/L Cr (VI) revealed that >99% of Cr (VI) can be removed from QAL and UMCf groundwater using CaSx. All final Cr (VI) concentration were <100 μg/L. For groundwater from both intervals, a Cr (VI) concentration below 10 μg/L was obtained for two times the calculated stoichiometric amount of CaSx. Additional CaSx up to 5 times the stoichiometric amount did not promote higher removals. Similar to CaSx, the use of ferrous sulfate resulted in > 99% removal of Cr (VI). However, at least 5X the stoichiometric amount of ferrous sulfate was needed to achieve comparable results to those of CaSx. In addition, final Cr (VI) levels < 10 μg Cr+6 /L were not achieved with ferrous sulfate. However, lower turbidity groundwater is obtained with the use of ferrous sulfate as compared to CaSx.

CaSx was injected into columns to remove Cr (VI) from both QAL and UMCf groundwater and showed excellent Cr (VI) removal, > 99%. The effluent Cr (VI) concentrations in QAL columns were numerically lower than that of UMCf column. However, there is no statistically significant difference (p> 0.05) between the effluent Cr (VI) concentrations of both columns during the injection period. Therefore, injection of CaSx can be used at NERT to remove Cr (VI) from both QAL and UMCf groundwater.

Microcosms for Reduction of Cr (VI) and Co-contaminants

For microcosms using QAL soil and groundwater, the results show that all substrates (i.e. EOS-PRO, molasses, and Industrial Sugar Wastewater) can support Cr (VI) reduction. However, Industrial Sugar Wastewater alone or mixed with EOS-PRO promotes faster degradation rates. To reach Cr (VI) concentrations below 100 μg/L, it took the Industrial Sugar Wastewater substrate 11 days as compared to 19 days for EOS-PRO. All carbon substrates investigated were able to promote Cr (VI) reduction in the QAL from 14,000 μg/L to < 10 μg/L within 36 days.

Cr (VI) reduction in the UMCf groundwater could also be achieved using all substrates studied, but the reduction is much slower due to the slow groundwater velocity through the UMCf. On Day 36, Cr (VI) in microcosms with a mixture of EOS-PRO and Industrial Sugar Wastewater were below detection limit (10 μg/L). The degradation was much slower for EOS-PRO microcosms, and only on Day 58 was the Cr (VI) below the detection limit (10 μg/L). For both QAL and UMCf, the addition of a highly biodegradable substrate, Industrial Sugar Wastewater, promotes faster degradation rates. Cr (VI) reduction rates in the UMCf were slower than that for QAL. Although 10 μg/L effluent Cr (VI) was obtained within 36 days for UMCf using Industrial Sugar Wastewater and a mixture of EOS-PRO oil and Industrial Sugar Wastewater, it took 58 days for EOS-PRO alone to reach these concentrations.

It is suspected that the reason for the slower degradation in the presence of EOS-PRO alone relates to the slower release of EOS-PRO from the UMCf soil as compared to QAL. Therefore, for UMCf remediation, it is advantageous to supplement with a highly biodegradable substrate. It was also found in this research that the use of Industrial Sugar Wastewater promoted about 40% abiotic reduction of Cr (VI) due to the presence of components in the wastewater that promoted chemical reduction. However, using a highly biodegradable substrate alone is not recommended for overall bioremediation because of the presence of other co-contaminants that will require higher substrate dosages. The concentrations of the contaminants of concern at the NERT site are very high and therefore the mass of carbon substrate needed for biodegradation is also high. Emulsified oil has a COD of 2,000,000 mg/L as compared to 100,000 mg/L for sugar, a soluble substrate. Therefore, the amount of sugar needed to perform the same remediation work would be 20 times that of emulsified oil.

Nitrate and chlorate biodegradation in the microcosm followed Cr (VI) reduction. In QAL, chlorate degradation was observed on Day 14 (about 75%) in the EOS-PRO microcosms, which was the same day when nitrate degradation was observed. Therefore, there was some concomitant degradation of nitrate and chlorate. The data reveal that EOS-PRO supports chlorate reduction very well, while Industrial Sugar Wastewater does not. Chlorate concentrations stayed relatively unchanged in microcosms that used only Industrial Sugar Wastewater. The opposite was noted for Cr (VI) reduction; while Cr (VI) reduction is supported by all substrates tested, especially by Industrial Sugar Wastewater, the degradation of nitrate and chlorate is better supported by EOS-PRO oil. Chlorate concentration was below detection limit (5 mg/L) on Day 19 in the EOS-PRO microcosms. For the Mix microcosms, chlorate degradation was not observed until after Day 19 and was below the detection limit on Day 26. For Industrial Sugar Wastewater, only about 26% of the chlorate was removed by Day 99.

For the UMCf microcosms, chlorate degradation was observed on Day 36 in the EOS-PRO microcosms (about 39%), which was the same day when nitrate degradation was observed in UMCf microcosms with EOS-PRO. The chlorate concentration was below 5 mg/L for the EOS-PRO microcosms on Day 71. For microcosms using a mixture of EOS-PRO and Industrial Sugar Wastewater, chlorate degradation was not observed until Day 44 and was below the detection limit on Day 82. For Industrial Sugar Wastewater microcosms, only about 8% of the chlorate degraded by Day 99. The lower degradation of chlorate in Industrial Sugar Wastewater suggests that Industrial Sugar Wastewater did not support chlorate degradation as compared to EOS-PRO.

Only very minor perchlorate degradation was observed in any of the microcosms during the 99 days of operation. In the microcosms fed with EOS PRO, a 17-20% decrease was observed after Day 82 for both QAL and UMCf.

Microbiological investigations revealed that the total number of bacteria present in the original soils, before addition to the microcosms, was 2.07E+06 and 1.35E+04, for QAL and UMCf, respectively. Therefore, the QAL soil contained 153 times more bacteria than UMCf. The addition of a carbon substrate, as expected, resulted in significant increase in the number of bacteria present. By Day 18, the number of bacteria increased approximately 230 times and 1,890 times for QAL and UMCf, respectively. However, by Day 102 the amount of bacteria decreased by about 50% for both UMCf and QAL soils. Bacteria diversity showed significant amounts of Pseudomonas (> 70-80%) and Acinetobacter (> 5-20%). In microcosms performed with fresh soil samples, within two weeks of soil collection, Pseudomonas and Acinetobacter persisted throughout the test run. However, microcosm tests performed with samples that had been collected six month earlier showed very different diversity. In these microcosms, with time, the species observed were Clostridium beijerinskii, Corynebacterium, Sporolctobacillus nakayamae, and Rummeliibacillus suwonensis. Many of the bacteria identified from the microcosms are spore forming; they are bacteria that can thrive under unfavorable conditions.

It is important to notice that while Cr (VI), perchlorate, and chlorate concentrations in the QAL and UMCf waters were similar, the nitrate concentration in QAL was approximately three times that of UMCf. This is important because significant chlorate degradation happened only after nitrate was significantly degraded. In the AP area, nitrate degradation is taking up a large percentage of the time required for remediation. In addition, TDS concentrations in the microcosms were approximately 12,000 (1.2%) mg/L in QAL and 10,000 (1%) mg/L in the UMCf microcosms. It is well established that salt concentrations greater than 0.5%, negatively impact perchlorate degradation. Therefore, two factors are contributing for the longer degradation times at the AP area: the high concentration of nitrate and high TDS concentrations.

Biological Reduction of Cr (VI) and Co-contaminants in Columns

QAL and UMCf columns were run for over 147 days with contact times of 8.9-10.6 days to 5.2 -7.2 days, respectively. When comparing the performance of the QAL and UMCf for Cr (VI) removal, the QAL columns did better, reaching non-detect levels (< 10 μg/L) after Day 45 of operation. The UMCf columns, fed the same COD equivalent of 8,000 mg/L, reached stable non-detect by Day 90. This observation may reflect the fact that contact times in the UMCf columns were 5.2-7.2 days, as compared to 8.9 to 10.6 days for QAL. Considering the QAL contact time was roughly twice as long, better degradation performance was expected. However, in the field, UMCf contact times will be longer and better performance is expected than for QAL under the same substrate feed conditions.

The results revealed that nitrate degradation is impacted by the presence of Cr (VI); Cr (VI) degradation is observed to occur first, however, when Cr (VI) levels decrease, nitrate and Cr (VI) are reduced simultaneously. For the QAL columns, complete nitrate degradation lagged about 5 days behind Cr (VI) reduction (Day 14 for Cr (VI) and Day 19 for nitrate). Similar to that observed for Cr (VI), nitrate levels increase when substrate levels decrease.

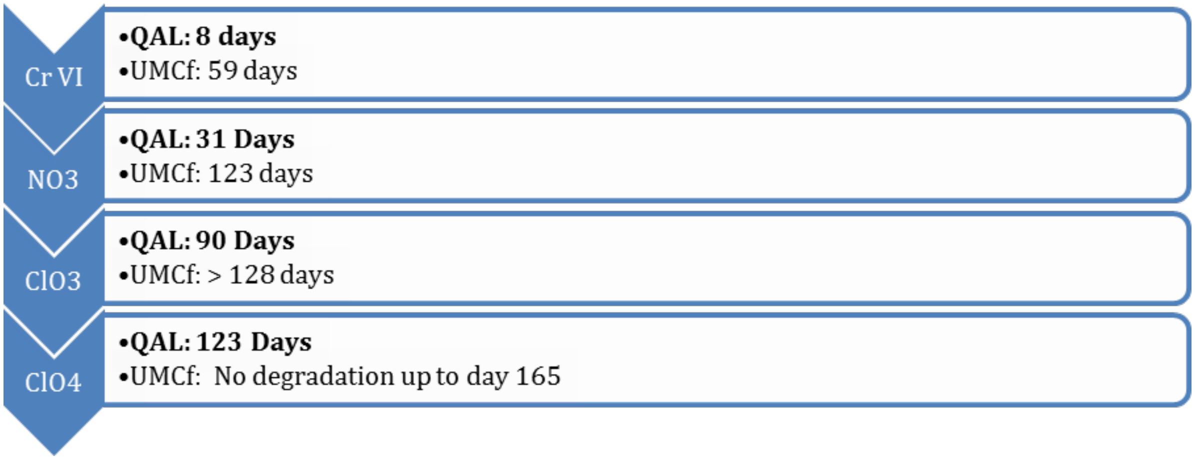
As observed for QAL, the UMCf data indicate that nitrate and Cr (VI) reduction occur at the same time. However, the level of nitrate reduction for the UMCf columns was less than that observed for QAL. In the QAL columns, nitrate reduction to < 1 mg/L was observed when Cr (VI) concentrations were below detection; for the UMCf columns, the lowest nitrate obtained was 50 mg/L. Again, this difference is due to the shorter contact time (5.2 to 7.2 days) in the UMCf columns as compared to that in the QAL columns (8.9 to 10.6 days). In the field, UMCf contact times will be much greater than the ones that were feasible to simulate in the laboratory.

In QAL, chlorate degradation was observed by Day 24, after Cr (VI) was non-detect and nitrate levels were about 2 mg/L as NO3 in both columns. Therefore, chlorate will degrade after nitrate and Cr (VI) have been utilized. The impact of nitrate on chlorate degradation was observed on Day 64 when the nitrate was less than 2 mg/L as NO3 in Column A, and Column B, a replicate column, had about 17 mg/L as NO3. The effluent chlorate in Column A was half of the chlorate in Column B (about 500 mg/L). After Day 127, no chlorate was observed in the QAL columns, which correlates to the period where both Cr (VI) and nitrate had also reduced.

On Day 113, chlorate was observed at half of its initial influent concentration (i.e., 3000 mg/L) in UMCf column A. Chlorate was completely biodegraded in Column A on Day 137 and on Day 151 in UMCf column B. For the UMCf columns, chlorate was biodegraded to non-detectable levels after Day 151 and after Cr (VI) and nitrate had been reduced.

No perchlorate degradation was observed until Day 101 in QAL columns. On Day 115, the perchlorate concentration was half the initial concentration in both columns. Recall that chlorate had degraded about 50% by Day 68 and it was completely degraded in Day 127. Therefore, the degradation of perchlorate observed in Day 101 follows chlorate degradation. No perchlorate degradation was observed until Day 165 in UMCf columns.

The microcosm and column tests demonstrated that in-situ bioremediation of Cr (VI) and co-contaminants at the AP area is possible. Cr (VI) degradation occurs relatively fast. However, the high nitrate concentrations in the area cause delay of chlorate and perchlorate degradation. The timeline and sequence of degradation for the contaminants of concern is illustrated below for the QAL and UMCf columns. Notice that in QAL, Cr (VI) is reduced in about a week and nitrate degrades in about a month. However, three times more time is needed to degrade chlorate; perchlorate degradation follows quickly after chlorate degrades. For UMCf, it took longer to degrade all the contaminants, especially nitrate which took 123 days to biodegrade.



Cr VI
- **QAL: 8 days**
- UMCf: 59 days

NO3
- **QAL: 31 Days**
- UMCf: 123 days

ClO3
- **QAL: 90 Days**
- UMCf: > 128 days

ClO4
- **QAL: 123 Days**
- UMCf: No degradation up to day 165

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CHAPTER 1 BACKGROUND AND OVERALL OBJECTIVES OF CHROMIUM REMOVAL INVESTIGATIONS

Tetra Tech, on behalf of the Nevada Environment Response Trust (NERT), has proposed to perform pilot testing to evaluate in-situ groundwater remediation of chromium at the NERT site in Henderson, Nevada. The site is contaminated with hexavalent chromium (Cr (VI)) and other co-contaminants (i.e nitrate, chlorate, and perchlorate). Prior to pilot scale testing, a bench-scale investigation was performed at the University of Nevada Las Vegas (UNLV) to support in-situ chemical and biological reduction of Cr (VI) at the site. Both batch and column tests were performed and both biological and chemical chromium reductions were investigated.

Currently, chromium-impacted groundwater at NERT is treated in the Groundwater Extraction and Treatment System (GWETS). GWETS includes two major treatment units, a chemical precipitation unit with ferrous sulfate to remove chromium and fluidized bed reactors (FBRs) to biologically reduce perchlorate, chlorate, and nitrate. The effluent from the chemical precipitation unit is discharged into an equalization basin which feeds the FBRs. Remaining chromium from the precipitation unit is biologically reduced in the FBR reactors. Currently chromium and perchlorate contamination at the site is prevented from reaching the Las Vegas Wash and Lake Mead by a system of intercepting wells including the Interceptor Well Field (IWF), the Athens Road Well Field (AWF), and the Seep Well Field (SWF). According to the 2015 NERT Performance Evaluation Report (Ramboll Environ, Oct 30, 2015), the highest concentrations of chromium are upstream from the IWF (3.6-25 mg/L). Concentrations upstream from the AWF and SWF are 68-270 mg/L and < 0.0040 mg/L, respectively. Therefore, the largest chromium concentrations are in the plume upstream of IWF, in the Ammonium Perchlorate (AP) area, where Tetra Tech is planning to conduct chemical and biological pilot remediation testing. Chromium present in the area is in the hexavalent form (Cr (VI)). The proposed location for the pilot test is the Southwest portion of the site close to wells M-22 (future biological pilot test) and M66 (future Chemical precipitation unit).

1.1 Objectives of Bench-Scale Remediation Testing

Prior to commencing pilot testing on site, bench-scale testing was performed by the Environmental Engineering and Water Quality Laboratory at the University of Nevada Las Vegas (UNLV). The objectives of the bench-scale testing were:

1) To evaluate whether calcium polysulfide (CaSx), a reducing agent commonly used in the winery industry, will be effective in chemically reducing chromium in-situ at the NERT site. Calcium polysulfide has been used effectively in treating groundwater (Freedman et al., 2005; Graham et al., 2006; Messer et al., 2003; Yu and Tremaine, 2002), brines (Pakzadeh and Batista, 2011), and residues (Graham et al, 2006) contaminated with high levels of chromium;

2) To compare the effectiveness of CaSx with that promoted by ferrous sulfate in reducing total chromium and hexavalent chromium to the concentrations stipulated in the NERT NPDES permit—0.01 mg/L (10 ppb) for Cr (VI) and 0.1 mg/L (100 ppb) for total chromium.

3) To investigate the potential for in-situ biological reduction of chromium and co-contaminants using various types of substrate as electron donors.

This report includes the results obtained for the chemical reduction of chromium and biological reduction of chromium and co-containants, using both microcosms and column testing. The testing used soil and groundwater extracted from the quaternary alluvial (QAL) and the Upper Muddy Creek Formation (UMCf) zones of the NERT site.

CHAPTER 2 METHODOLOGY

2.1 Soil and Groundwater Sample Collection from the NERT Site and Blending

Soil and groundwater used in this study were obtained from a borehole drilled at the NERT pilot test site. Soil samples were collected from three intervals 23- 48 feet below ground surface (ft bgs) by Tetra Tech. Soil samples were collected from UFIW-02S (QAL, 23-28 ft bgs), UFIW-02I (Intermediate between QAL and UMCf, 31-36 ft bgs), and UFIW-02D (UMCf, 43-48 ft bgs). Later, soil samples from CTMW-03S (QAL, 18 to 23 feet bgs) and CTIW-01D (UMCf, 33 to 38 ft bgs) were collected for biological tests. The soil samples were collected using sterile hand shovels and sterile 3-gallon plastic buckets provided by UNLV. Prior to sample collection, the buckets were soaked for 2 hours with 5% chlorine solution and then rinsed 8 times with deionized autoclaved water and allowed to air dry covered with autoclaved aluminum foil. The shovels were flame-sterilized using ethyl alcohol and then wrapped with aluminum foil and sent to the field. Approximately 6 gallons of soil cuttings (two 3-gallon buckets) were collected from each drilling interval.

Groundwater samples were collected using sterilized 5-gallon plastic containers from well UFIW-06S (QAL, screened at 25-30 ft bgs) and well UFIW-06I (UMCf, screened from 35-40 ft bgs). In later tests, groundwater samples were also collected from UFIW-03, CTIW-01, and CTMW-03. Some groundwater was collected from well BMW1, however it was only used in preliminary testing of chromium removal using columns, found in section 2.5.1 and Appendix D. Groundwater and soil samples were transferred to the laboratory immediately after collection and were refrigerated at 32^{o}F. Groundwater and soil samples were used for batch chromium chemical reduction tests.

To generate homogeneous, representative soil samples, equal volumes of soil (about a gallon) were collected from each of the two buckets from each soil depth interval and were thoroughly mixed in a clean, disinfected plastic pan using shovels. The wet blended samples were used for chemical soil analysis and biological reduction batch tests. The remaining blended soil (~ 2 gallons) from each depth was transferred to three sterile, shallow plastic pans and placed outdoors to air-dry (105^{0}F in the sun). Samples were loosely covered with cloth towels to avoid contamination while outside. These air-dried soil samples were used for grain size distribution and columns (Chapter 3).

For batch and column testing, two of the soil samples from the soil horizon 23-28 feet and 43-48 feet were selected as alluvial (QAL) and Muddy Creek Formation (UMCf), respectively.

2.2 Analysis of Soil and and Groundwater Samples

The blended wet samples were analyzed for chromium, perchlorate and nitrate first in liquid extracted from the soil moisture, and then later by rinsing the soil with nanopure water. For groundwater, additional parameters such as COD, pH, and turbidity were also measured. The results for these analyses are discussed in Chapter 3.

2.2.1 Characterization of Soil Samples

Contaminants Measured in the Dry Soil from UFIW–02 Well

Twenty grams of soil were weighed in triplicate from each soil depth and dried in an oven at 105^{0}C for 12 hours for moisture content computations. The moisture content was used to determine the concentration of contaminants in the soils on a dry weight basis. Data from the dry soil testing can be found in section 3.1.

Contaminants Measured in the Soil Moisture from UFIW–02 Well

About 200 g of wet blended soil from each horizon from the UFIW-02 well (23-28 ft bgs, 31-36 ft bgs, and 43-48 ft bgs) were weighed and centrifuged for an hour at 4,400 rpm to extract water from the soil samples. In the first attempt, only the sample from 31-36 ft bgs yielded liquid. Therefore, the procedure was modified and the amount of soil was doubled (i.e. ~ 400 g). This procedure yielded moisture from two sample intervals (31-36 ft bgs and 43-48 ft bgs), but no liquid was obtained from the shallowest sample (23-28 feet bgs). The extractions of liquid from soil depths 31-36 ft and 43-48 ft were repeated three times with 400 g soil until a volume of about 25 mL liquid was collected from each horizon for the chemical analysis. The data resulting from the chemical analyses are presented in 3.1.2.

Contaminant Extraction from UFIW–02 Well, CTMW-03S, and CTIW-01D by Rinsing Soil with Nanopure Water

Five different soils were tested by rinsing with nano pure water: three different horizons for UFIW-02 (QAL 23-28 ft bgs, QAL 31-36 ft bgs, and UMCf 43-48 ft bgs), CTMW 03 S (QAL 18-23 ft bgs), and CTIW 01D (UMCf 33-38 ft bgs). For each soil, fifty grams of wet soil were transferred to 250 mL centrifuged bottles and 100 mL nanopure water was added. The mixture was placed in a rotary shaker at 45 rpm for 24 hours. After mixing in the rotary shaker, the samples were centrifuged for 30 minutes at 4400 rpm (Legend RT Sorvall centrifuge, Thermo Fisher Scientific, Inc., Waltham, MA). The supernatant was carefully transferred to graduated cylinders to measure the volume, and was then stored in labeled vials.

For the second rinse, 100 mL DI water was added to each bottle and the bottles were transferred back to the rotary shaker for 24 hours. The content was centrifuged for 30 minutes and the supernatant was carefully transferred to another vial. A third rinse was carried out using the same procedure to generate a third rinsate. The rinsate volumes collected were noted for each rinse, and were filtered and analyzed on the same day for Cr (VI) and nitrate. All the samples were refrigerated at 32°F prior to perchlorate analysis. Cr (VI), nitrate, and perchlorate are reported as as µg or mg/kg soil. The mass of contaminant in each extract was calculated by multiplying the concentration measured and the rinsate volume. The mass was then divided by the amount of dry soil (accounting for moisture content for the 50 grams of wet soil) used for extraction. Results can be found in section 3.2.

For each soil horizon, the first rinse sample was also analyzed for chemical oxygen demand COD (a measure of the organic content), hardness, phosphate, sulfate, and total dissolved solids (TDS). Table 2.1 shows the analytical procedure used for each analyte of interest in the extract of soil.

2.2.2 Characterization of Groundwater Samples

The groundwater samples' chemical constituents were measured directly in filtered (0.2 µm membrane filters-VWR Scientific) groundwater samples. Table 2.1 shows the analytical procedure used for each analyte of interest in the groundwater samples. Groundwater characterization is further addressed in section 3.3.

2.3 Analytical Methods Used for Chemical Characterization of Soil and Groundwater

Table 2.1 lists all the constituents that were analyzed in this study and corresponding methods of analysis.

Table 2.1: Analytical Procedures Used in the Study

Parameter	Method details/ Reagents used	Hach method or EPA method	Limits	Equipment
COD	Ultra Low Range Low Range, High Range, High Range Plus	8000	0.7 to 40 mg/L (ULR); 3 to 150 mg/L (LR); 20 to 1500 mg/L (HR); 200 to 15,000 mg/L (HR Plus)	Spectrophotometer (Hach DR 5000)
Ammonia	Low Range, High Range	10031	.4 to 50 mg-N/L (HR)	Spectrophotometer (Hach DR 5000)
Nitrate	NitraVer® 3	10020	0.2 to 30.0 mg-N/L (HR)	Test 'N Tube™ Vials
Chlorate/Perchlorate	KOH (eluent)	314.0	2.0 to 0.53 μg/L	Ion Chromatograph (Dionex ICS-2000)
Phosphate	PhosVer® 3	8048	0.02 to 2.5 mg/L	Spectrophotometer (DR 5000)
Sulfate	SulfaVer® 4	8051	2 to 70 mg/L	Spectrophotometer (DR 5000)
Total Iron	FerroVer®	8008	0.02 to 3.00 mg/L	Spectrophotometer (DR 5000)
Hexavalent Chromium	ChromaVer® 3	8023	0.010 to 0.700 mg/L (spectrophotometers); 0.01 to 0.60 mg/L (colorimeters)	Spectrophotometer (Hach DR 5000Colorimeter (DR 900)
pH	pH buffer solution	8156	0 to 14	pH meter
Total metal (trace and major metal)		200.7		Thermo ICP 6300
Total Dissolved Chromium		200.7		Thermo ICP 6300

Replicate analyses were run for every 5 samples processed.

2.4 Batch Chemical Reduction Tests for Chromium

For bench-scale testing purposes, low and high Cr (VI) concentrations were established as 500 μg/L and 10000 μg/L, respectively. Table 2.2 shows the permit limits and targeted removal (%) in groundwater contaminated with low (500 μg/L) and high (10000 μg/L) concentrations of chromium.

Table 2.2: NPDES limit for chromium (Cr (VI) and total) and corresponding target removals (%) in groundwater with low and high concentrations of chromium

Category based on chromium concentration	Chromium NPDES limit (μg/L)		Target removal (%)	
	Cr (VI)	Total	Cr (VI)	Total
Low (500 μg/L)	10	100	98	80
High (10000 μg/L)	10	100	99.9	99

2.4.1 Groundwater Used for Batch Testing

Samples from UFIW-06S (QAL) and UFIW-06I (UMCf) were specifically collected for chemical batch tests. The concentrations of Cr (VI) in both groundwater samples were less than 0.5 mg Cr^{+6}/L. Therefore, the groundwaters from both QAL and UMCf were spiked with a Cr (VI) standard (Hach, Loveland, Colorado) to achieve about 10,000 μg Cr^{+6}/L for a 'high concentration' testing; for 'low concentration' testing, the groundwaters were either used as they were (i.e. no spiking) or were spiked to achieve about 500 μg Cr^{+6}/L. There were analytical interferences detected with measuring Cr (VI) in the spiked 'low concentration' QAL groundwater. The QA/QC identified that readings of Cr (VI) levels below 0.05 mg/l were not reliable because the method would give different readings when duplicate samples were analyzed. The various tests conducted to investigate analytical interference with chromium (VI) detection in the QAL groundwater are presented in Appendix A. The solution to the interference was to dilute the QAL groundwater by 100X before adding chromium to achieve the desired chromium concentration. In addition, dissolved chromium was measured using inductively coupled plasma (ICP). No interference was found when measuring total chromium using ICP in QAL or UMCf samples.

2.4.2 Preliminary Batch Testing for Cr (VI) Reduction in Groundwater at High and Low Concentration Using CaSx and $FeSO_4$

Batch chemical reduction tests were conducted in 1L glass beakers using a Phillip and Bird Batch Tester (Figure 2.1). A preliminary batch test was performed to select a range of coagulant (i.e. CaSx or $FeSO_4$) to chromium ratios. Preliminary batch test ratios were guided by ratios reported by Pakzadeh and Batista (2011) and Qin et al. (2005). The preliminary batch groundwater tests were performed on groundwaters without spiking (for low chromium test) and groundwaters spiked with ~10,000 Cr^{+6}/L (for high chromium test). The theoretical stoichiometric requirement for CaSx is 1.5 moles of CaSx per moles of Cr (VI) and for ferrous sulfate is 3 moles of Fe per mole of Cr (VI). The CaSx to Cr ratios selected for preliminary test were 2 and 3 times the stoichiometric ratio, and the ferrous sulfate (as Fe) to chromium ratios selected were 10 and 30 times the stoichiometric ratio. The matrix of tests used in the preliminary batch test is shown in Appendix B.

In these tests, CaSx and ferrous sulfate were used as coagulants to remove Cr (VI) as per equations below:

$$2\,CrO_4^{-2} + 3CaS_5 + 10H^+ \rightarrow 2\,Cr(OH)_3 + 15\,S + 3Ca^{+2} + 2H_2O$$

$$3Fe^{+2} + CrO_4^{-2} + 3e^- + 5H^+ \rightarrow Cr(OH)_3 + 3Fe^{+3} + H_2O$$

For the preliminary batch tests, 250 or 500 mL of groundwater containing Cr (VI) were placed in a glass beaker. The coagulant dose was added and the contents of each beaker (i.e. water, any suspended solids, and coagulant) were stirred rapidly at 100 rpm for a minute. Next, the mixer speed was decreased to to 30 rpm for a period of 30 minutes to promote slow mixing. The contents of the beaker were transferred to a graduated cylinder to allow formed solids to settle. The solids volume was recorded after 10 minutes settling time. The goal was not to obtain a clear effluent, such as often desired in water treatment, because when used in-situ treatment the precipitates formed by the coagulants are retained by the soil. About 100mL of supernatant from the graduated cylinder were transferred into vials to measure pH, total chromium, and turbidity. For dissolved chromium analysis, about 25 mL of the supernatant was preserved with trace metal quality nitric acid for ICP analysis. The remaining content of the graduated cylinder was then transferred to a large bottle and centrifuged for 30 minutes at 3000 rpm. The supernate was carefully poured and was filtered (0.45 µm membrane filter) to analyze for nitrate, perchlorate and hexavalent chromium. The solids were transferred into preweighed aluminum dishes for suspended solids testing. The blades and the beaker walls were inspected for scale formation. The preliminary results of the batch tests are presented in Appendix B.

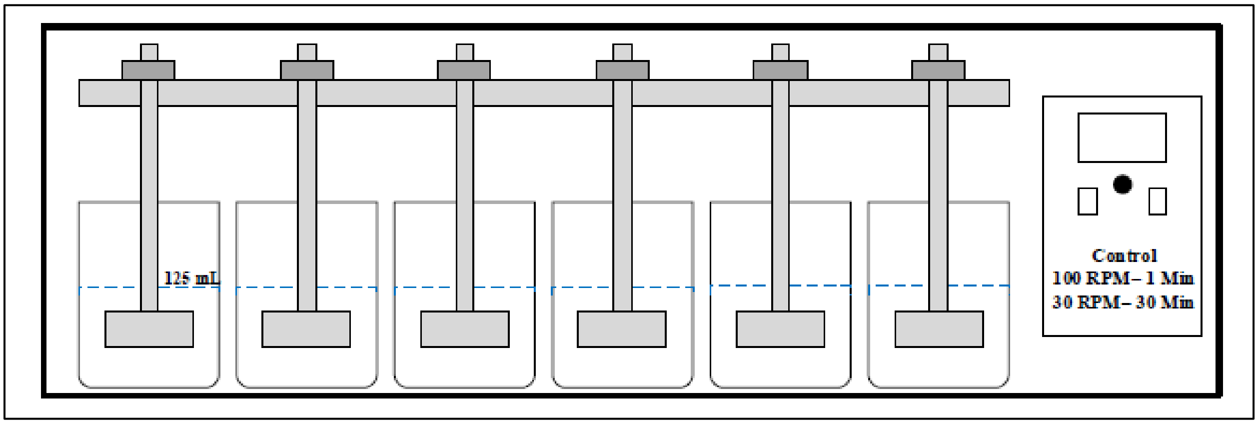


Figure 2.1 Experimental setup used in the batch tests for chromium precipitation with CaSx and $FeSO_4$.

2.4.3 Secondary Batch Testing for Cr (VI) Reduction at High and Low Concentration Using CaSx and $FeSO_4$

Six sets of secondary batch tests were conducted with the methods described in section 2.4.2. Each set comprised of six beakers. QAL and UMCf groundwaters were spiked with Cr (VI) for high (10,000 µg Cr^{+6}/L) and low (500 µg Cr^{+6}/L) concentrations testing. The batch testing was conducted with varying ratios from 1.5X to 5X times the stoichiometric requirement for CaSx and 5X to 50X times the stoichiometric requirement for ferrous sulfate. The testing matrix is shown in Table 2.3.

Table 2.3: Matrix Used for Cr (VI) Removal Using CaSx and FeSO4

Sets	Cr concentration	Groundwater source and concentration	Ratio for CaSx X Stoichiometric requirement	Ratio for $FeSO_4$ X Stoichiometric requirement
Set 1	High Cr concentration (Target starting: 10000 µg Cr^{+6}/L) Groundwater in each beaker = 250 mL	QAL at 10500 µg Cr^{+6}/L	1.5X, 2X, 3X, 4X and 5X, and replicate 2X	5X, 10X, 20X, 30X and 50X, and replicate 10X
Set 2		UMCf at 9800 µg Cr^{+6}/L with 1 g of dry soil/L		
Set 3		QAL at 10500 µg Cr^{+6}/L with filtered groundwater and with and without 1 g of dry QAL soil/L	5X and 10X, and replicate 5X (3 beakers without soil and 3 beakers with soil)	N/A
Set 4		UMCf at 9800 µg Cr^{+6}/L with filtered groundwater and with or without 1 g of dry QAL soil/L	N/A	5X and 10X, and replicate 5X (3 beakers without soil and 3 beakers with soil)
Set 5	Low Cr concentration (Target starting: 500 µg Cr^{+6}/L) Groundwater in each beaker = 500 mL	QAL at 500 µg Cr^{+6}/L	1.5X, 2X, 3X, 4X and 5X, and replicate 2X	5X, 10X, 20X, 30X and 50X, and replicate 10X
Set 6		UMCf at 500 µg Cr^{+6}/L		

Batch test sets 1-4 were conducted for high Cr concentrations. The preliminary test showed that the groundwater from the UMCf had very low turbidity and did not coagulate well with the dosages of $FeSO_4$ and CaSx. Therefore, soil was added such that 1 g dry UMCf soil/L of UMCf groundwater was maintained in batch set 2 (0.25 g in each beaker with 250 mL groundwater).

Batch test sets 3 (QAL with CaSx) and 4 (UMCf with $FeSO_4$) were operated to investigate the effect of suspended solids (i.e turbidity) in high Cr (VI) concentration tests. The groundwater from both depths was filtered through a coffee filter (about 20 µm) and hexavalent chromium was added to increase chromium concentration to about 10,000 µg Cr^{+6}/L. Three of the six tests in batch test set 3 were operated with 250 mL coarsely filtered groundwater; the other three batch tests were performed with coarsely filtered groundwater to which QAL or UMCf soil was added to obtain 1 g dry soil/L of groundwater. All testing matrices are presented in Appendix C. Batch test sets 5 and 6 were performed with low hexavalent chromium concentration spikes. The results and discussion of the six sets of secondary batch tests can be found in section 4.1.

2.5 Column Testing for Cr (VI) Removal Using Calcium Polysulfide

2.5.1 Preliminary Column Testing

Column tests were performed to simulate in-situ remediation using chemical reduction of chromium. A preliminary test was run with two columns for 36 days. The columns were packed with the QAL and UMCf soils, respectively. The preliminary column testing was performed for low concentration chromium in groundwater (spiked with 1000 µg Cr+6/L). Two-inch diameter columns were packed with dried soil from the site to mimic the groundwater aquifer and flow velocity. Experimental setup details and results of the preliminary column tests are presented in Appendix D (Schematic diagram is presented in Figure D1). Based off of previous experience working with very fine soils, the columns were packed on a "sandwich"-like scheme, so the soil where the testing took place was layered between a well built base and a top cap. The bottom of the column was filled with glassbeads and gravel followed by packed soil (13 inches) to form a contact between the glass beads and the other materials to follow. Above the contact soil, about a half inch of gravel was placed and the injection port was filled with 1/4th inch glassbeads (1 inch height). Next, a layer of gravel (0.5 inches) was placed above the glassbeads, packed with soil (about 2 inches). Next, a layer of gravel (0.5 inch) was placed on top of the soil. All the columns were then saturated with groundwater on a downflow mode.

The QAL column was gravity fed and the UMCf column was operated at 30 psi using a pressure valve built in-house at the UNLV Mechanical Shop. The low hydraulic conductivity of the UMCf required higher pressure to facilitate flow within the time frame allocated for the project. The dosages of CaSx used were based in the results obtained in the batch tests. Based on the batch testing, CaSx at 2X the stoichiometric ratio was selected for the chemical column tests (ie. 34 mL/1000 L groundwater in both QAL and UMCf columns). However, considering the mixing issue in the columns, a factor of 10 was selected. Thus, an effective dosage of twenty times (20X) the stoichiometric requirement (ie. 340 mL/1000L groundwater) was used.

The calcium polysulfide was injected once a day into the UMCf column. A syringe was inserted through a port drilled at about 1 inch above the contact soil in the column. It was not possible to inject manually because of the 30 psi pressure built up in the UMCf column, therefore the pressure pump had to be shut down before injecting the CaSx. It was noted that upon shutting down the pressure, the soil expanded and a fine horizontal crack formed in the cover soil. The cracks were invisible when the pressure pump was started again. Initially, it was not considered problematic because the crack was not observed in the contact soil. However, later more prominent cracks were observed in the contact soil and CaSx diffused upward through the cracks into the water above the cover soil. For the QAL column, an Intravenous (IV) and was used to maintain CaSx flow at a rate of 370 to 400 µL/min contiuously. The IV required frequent replacement to prevent excessive flow of CaSx into the column. The preliminary columns' results are shown in Appendix D.

2.5.2 Secondary Column Testing for Cr (VI) Reduction in Groundwater at High and Low Concentration Using CaSx

Three columns were operated to examine the reduction of hexavalent chromium at low (1000 µg Cr^{+6}/L) and high (10,000 µg Cr^{+6}/L) concentrations using CaSx. Two columns were fed with low-chromium concentration groundwater (1000 µg Cr^{+6}/L), one column packed with QAL soil (QAL column) and the other with UMCf soil (UMCf A column). A third column, packed with UMCf soil, was fed with high-chromium groundwater (10,000 µg Cr^{+6}/L) (UMCf B column). Both UMCf columns were operated at 15 psi and the QAL column was gravity fed. Figure 2.2 shows the schematic diagram of the columns and their dimension (A picture of the set-up is presented in Appendix F). In this experiment, the total contact depth for calcium polysulfide and chromium was 25 inches. All the columns were filled with glass beads (2 inches) at the injection port and a layer of small sized gravel with coarse sand was placed above it. About 6 inches of soil was then packed and capped with gravel. The cover soil was used as a barrier and hence was not considered as contact soil depth. Approximately 5 kg of soil was packed into the columns including the contact depth and the cover soil.

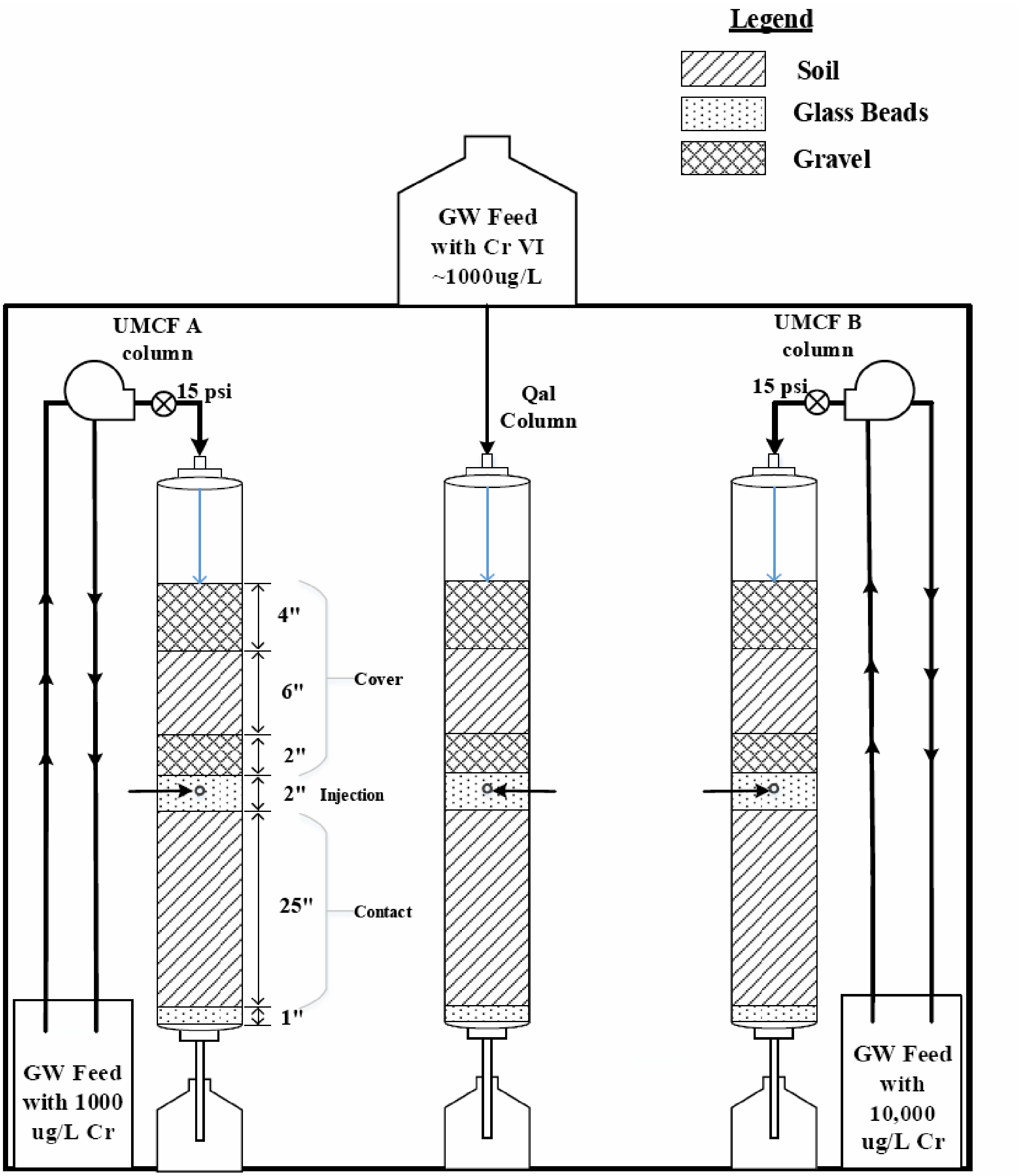


Figure 2.2: Schematic diagram of columns for chemical precipitation of chromium in columns using calcium polysulfide. The horizontal arrows at 27 inches from the bottom of the column indicate the injection port for calcium polysulfide.

Operation of the Columns

Table 2.4 shows the operation procedure for each column. In the beginning, the columns were fed with chromium spiked groundwater without calcium polysulfide. After two days, the concentration of chromium in the effluent was close to that in the influent, indicating the soil and pore spaces were saturated with chromium. The columns were operated for 24 days due to clogging of the effluent valves by movement of the fines contained in the soil. The effluent valve required daily cleaning to keep columns operating properly. Once the flow in the column was stabilized—between 24 and 26 days for each column—CaSx injection was initiated. The day CaSx was injected was recorded as Day 1 for data analysis purposes, excluding the days operated without CaSx (for hydraulic purposes). The calcium polysulfide dosage selected was 2X stoichiometric, based on the batch test results. However, considering potential mixing issues due to very fine grained soils, 20X stoichiometric was used for the low concentration columns and fourty times (40X) for columns with high concentration chromium (10,000 μg Cr^{+6}/L). For the QAL column, half of the estimated amount of CaSx (ie. 2 mL CaSx) was injected twice everyday (ie. 1 mL on each injection). For the UMCf A and B columns, 0.3 mL CaSx and 1 mL CaSx, respectively, were injected once a day.

The operation of the columns included measurement of flow rate, throughput volume, pH, hexavalent chromium (as a 24-hour composite sample and a grab sample), and total chromium (in composite samples). Every two days, groundwater spiked with 1000 μg Cr^{+6}/L or 10000 μg Cr^{+6}/L was prepared and added to the feed tanks. The chromium concentration in the feed tank was measured every time new groundwater was added to the tank.

Table 2.4: Operation of Chemical Precipitation Columns

	Number of Days		
Operation Phase	QAL 1000 μg/L	UMCf A 1000 μg/L	UMCf B 10000 μg/L
Without calcium polysulfide	36	34	24
Injection of calcium polysulfide	1 to 30	1 to 17	1 to 23
No injection with same Cr (VI) concentration	31 to 44	30 to 46	24 to 36
No injection with Cr (VI) increased by 10X	44 to 51	46 to 53	36 to 39

In the last weeks of testing—because breakthrough in the columns did not occur after stopping CaSx addition—the influent chromium concentration was increased by 10X to promote breakthrough.

Chromium Analysis

Chromium in the effluent of the columns was analyzed in 24-hour composite sample and in grab samples, both collected at the same time. The samples were collected before the injection of CaSx, therefore, the composite samples are likely to have lower chromium concentrations than the grab. This is only the case because chemical injection happened after sample collection. The grab samples collected were filtered and analyzed the same day for Cr (VI) using the Hach 8023 method. The composite samples were preserved with nitric acid and analyzed by ICP within 15 days. The composite samples were not filtered and were relatively clear due to filtering through the column. The goal was to mimic in-situ applications, where the formed precipitates are trapped in the pores of the soil. The discussion of secondary column testing continues in section 4.2.

2.6 Batch Test for Biological Reduction

All microcosm tests were performed using 125 mL autoclave-sterilized borosilicate glass bottles. In all tests, 30 grams of wet soil were transferred to the glass bottles. Next, a total of 100 mL of groundwater, nutrients, and desired amount of substrate were added. The volume of substrate added was to achieve 100 times the stoichiometric demand considering chromium, nitrate, perchlorate and chlorate concentration (Stoichiometric demand calculations are presented in Appendix E). Table 2.5 summarizes the microcosm tests performed including the substrate types and well sources for soil and groundwater. Although the initial project was envisioned for Cr (VI) degradation only, the presence of co-contaminants (i.e. nitrate, chlorate and perchlorate) resulted in the evaluation of biological reduction for all major contaminants present in the groundwater.

Table 2.5: Summary Table with Well ID of Soil and Groundwater

Biodegradation experiment	**Well ID for**	
	Soil sample	Groundwater
Trial Testing of Microcosm Using EOS-PRO, Industrial Sugar Wastewater and Molasses (Appendix)	UFIW-02 S (23-25 feet, QAL) and UFIW-02 I (31-36 feet, UMCf) UFIW-03	UFIW-06S (QAL) and UFIW-06I (UMCf) (spiked with 5 mg/L Cr^{+6})
Preliminary Microcosm Using EOS-PRO, Industrial Sugar Wastewater, and Mixture of the two substrates	CTMW 03S for QAL and CTIW 01D for UMCf	CTMW 03S (QAL) CTIW 01D (UMCf)
Microcosm Using Mixture of EOS-PRO and Industrial Sugar Wastewater (3 parts of EOS-PRO and 12 parts of Industrial Sugar Waste) with Di-ammonium Phosphate		
Microcosm Using Mixture of EOS-PRO and Sugar (to test as Substitute for Industrial Sugar Waste)		

The microcosm bottles were crimped closed using butyl rubber caps and aluminum rings to ensure anaerobic/anoxic conditions, and were continuously mixed in a rotary shaker at 30 rpm at room temperature. All tests were performed in duplicate. At pre-determined time intervals, one bottle and its duplicate were tested and sacrificed, unless otherwise specified. The microcosm bottles were taken out of the rotor and were left to settle solids for at least 6-8 hours. This settling was necessary because of the very fine nature of the soil encountered in the AP area and used in the testing. The liquid from the microcosm bottles was decanted and filtered through a 0.2 μm membrane filter (Paul Laboratories). The filtered samples were analyzed for Cr (VI), nitrate, perchlorate, chlorate, and COD. COD measurements for this project quantify the amount of organic carbon present either as emulsified oil, Industrial Sugar Wastewater, molasses, or sugar.

Nutrient Addition

Phosphorus was added to supplement the Industrial Sugar Wastewater and molasses microcosms because their phosphorus content was not sufficient to support microbial growth. The EOS-PRO oil contains phosphate. A nitrogen source was not initially added because soils and groundwater of the NERT site contained significant amounts of nitrate that could serve as a source of nitrogen for bacteria. However, in some microcosms, after all nitrate was degraded, di-ammonium phosphate was added to supply both nitrogen and phosphorus.

Control Microcosms

The control microcosms introduced were: 1) Blank, without addition of substrate (BLK), 2) Industrial Sugar Wastewater without phosphate, and 3) Molasses without phosphate. The control microcosms were tested for both QAL and UMCf. No substrate was added to the BLK microcosms to test biodegradation rates in the absence of an external electron donor. Control microcosms without phosphate were introduced to investigate the impact of phosphate—a nutrient for bacteria—on chromium, nitrate, chlorate, and perchlorate biodegradation.

2.6.1 Phase I Microcosms for Biodegradation of Chromium, Perchlorate, and Nitrate using EOS-PRO, Industrial Sugar Wastewater, a Mixture of EOS-PRO and Industrial Sugar Wastewater, and Molasses as Substrate

For this experiment, 128 microcosms were prepared including microcosms for the selected substrates and each substrate's control microcosms—i.e. without phosphate, and blanks. The substrates selected were: EOS-PRO, Industrial Sugar Wastewater, a mixture of the Industrial Sugar Wastewater and EOS-PRO, and molasses. The experimental matrix used in the microcom tests is depicted in Appendix E (Table E.5). About 15% by volume and 10% by volume DI water was added to EOS-PRO and Mix microcosms, respectively, to account for the dilution contributed by the phosphate buffer addition in the Mix and Industrial Sugar Wastewater microcosms.

During this phase of testing, some microcosms were sampled and then returned to the rotors to be re-sampled on a later date. Re-sampling was performed because the degradation took longer than expected and it was necessary to ensure enough bottles were available for the study. However, in general, the microcosms that were sacrificed were centrifuged, filtered, and analyzed for the contaminants of concern. Nitrate, Cr (VI), perchlorate, chlorate, COD and phosphate were measured. The high total dissolved solids (TDS) present in the AP area groundwater resulted in poor detection of chlorate using the

UNLV ion-chromatograph method—that typically used for the NERT samples. To check chlorate degradation, some samples were sent to Silver State Labs, a certified commercial laboratory in Las Vegas. Total dissolved chromium concentrations were analyzed using inductively coupled plasma (ICP) at a certified university laboratory with our partner Utah State Laboratories. Samples for total dissolved chromium analysis by ICP were preserved with nitric acid at pH =2. The results and discussion of the first phase of batch biological tests can be found in section 5.1.1.

2.6.2 Phase II Microcosms with EOS-PRO and Industrial Sugar Wastewater as Substrate (at 3 parts EOS-PRO: 12 parts Industrial Sugar Wastewater Ratio) and with Di-ammonium Phosphate

The experimental matrix used in these microcosm tests is depicted in Appendix E (Table E.6). For these tests, a mixture of EOS-PRO and Industrial Sugar Wastewater (referred to as Mix), was selected as the substrate. The substrate was comprised of three parts of EOS-PRO and twelve parts of Industrial Sugar Wastewater by volume. The hypothesis for adding Industrial Sugar Wastewater to EOS was to provide a readily biodegradable compound that would jump start biological reduction faster than when EOS-PRO is used alone.

For all microcosms, di-ammonium phosphate (P) was added except for the control (without phosphate). The controls introduced were: 1) blank (without substrate), and 2) Mix without P. The phosphate was added such that about 140 mg P/L was present in the QAL and UMCf microcosms. On Day 120, about 10% by volume DI water was added to all remaining microcosms to dilute the high TDS present—pre-existing TDS plus that resulting from chlorate degradation. Soluble COD (dissolved in the aqueous phase), nitrate, perchlorate, chlorate, Cr (VI), phosphorus, and total dissolved solids (TDS) were measured. Section 5.1.2 contains the results and discussion of the Phase II microcosm tests.

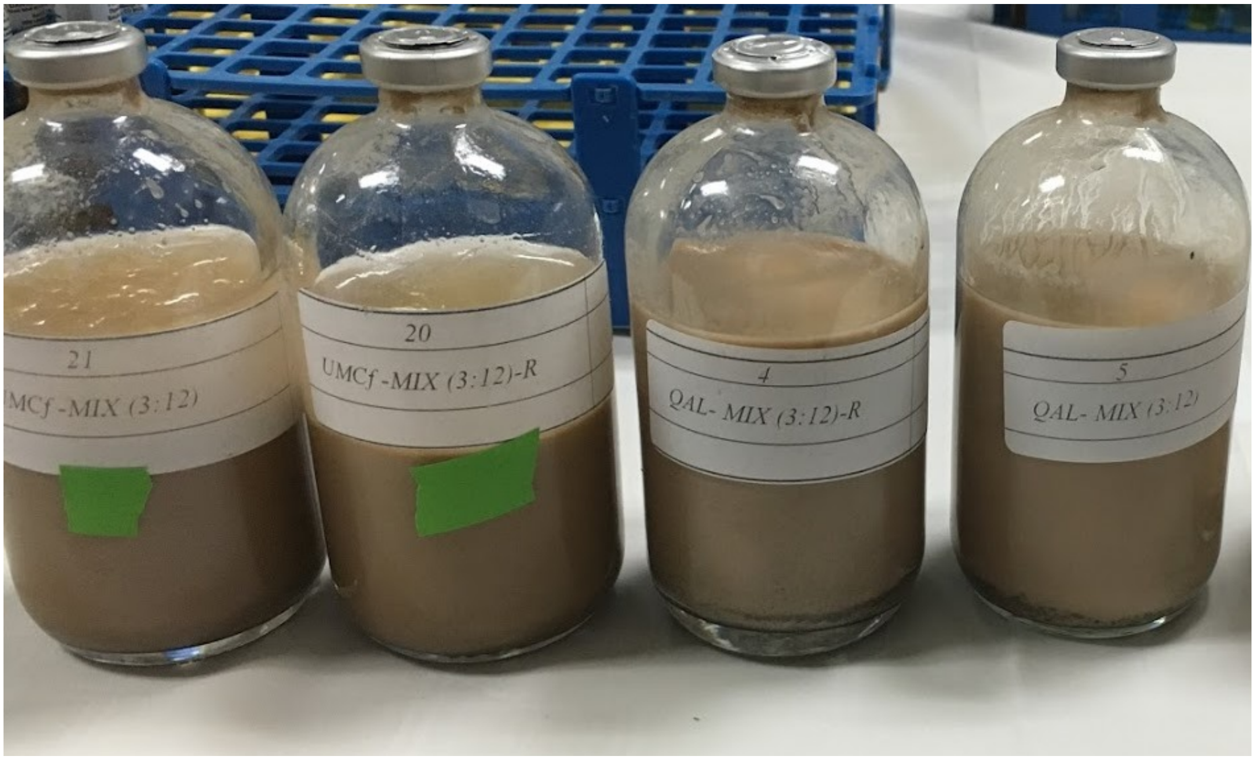


Figure 2.3: Microcosms with EOS-PRO and Industrial Sugar Wastewater as substrate at (3 parts of EOS-PRO: 12 parts of Industrial Sugar Waste) ratio and with di-ammonium phosphate

2.6.3 Microcosms with Sugar as Substrate to Substitute for Industrial Sugar Wastewater

Table E.7 in Appendix E depicts the experimental matrix used in these microcosm tests. A mixture of EOS-PRO and food grade sugar (Mix-Sugar) was used as the substrate and phosphate buffer (P) was added in all microcosms except for one control (without phosphate). The controls introduced were: 1) blank (without substrate), 2) Mix without phosphate, and 3) Sugar only. Soluble COD, nitrate, perchlorate, chlorate and Cr (VI) were measured and the data can be found in section 5.1.3.

2.7 Column Test for Biological Reduction

The biological reduction of chromium and co-contaminants was evaluated using four columns. Two of the columns were packed with soil from depths 25-30 ft (Alluvial layer) termed QAL columns and two with soil from 35-40 ft (Muddy Creek Formation) termed UMCf columns. The columns were 2 inches in diameter and 50 inches long. Approximately 3 kg of dried QAL soil was packed in each QAL column and about 2.3 kg of dried UMCf soil was packed in each UMCf column. The approximate bulk densities of soil were 1,300kg/m^3 for a QAL column and 910 kg/m^3 for UMCf. The characteristics of the soils used in the columns are shown in Table 2.6. Notice that QAL materials are heavier with bulk density 1.43 times greater than that of UMCf. However, UMCf material is more porous with a porosity of 65.64% compared to 48% for QAL. The field data for this site generated by Tetra Tech (e-mail from Carl Lenker Sept 14, 2017) show dry bulk densities for QAL and UMCf varying from 1.10 - 1.56 and 0.8 - 1.29, respectively. Therefore, the bulk densities measured in the laboratory columns after packing are similar to values measured in the field. In the field data generated by Tetra Tech, QAL and UMCf porosities vary from 35-61% and 51-66.8%, respectively. Thus, the values measured in the laboratory are within the range measured in the field and show much larger porosity for UMCf (65.64%) as compared to that of QAL (48%).

For the biodegradation tests, columns were fed with groundwater from the CTMW-03S well for QAL and CTMW-03D for UMCf. Before biodegradation testing started, the dried soils were saturated with groundwater, free of any electron donor or nutrients.

Table 2.6: Parameters of the Soil Used in the Biological Columns

	QAL	UMCf
Volume of column occupied by soil (excluding the top cover), cm^3	2329	2329
Weight of soil used in column, g	2213	3026
Bulk density of dry QAL and UMCf, g/cm^3	1.3	0.91
Volume of solids only in the soil (estimated based on bulk density), cm^3	1146.8	802.57
Estimated porosity of the column (%)	48	65.64

The QAL columns were gravity fed at first, and then were pressurized to 5 psi from Day 28 because the flowrate decreased significantly. This decrease is attributed to settling of the fine grained material present in QAL in the lower portion of the column as groundwater passed through. During saturation, the UMCf columns were pressurized at 15 psi, but the pressure was reduced to 10 psi from Day 1 of the operation of the columns. An in-house built pressure valve was used to pressurize the soil columns along with an Aquatec CDP6800 booster pump. Figures 2.5a and 2.5b depict the schematic diagrams of the experimental set up used in the column testing. Note that both UMCf and QAL columns were operated under pressure after Day 28 (Figure 2.5). The operation details for the UMCf and QAL columns are shown in Table 2.7. Notice that the column feed solution composition was changed with time. Compositions included groundwater (GW) with EOS-PRO, a mixure of Industrial Sugar Wastewater and EOS-PRO, and GW alone.

The effluent valve in the QAL columns had clogging issues due to fines flowing with groundwater. To resolve the clogging issue, the effluent valves in the QAL columns were cleaned and the columns were operated only with groundwater for five days. Therefore, the UMCf columns and QAL columns were operated five days apart. The day for the substrate injection into the QAL columns (Day 1) corresponds to Day 6 for the UMCf columns.

Table 2.7: Operation Details for QAL and UMCf columns Used to Investigate Biological Reduction of Chromium and Co-contaminants

Substrate variation	QAL operation		UMCf operation	
	Days	Variation in feed	Days	Variation in feed
High amount of substrate (comparing the impact of Industrial Sugar Wastewater, no substrate and EOS-PRO alone)	1-2	7% Industrial Sugar Wastewater and 2% EOS-PRO in 91% GW (45880 mg/L COD equivalent)	1-7	7% Industrial Sugar Wastewater and 2% EOS-PRO in 91% GW 45880 mg/L COD equivalent)
	3-5	Dilution of the previous feed by GW	8-10	Dilution of the previous feed by GW
	6-8	GW only	11-13	GW only
	9-14	7% Industrial Sugar Wastewater and 2% EOS-PRO in 91% GW(45880 mg/L COD equivalent)	14-19	7% Industrial Sugar Wastewater and 2% EOS-PRO in 91% GW 45880 mg/L COD equivalent)
	15-17	0.2% EOS-PRO in 99.8% GW(4000 mg/L COD equivalent)	20-31	0.2% EOS-PRO in 99.8% GW (4000 mg/L COD equivalent)
	18-29	GW only		
	30-36	0.4% EOS-PRO (8000 mg/L COD equivalent)	32-40	0.4% EOS-PRO in 99.6% GW (8000 mg/L COD equivalent)
Low amount of substrate	37-160	1.5% Industrial Sugar Wastewater and 0.4% EOS-PRO and 1.9% Phosphate in 96.2% GW (9260 mg/L COD equivalent)	41-165	1.5% Industrial Sugar Wastewater and 0.4% EOS-PRO and 1.9% Phosphate in 96.2% GW (9260 mg/L COD equivalent)

The columns were disturbed twice for two hour periods due to power outages in the building on Days 105 and 110. In the QAL columns, some cracks in the packed material were observed on Day 106 which resulted in high effluent flow; a constant flow could not be maintained until Day 113. On Day 120, small cracks on the material inside UMCf column B were also observed. The UMCf columns, despite the very fine nature of the clay material, ran much smoother than the QAL columns. The results and discussion of the column tests are presented in section 5.2.

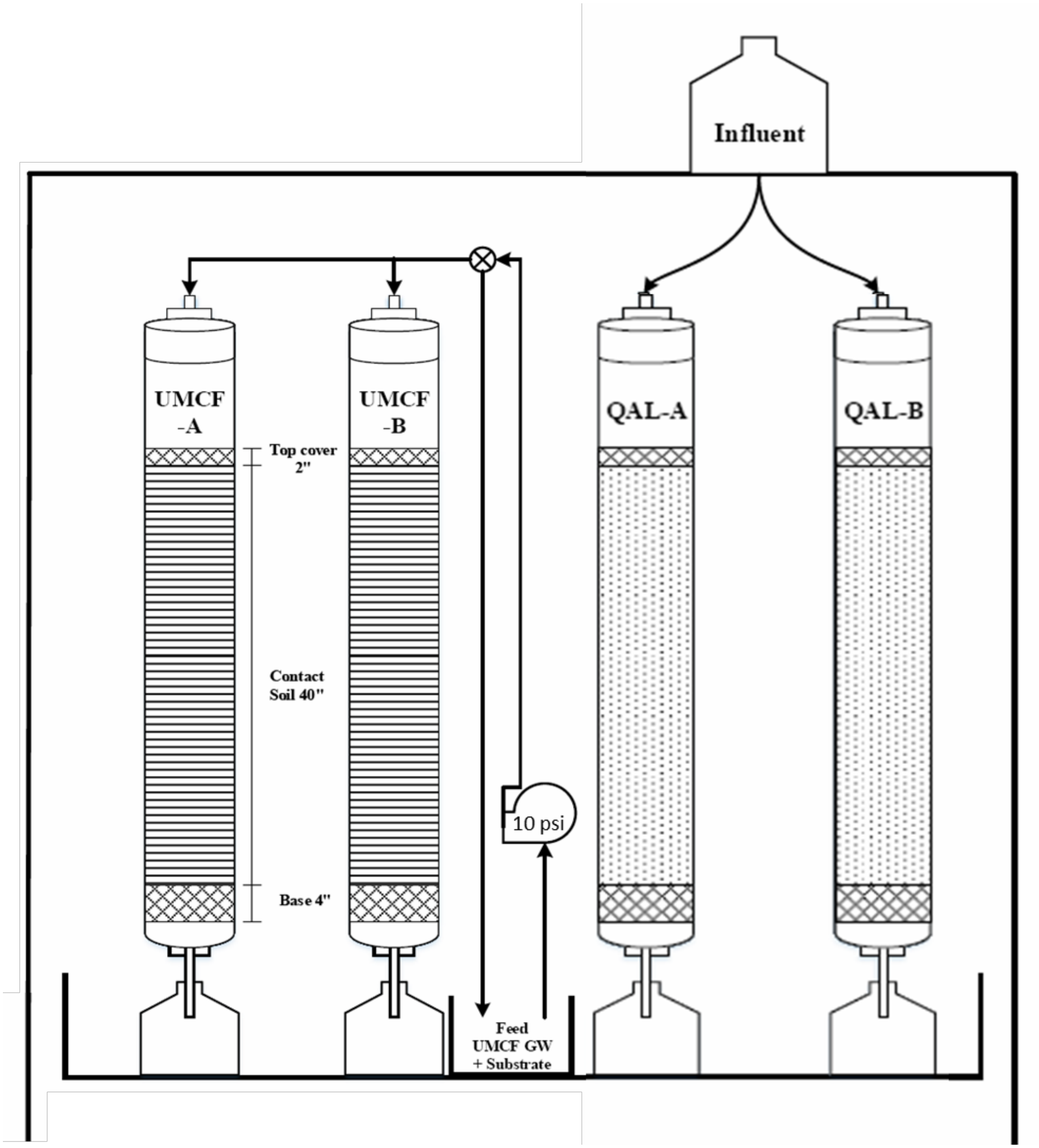


Figure 2.4: Schematic diagram of columns used for biological treatment of the UMCf and QAL contaminated groundwater (Day 1 to Day 28).

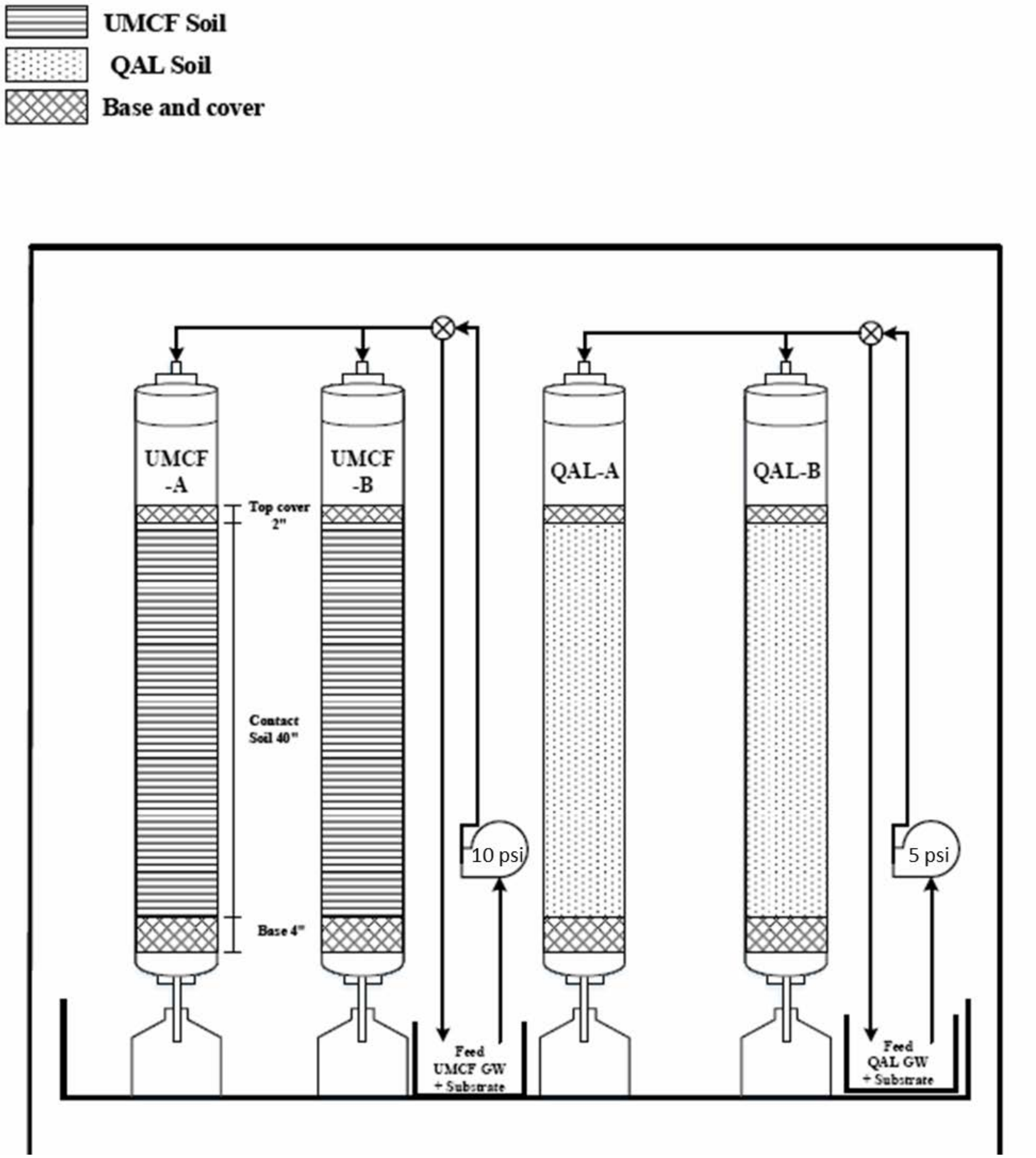


Figure 2.5: Schematic diagram of columns used for biological treatment of the QAL and UMCf groundwater after Day 28. The QAL columns were pressurized at 5 psi and UMCf was 10 psi. The QAL columns before Day 28 were gravity fed.

2.8 Microbial Analysis

On desired dates, about 30 mL of the microcosm content were transferred to autoclaved containers and shipped overnight to a commercial laboratory (Research and Testing Laboratories, Lubbock, Texas) for bacterial community analysis. The total number of bacteria, archaea, and Cr (VI) reducing bacteria were evaluated.

DNA from the microorganisms present was extracted using Illumina next-technology (Research and Testing, 2015) which utilizes clonal amplification and sequencing by synthesis. The first primer selected for the study was 515F-806R, which is specific for bacteria and archaea. For the chromium reducing bacteria, the primers were 27YMF and 534 R based on a previous study by Somenahally et al., 2013. Once the sequences were generated, the data were examined for the removal of short, singleton, noisy, and bad read sequences. The quality-checked sequences were clustered at a 4% divergence using USEARCH clustering algorithm (Research and Testing, 2015). The sequences obtained were identified using an in-house-maintained database that is derived from the National Center of Biotechnology Information (NCBI). The final results obtained include the percentages for each organism identified up to species level.

CHAPTER 3 SOIL AND GROUNDWATER CHARACTERIZATION

3.1 Soil Characterization

The soil characterization included grain size distribution and chemical contribution of the soil from the UFIW-02 well (Table 3.1). The moisture content in soil samples were 12.01 ±0.58% in the QAL (25-28 feet), 50.88 ± 3.40% in the Intermediate (31-36 feet) interval and 42.26 ±3.55% in UMCf (43-48 feet). The Intermediate sample was taken at a depth on the boundary between the QAL and UMCf. The QAL soil samples were visibly granular and dry, while the two lower depths—Intermediate and UMCf—were clayey with very high moisture.

Table 3.1 Grain Size Distribution and Contaminant Contribution from the Soil Samples at QAL (23-28 feet), Intermediate (31-36 feet), and UMCf (43-48 feet) depth

Wet Soil Sample at Various Depths	Moisture content (%)	Contaminant concentration in extracts		Size fractions (%)	
		Moisture extraction	Rinsed- extraction	Sieve size (mm)	Percent retained
 Depth:23 to 28 ft (QAL)	12 ±0.6	No liquid could be collected	Chromium= 21 ± 8 μg/L	> 9.5	3.19
				> 4.75	8.09
			Nitrate= 10.380± 1.7 mg NO_3/L	> 0.85	26.44
				> 0.425	11.06
			Perchlorate = 7.1215 ±1.7 mg/L	> 0.075	43.96
				< 0.075	7.25
 Depth:31 to 36 ft (Intermediate)	50 ±3	Chromium= 35 μg/L	Chromium= = 17±10 μg/L	> 9.5	6.10
				> 4.75	1.80
		Nitrate= 1183 ±0.42 mg-NO_3/L	Nitrate= 140.304± 1.0 mg NO_3/L	> 0.85	14.84
				> 0.425	11.47
		Perchlorate = 1333 ±14 mg/L	Perchlorate = 50.2101 ±1.1 mg/L	> 0.075	45.51
				< 0.075	20.24
 Depth:43 to 48 ft (UMCf)	42 ±4	Chromium= 20 μg/L	Chromium= 26 ±12.7 μg.L	> 9.5	10.36
				> 4.75	0.00
		Nitrate= 1182 mg-NO_3/L	Nitrate= 40.103± 2.9mg NO_3/L	> 0.85	8.00
				> 0.425	3.98
		Perchlorate = 1282 ±37 mg/L	Perchlorate = 45.6394± 1.1 mg/L	> 0.075	42.30
				< 0.075	35.70

3.1.1 Grain Size Distribution of Soil

The grain size distributions of the soils from different depth intervals are shown in Table 3.1. The sieve analysis shows that the majority of the grains were of a size between 0.425 mm to 0.075 mm (>45%). The second highest percentages were: for QAL particles between 4.75 and 0.85 mm (26.44%), for Intermediate particles < 0.075 mm (20.24%), and for UMCf particles < 0.075mm (35.70%).

3.1.2 Contaminant in the Groundwater Extracted from the Soil Samples (Moisture-Extraction)

An attempt was made to extract the groundwater (soil moisture) from soil samples. The Intermediate and UMCf yielded water and were analyzed for chromium, nitrate, and perchlorate. Table 3.1 shows the concentration of contaminants in the extracted liquid from the soil depths. No liquid could be extracted from QAL. Notice that the concentrations of the contaminants were similar to those measured in the groundwater from QAL (Figure 3.1 and Figure 3.2).

3.2 Contaminant Extraction by Soil Rinsing

3.2.1 Contaminant Extraction by Soil Rinsing for Soil from Well UFIW-02

Table 3.2 shows the amount of hexavalent chromium, perchlorate, and nitrate measured in the extracts from the various soil horizons in well UFIW-02. Chromium concentrations are twice as large in Intermediate and UMCf compared to QAL, showing greater Cr in the UMCf than in the QAL. Nitrate and perchlorate concentrations are very high and increase with depth.

Table 3.2: Amount of contaminants of concern in the soil at different depths

Soil Depth (ft)	Chromium hexavalent	Nitrate	Perchlorate
	µg/kg dry soil	mg NO_3/kg dry soil	mg/kg dry soil
QAL (23-28 feet)	150 ± 50	70.04 ±10.10	47.30 ±8
Intermediate (31-36 feet)	240 ±140	552.69 ±12.25	688.49 ±16.77
UMCf (43-48 feet)	300 ±140	466.44 ±31.63	530.85 ±15.78

Note: The mass of contaminant in each extract was calculated by multiplying the concentration measured and the extract volume. The mass was then divided by the amount of dry soil (moisture content was also computed and was used to determine dry soil weight).

3.2.2 Contaminant Contribution by the Soil Samples in Soil Fractions (Rinsed-soil)

Table 3.3 shows the average amount of hexavalent chromium, perchlorate, and nitrate measured in the extracts from the mixed, sundried, and sieved soil. The contaminant concentration gradually increased with decrease in soil grain size for all contaminants in each horizon except for chromium. The chromium concentrations were similar (90-120 ppb) in all horizons except for soil grain size 0.075–0.425 mm (passing through #40 and retained on #200) in the 23-28 ft horizon. The concentration was significantly higher at 220 µg Cr/kg dry soil. Both nitrate and perchlorate were very high in the deeper soil intervals. It was expected that the contaminant concentration would increase with depth, but nitrate concentration was the highest in all soil fractions from at a depth of 31-36 ft rather than in the 43-48 ft samples. Perchlorate concentration increased with soil fraction for each soil horizon depth. The QAL soil had the lowest perchlorate concentration for finer soil, but the intermediate depth soil had the lowest perchlorate concentration for the coarser soil.

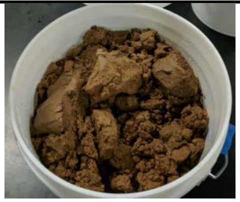
3.2.3 Contaminant Extraction by Soil Rinsing for Soil from Wells CTMW-03S and CTIW-01D

Table 3.4 shows the amount of hexavalent chromium, perchlorate, and nitrate measured in the extracts from the QAL (CTMW-03 S) and UMCf (CTIW-01D). Chromium and perchlorate concentrations were very high and increased with depth. Nitrate was almost double in the QAL soil as compared to the UMCf.

Table 3.3: Average amount of contaminants of concern in the soil at different depths

Soil Depth(ft) Soil fraction	Chromium (µg/kg dry soil)			Nitrate (mg NO_3/kg dry soil)			Perchlorate (mg/kg dry soil)		
	QAL (23-28 feet)	Intermediate (31-36 feet)	UMCf (43-48 feet)	QAL (23-28 feet)	Intermediate (31-36 feet)	UMCf (43-48 feet)	QAL (23-28 feet)	Intermediate (31-36 feet)	UMCf (43-48 feet)
passing #20; remaining #40 (grain size: 0.425 mm)	120	90 ±0.02	130	60.1 ± 0.99	470.1	373.7	48.8 ± 0.30	28.2 ± 2.57	365.1 ± 3.81
passing #40; remaining #200 (grain size: 0.075 mm)	220 ±0.21	110	110 ±0.03	66.8	529.8	407.6 ± 0.03	51.80± 2.97	322.30 ± 2.09	396 ± 1.145
passing #200 (grain size: < 0.075 mm)	90 ±0.02	100	120 ±0.02	72.6	752.4	536.9	56.5 ± 0.78	444.7 ± 4.47	530.5 ± 1.91

Table 3.4: Amount of contaminants of concern in the soil

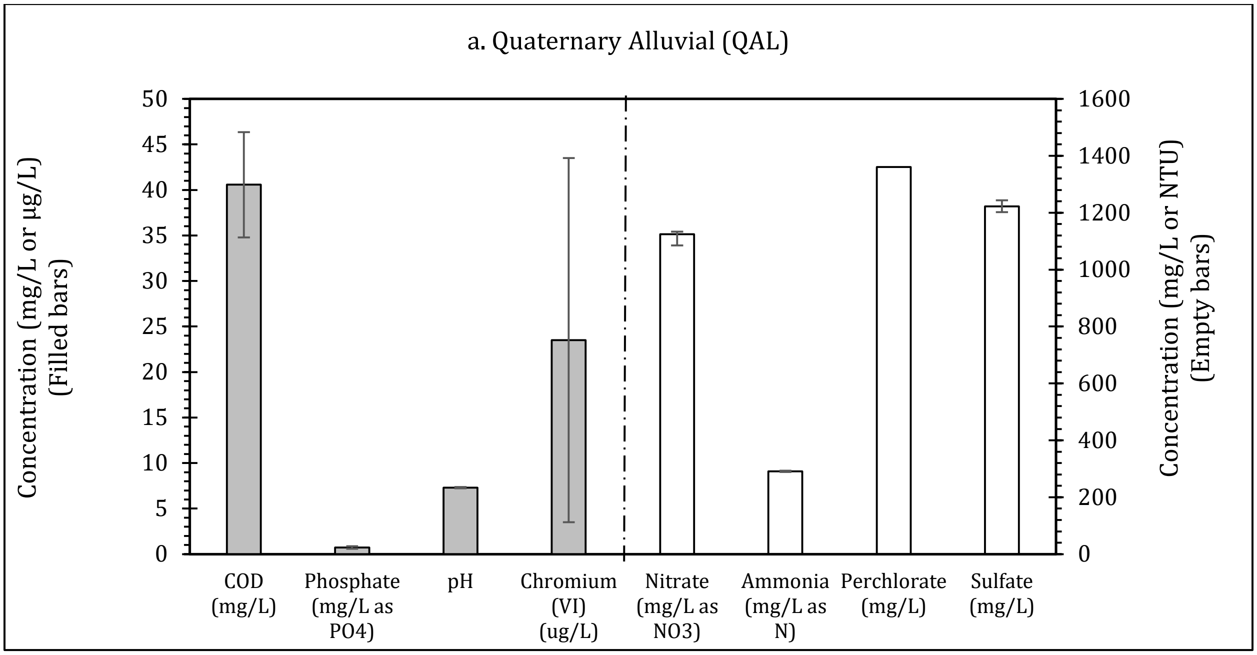
Soil Depth (ft)	Cr (VI) Average± standard deviation		Nitrate Average± standard deviation		Perchlorate Average± standard deviation	
	µg/L	µg/kg dry soil	mg/L	mg NO_3/kg dry soil	mg/L	mg/kg dry soil
 **CTMW 03S, QAL (18.3 to 23 ft)**	6.08± 0.13	38.1 ± 0.9	18± 0.5	112.67±0.9	37 ±2.7	232.41 ±16.4
 **CTIW 01D, UMCf (33.5 to 38.5 ft)**	1271 ± 114	5378±47	16 ± 0.5	69.38±1.5	71 ±1.4	302.41±8.5

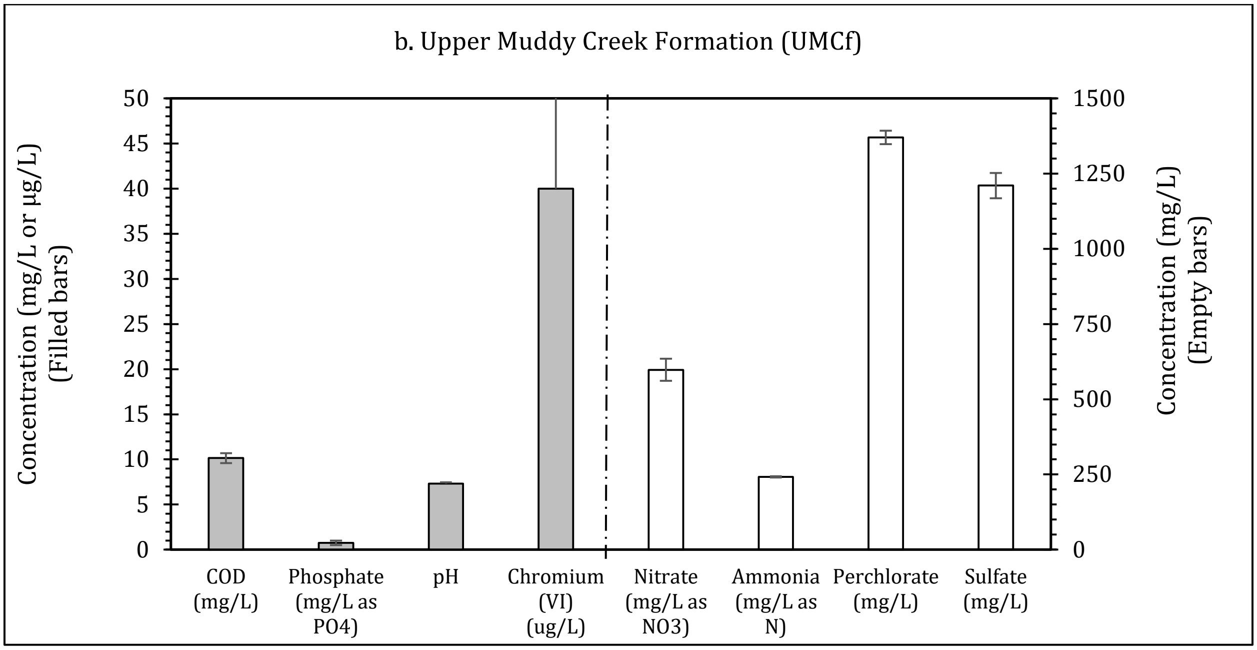
3.3 Groundwater Characterization

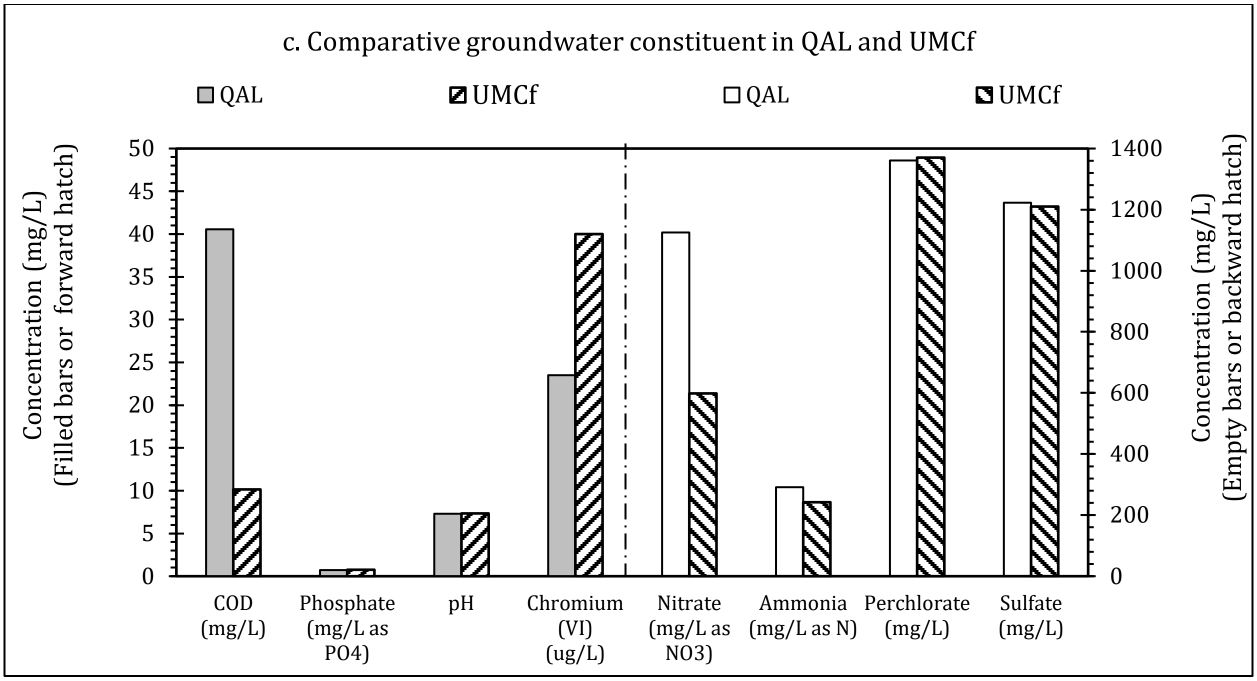
Groundwater from Well UFIW-06 Collected 7/22/2016

The groundwater obtained from the site on 7/22/2016 from well UFIW-06 was analyzed immediately upon arrival. The average concentrations of contaminants measured in four bottles from the quaternary alluvial layer (25-30 ft bgs), QAL, and UMCf (35-40 ft bgs) are presented in Figure 3.1 (a), and Figure 3.1 (b), respectively. The pH levels of both waters are around the neutral range. Each groundwater bottle showed different turbidity—likely due to the lack of sufficient water yielded in the well. The chemical oxygen demand (COD)—a measure of the presence of organic compounds—is higher in the QAL (40 mg/L) as compared to the UMCf (10 mg/L). Nitrate concentrations are very high, varying from 135 mg N/L (597 mg-NO_3/L) in QAL to 250 mg N/L (1,106 mg-NO_3/L) in the UMCf. Perchlorate concentrations in both horizons are extremely high and above 1,300 mg/L. Sulfate levels in both horizons are similar and around 1200 mg/L. Ammonium levels are high in both horizons varying from 240-250 mg-N/L. This is unusual since in the lower areas of NERT ammonium has been converted to nitrate, unlike this area. It is advisable to check the in-situ concentrations of oxygen in these wells given the very high ammonium concentrations. Phosphate levels are very small and below 1 mg/L.

The Cr (VI), COD, and turbidity in each bottle is shown in Figure 3.2. Turbidity varied in each sampling bottle. At the QAL, turbidity was between 600-1200 NTU while at UMCf it was much lower (4-12 NTU). This shows that the fine-grained material from the QAL is easily carried away by water—as was also found when we studied soil flushing in other areas of NERT. Cr (VI) also varied in each sampling bottle from 10 to 60 μg/L in QAL and 10 to 70 μg/L in UMCf. The bottles were labelled as they were filled in the field. It was suspected that upon each drawing the Cr (VI) was different. However, groundwater from both horizons contained low Cr (VI) concentrations, below 80 μg/L. It was suspected that COD might also vary in the sampling bottles, but the COD measurements were between 37.4 to 38.7 mg/L in QAL and 8 to 11.6 mg/L in UMCf groundwater.


a. Quaternary Alluvial (QAL)


b. Upper Muddy Creek Formation (UMCf)



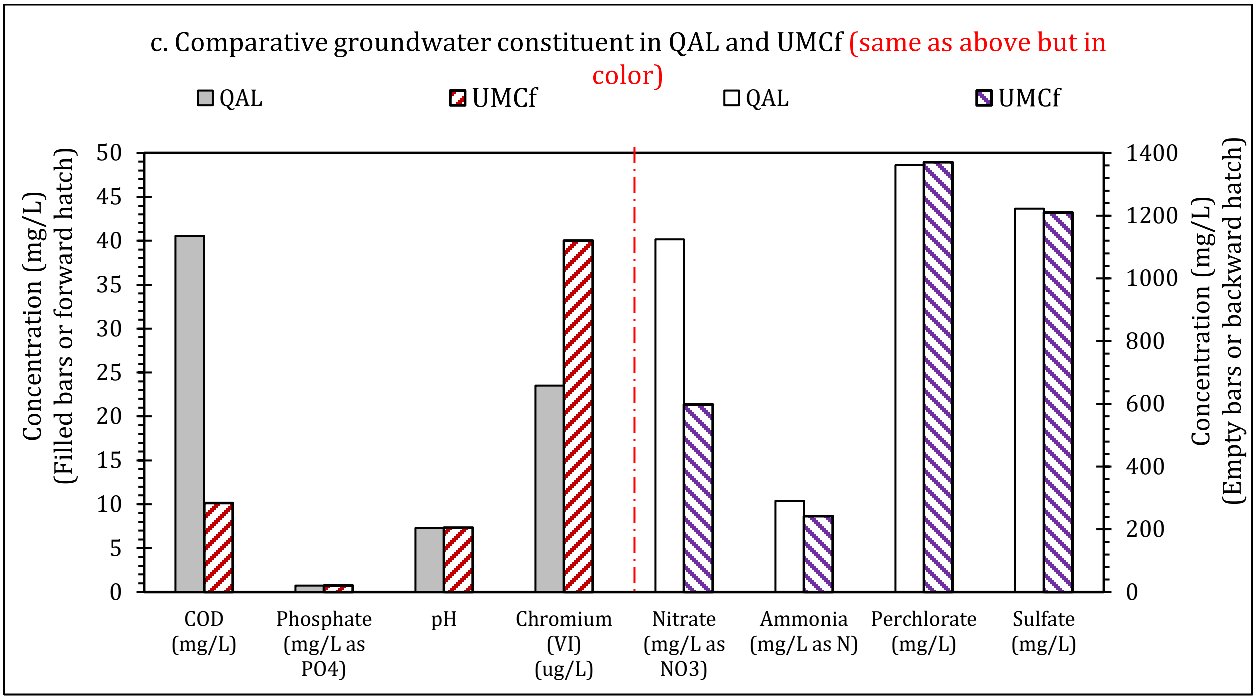


Figure 3.1: Groundwater characterization in quaternary alluvial layer (25-30 ft) (a), muddy creek formation (35-40 ft) (b) groundwater from UFIW-06 received on 7/22/2016 and comparison of QAL and UMCf groundwater (c). The contaminants concentrations for the filled and with forward hatched bars (left of the vertical dotted line) are read on the left y-axis and for the filled and with backward hatched bars (right of the vertical dotted line) are read on the right y-axis.

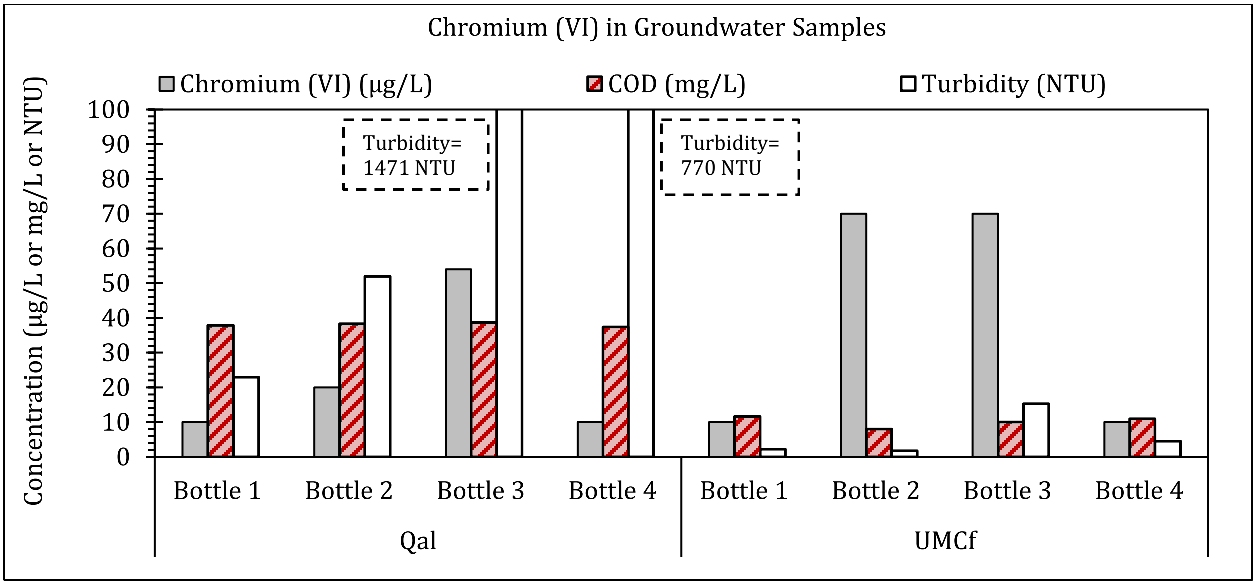
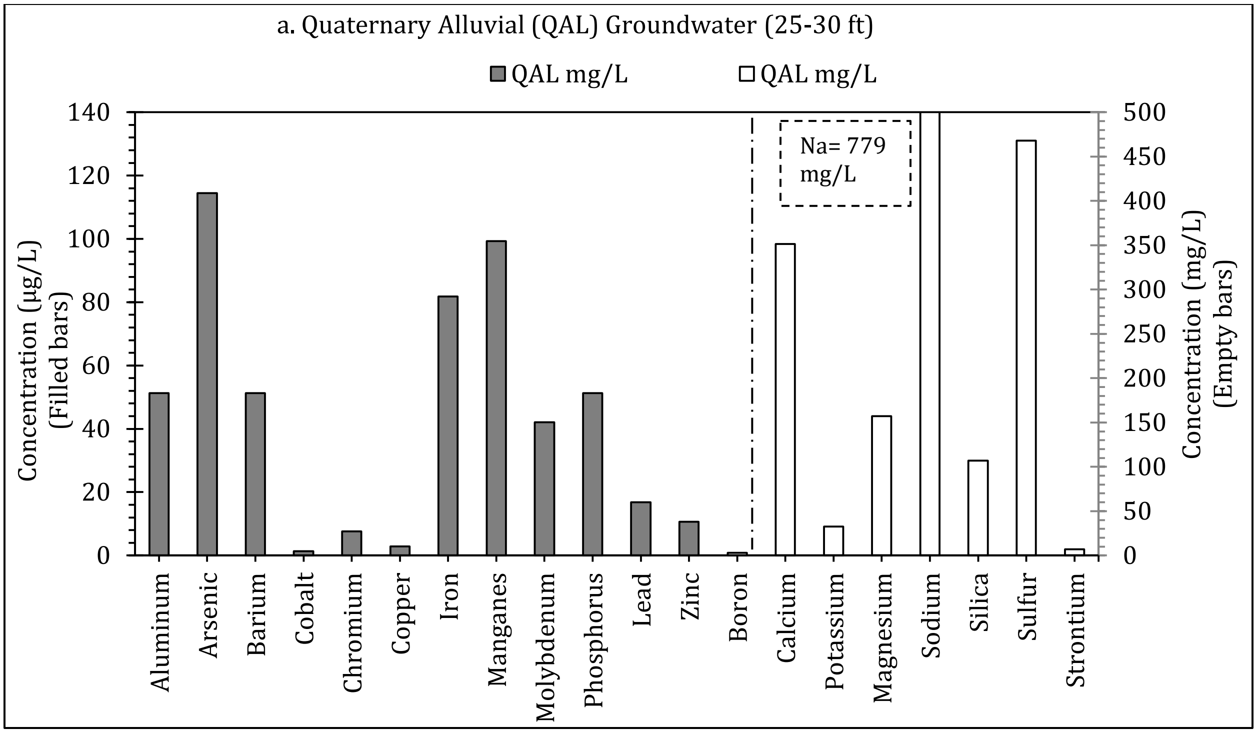
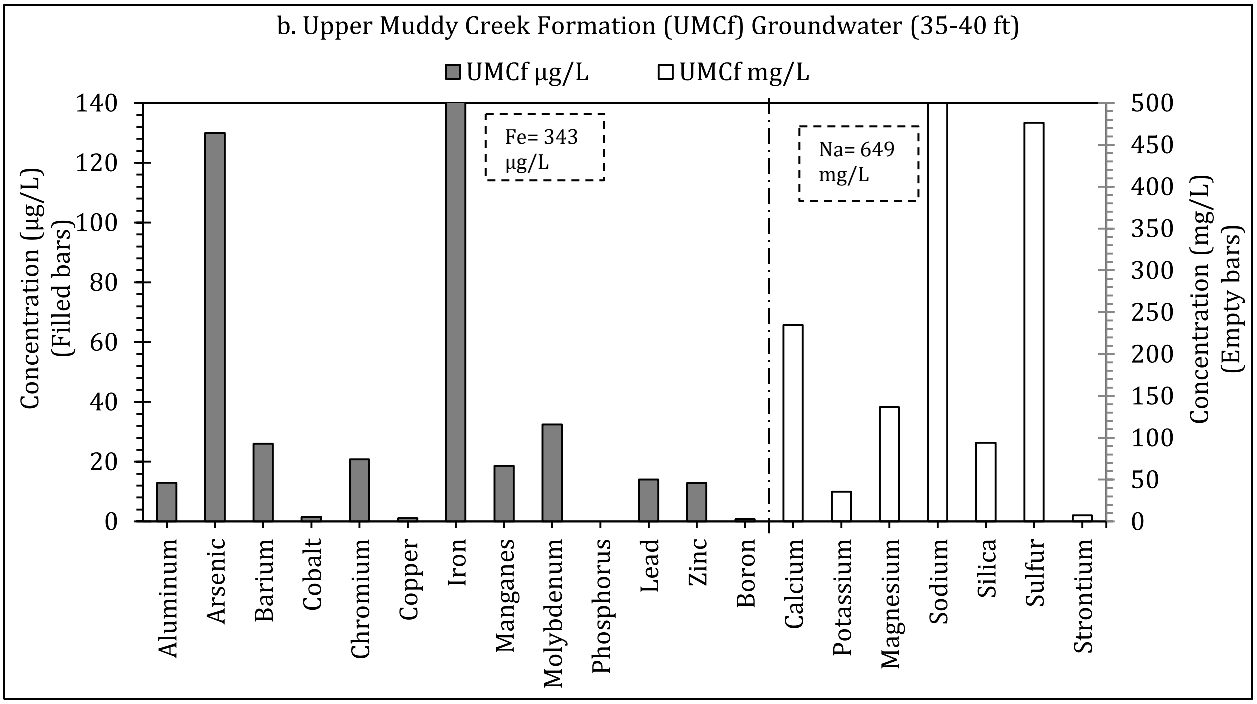


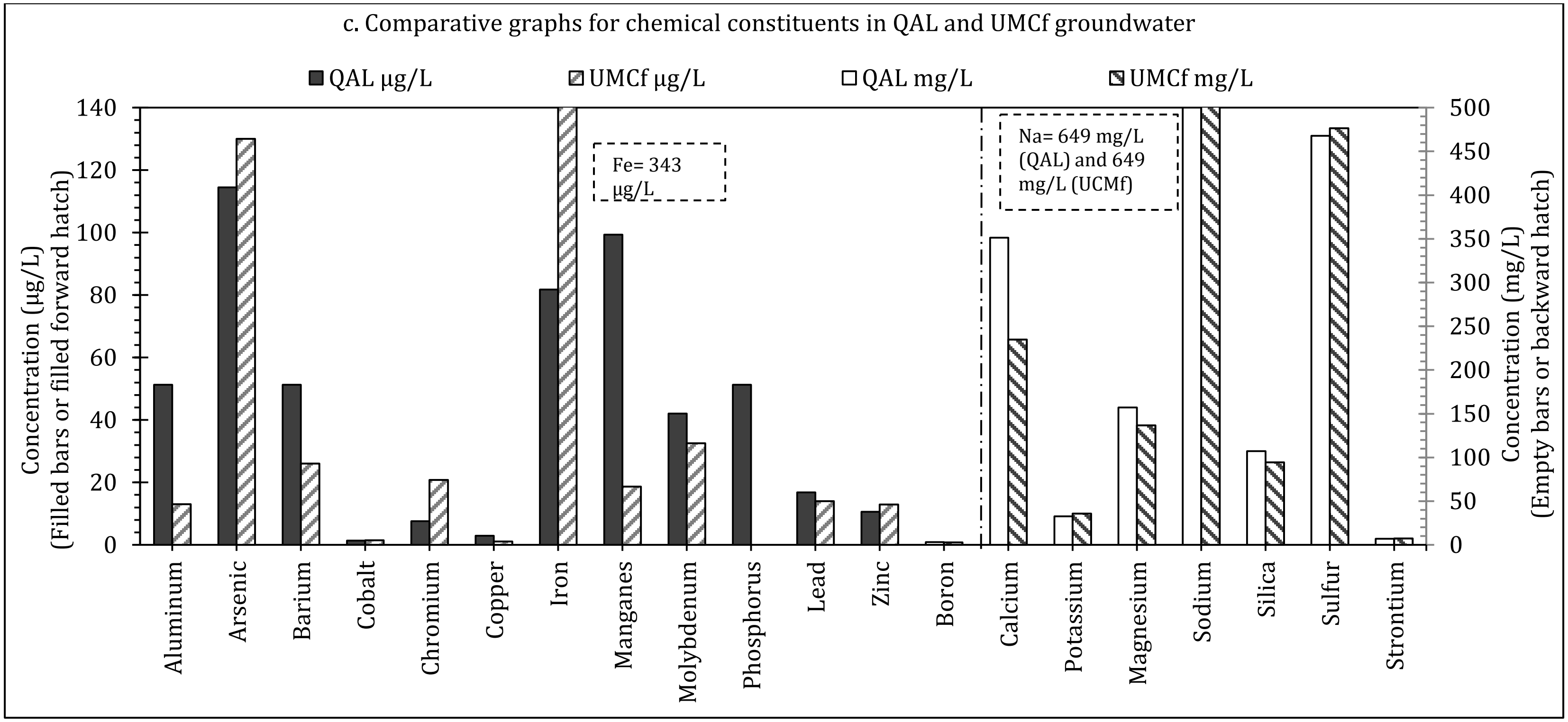
Figure 3.2: Hexavalent chromium, COD and Turbidity varied in each groundwater sample from UFIW-06 received on 7/22/2016 from both depths.

Note: Units of each contaminant are different and are specified in the legend. Bottles were numbered according to the filling at the site.

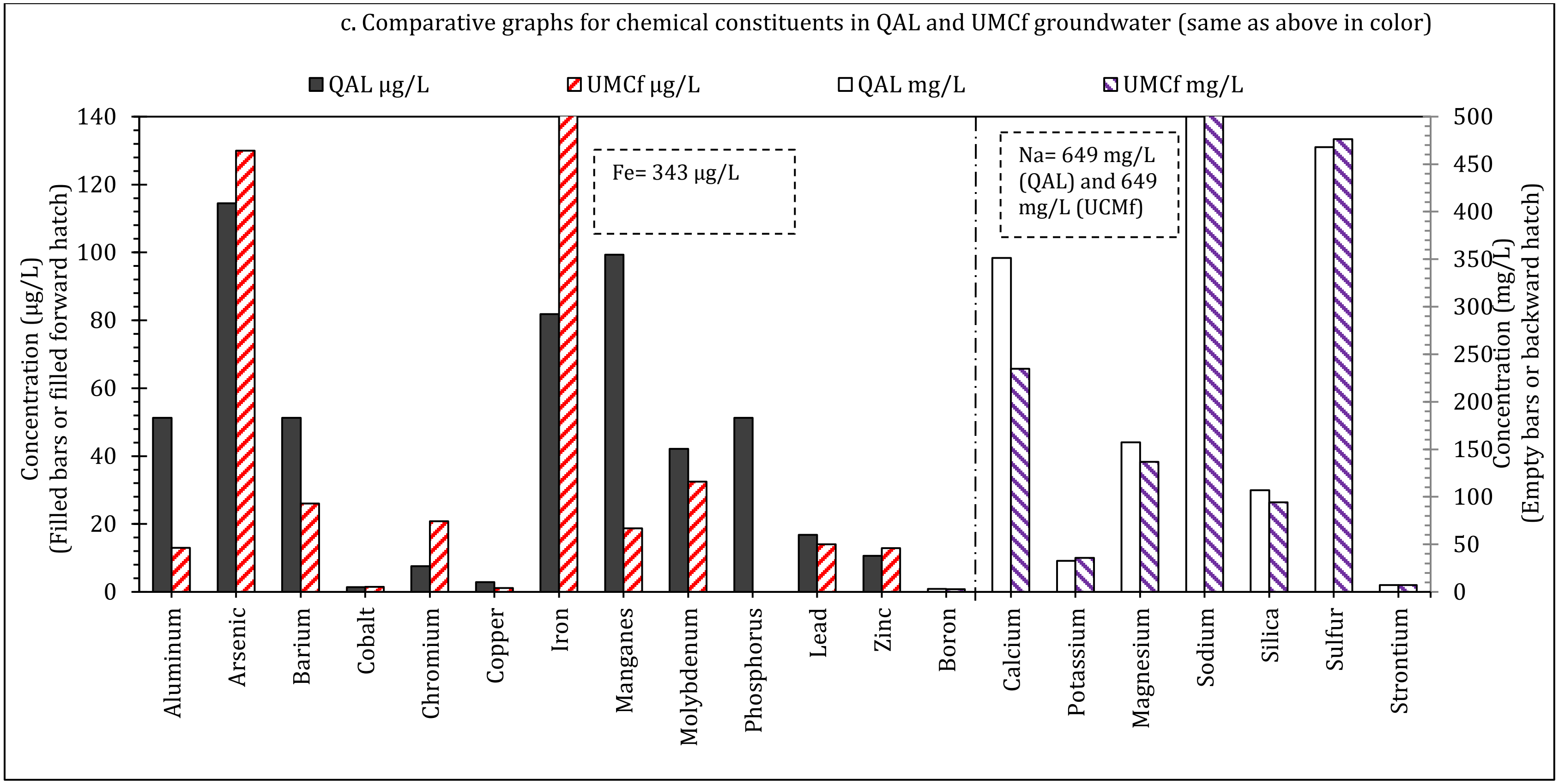
Total metal analysis for the groundwater is shown in Figure 3.3. Metal and elemental analysis indicated high concentrations of arsenic (100 µg/L), calcium (351.3 mg/L), sodium (779 mg/L), and sulfur (468 mg/L) in QAL groundwater. In UMCf groundwater, the concentrations of key analytes included arsenic (130 µg/L), iron (343 mg/L), sodium (649 mg/L), and sulfur (476 mg/L). The arsenic concentration in both waters is much greater than that of chromium.


a. Quaternary Alluvial (QAL) Groundwater (25-30 ft)


b. Upper Muddy Creek Formation (UMCf) Groundwater (35-40 ft)



Below is same graph in color.



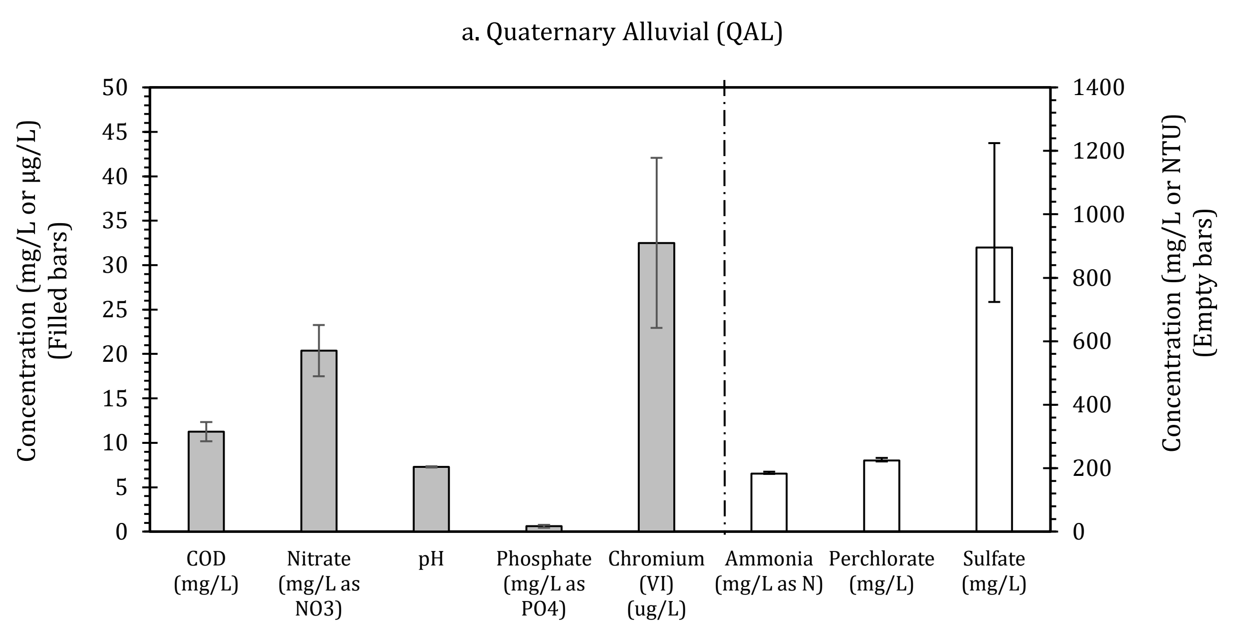
c. Comparative graphs for chemical constituents in QAL and UMCf groundwater (same as above in color)

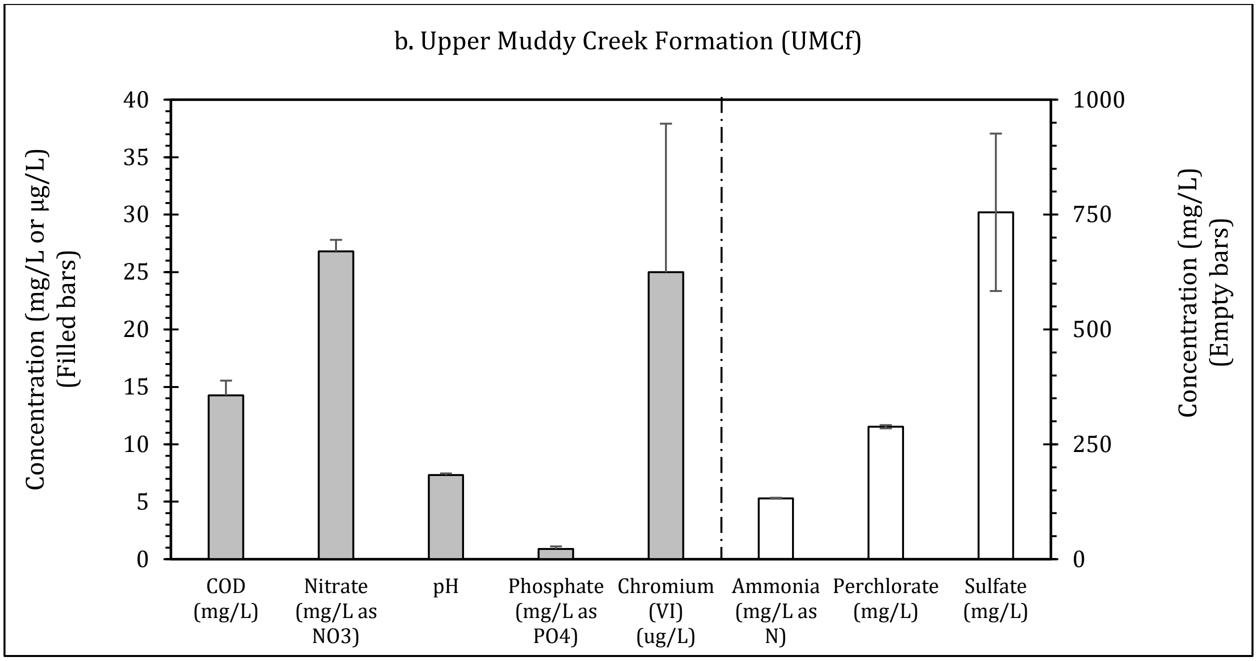
Figure 3.3: Total metal analysis in the groundwater sample from UFIW-06 received on 7/22/2016.

Groundwater from Well UFIW-03 Collected 8/26/2016

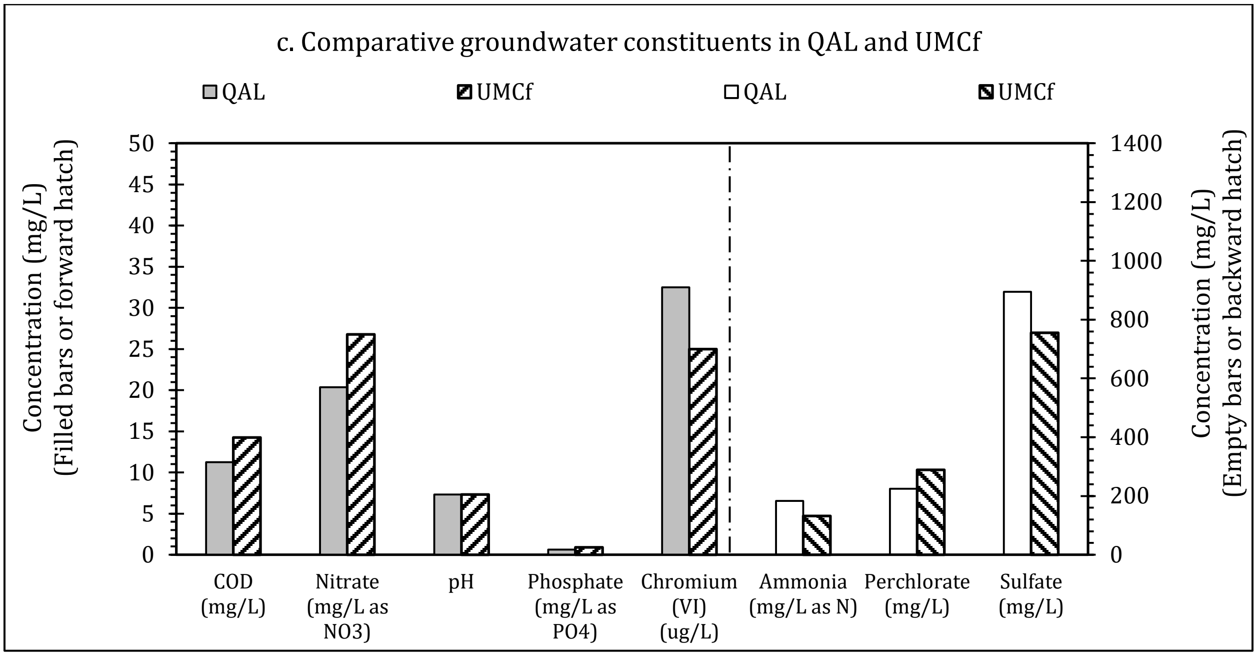
Groundwater collected from the site on 8/26/2016 from well UFIW-03 was analyzed immediately upon arrival. The groundwater from each field collection bottle was carefully transfered into storage bottles to ensure no resuspension of the settled solids and prevent clogging of the columns. The average concentrations of contaminants measured in four bottles each from QAL depth and UMCf depth are presented in Figure 3.4 (a) and Figure 3.4 (b), respectively. The pH readings of both waters are around 7.3. The standard deviation for each contaminant measurement is shown in the bar graphs of Figure 3.4.

COD, nitrate as NO_3, perchlorate, phosphate, and sulfate measured in the groundwaters of QAL and UMCf were comparable. COD in groundwater from both depths were below 15 mg/L. Nitrate was about 20 mg NO_3/L and perchlorate was around 250 mg/L. The Cr (VI) varied from 20 to 40 µg/L in QAL and 10 to 40 µg/L in UMCf groundwater. Groundwater from both horizons contained low Cr (VI) concentrations, below 40 µg/L.





b. Upper Muddy Creek Formation (UMCf)



c. Comparative groundwater constituents in QAL and UMCf

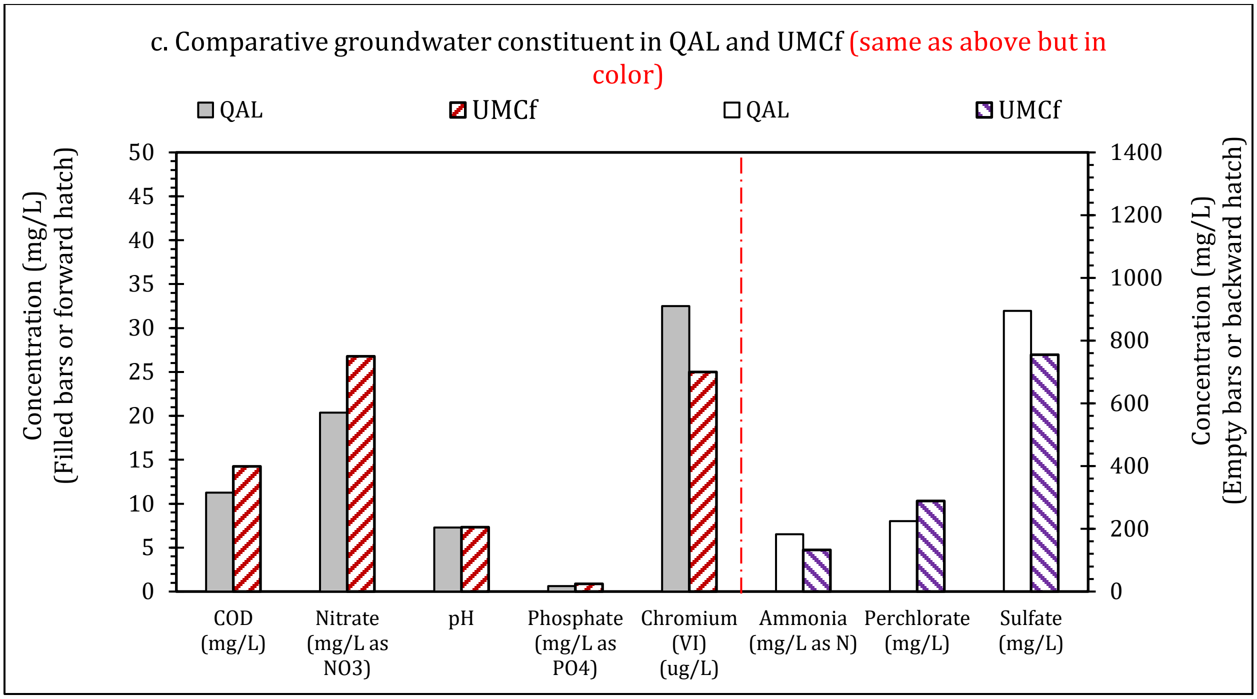


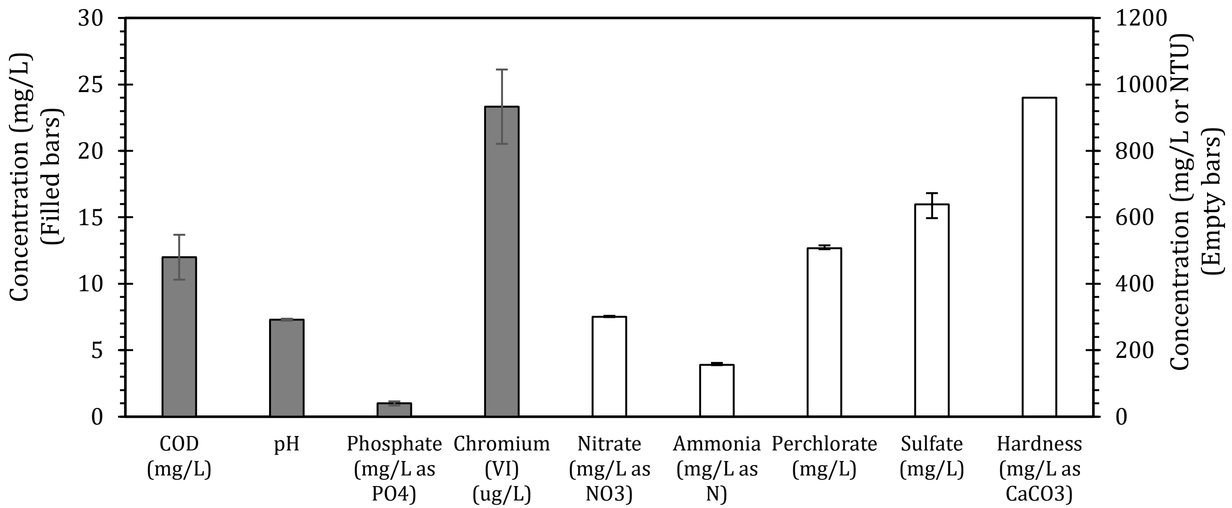
Figure 3.4: Groundwater from UFIW-03 received on 8/26/2016 for characterization in quaternary alluvial layer, QAL (25-30 ft) (a), muddy creek formation, UMCf (35-40 ft) (b), and comparison between QAL and UMCf (c).

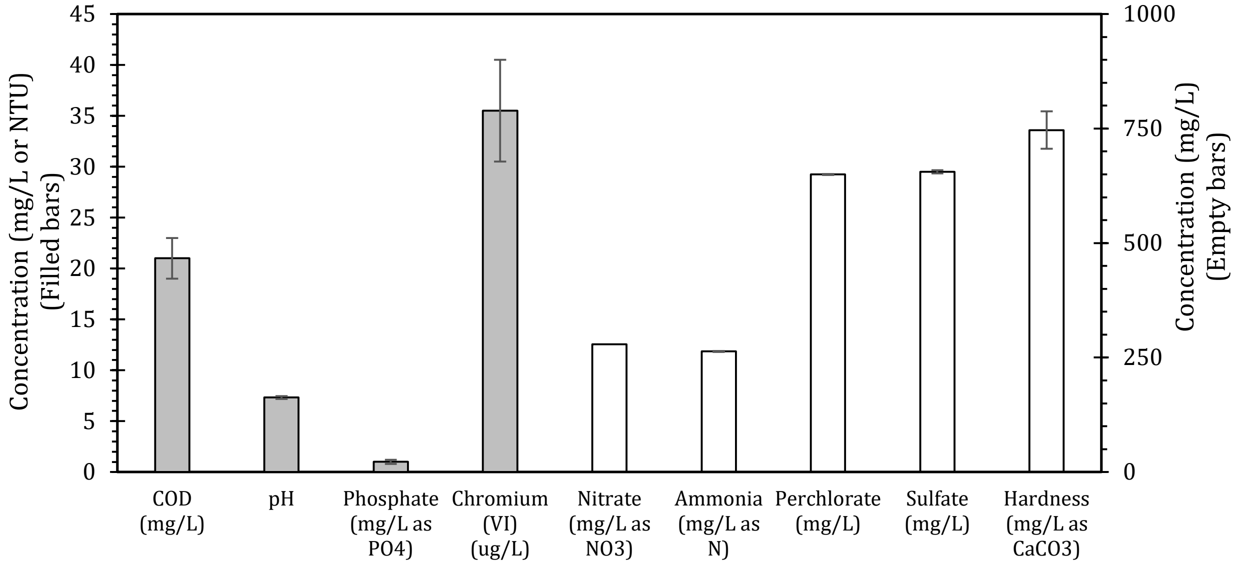
Note: The contaminants concentrations for the filled and with forward hatched bars (left of the vertical dotted line) are read on the left y-axis, and for the filled and with backward hatched bars (right of the vertical dotted line) are read on the right y-axis in Figure 3.4 c.

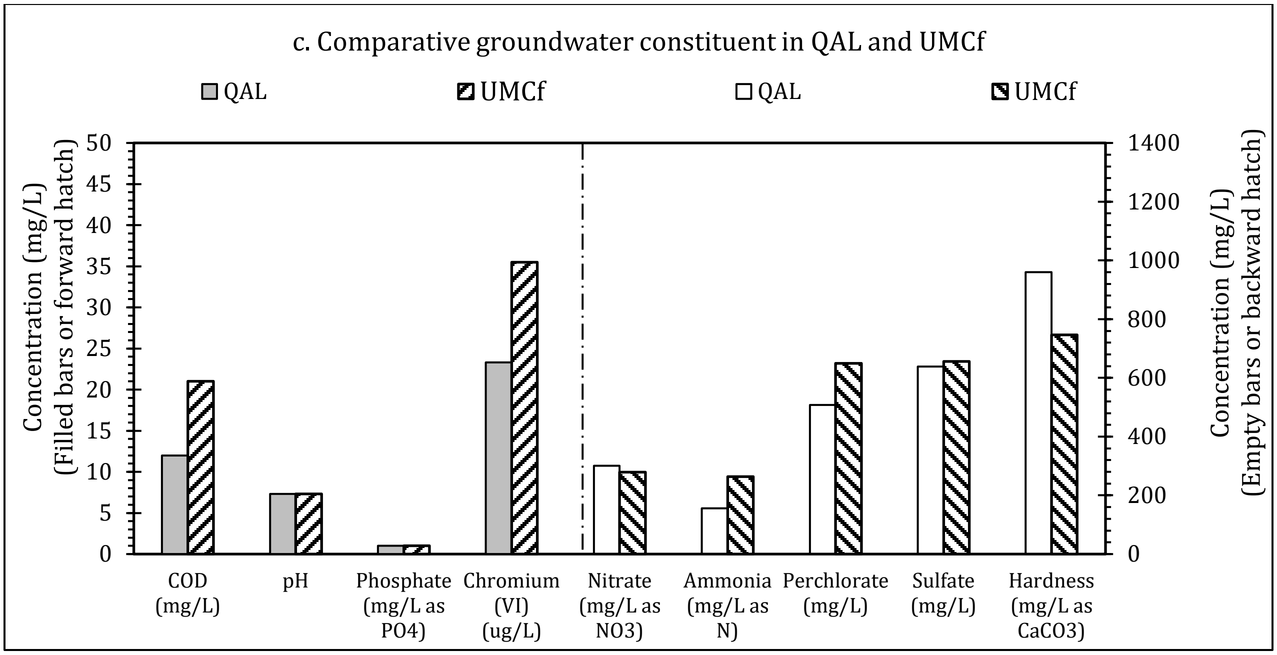
Groundwater from Well UFIW-06 Collected 11/22/2016

Groundwater collected from the site on 11/22/2016 from UFIW-06S and UFIW-06I were carefully transfered into two clean, labelled buckets to ensure no resuspension of the settled solids. All the bottles with QAL groundwater were mixed in one bucket and all UMCf groundwater bottles were mixed in another bucket. The concentrations of contaminants measured from the mixed QAL groundwater (25-30 ft bgs) and UMCf (35-40 ft bgs) are presented in Figure 3.5 (a) and Figure 3.5 (b), respectively. The pH measurements of both waters are around the neutral range. The standard deviation for each contaminant measurement is shown in the bar graphs of Figure 3.5. Figure 3.5 (c) shows the comparison of constituents in the QAL and UMCf groundwater.

All the contaminant levels of concern (COD, nitrate as NO_3, Cr (VI), perchlorate, phosphate, and sulfate) were comparable between the QAL and UMCf groundwaters. COD in groundwater from both depths were below 25 mg/L. Nitrate was about 270-300 mg NO_3/L and perchlorate was around 500-600 mg/L. The Cr (VI) in both groundwaters was below 40 µg/L.


a. Quaternary Alluvial (QAL)


b. Upper Muddy Creek Formation (UMCf)



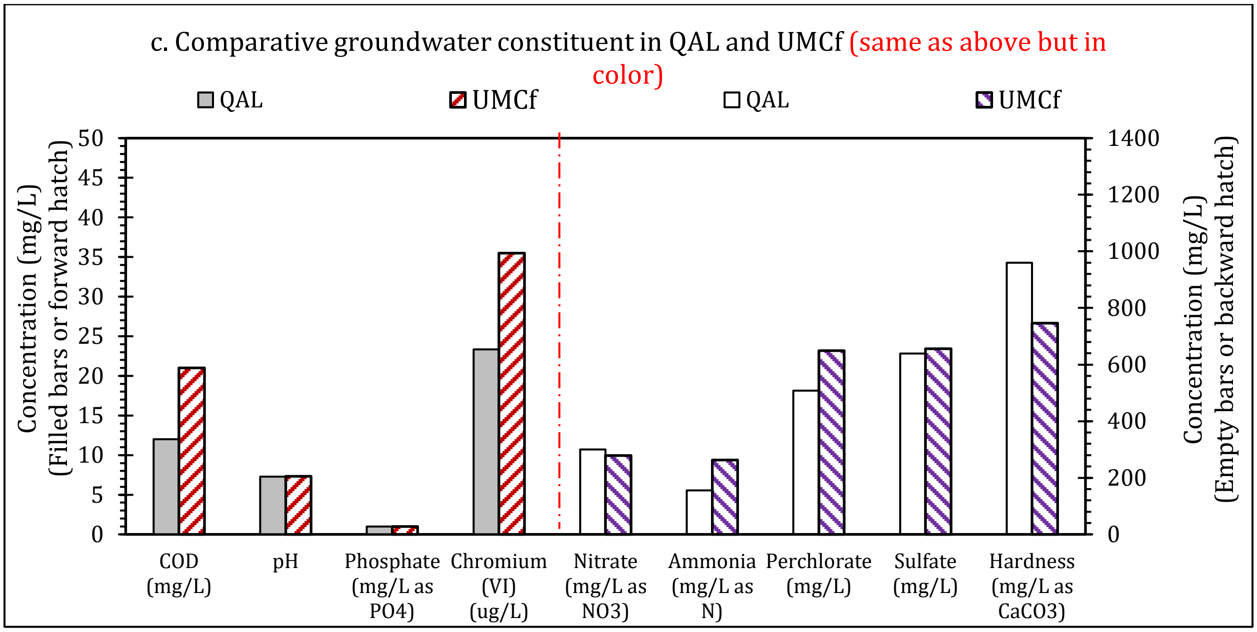


Figure 3.5: Groundwater from UFIW-03 received on 11/22/2016 for characterization in quaternary alluvial layer, QAL (25-30 ft) (a), muddy creek formation, UMCf (35-40 ft) (b), and comparison between QAL and UMCf (c)

Note: The contaminants concentrations for the filled and with forward hatched bars (left of the vertical dotted line) are read on the left y-axis, and for the filled and with backward hatched bars (right of the vertical dotted line) are read on the right y-axis in Figure 3.6 (c).

Groundwaters from Wells CTMW-03 and CTIW-01 Collected 12/07/2017

Groundwaters CTMW-03S (QAL) and CTIW-01D (UMCf) were obtained on 12/07/2017. The QAL groundwaters in four bottles were mixed and stored; the UMCf groundwater in four bottles were also mixed and stored. The results of the groundwater analyses performed on the mixed QAL and mixed UMCf groundwater are shown in Figure 3.6.

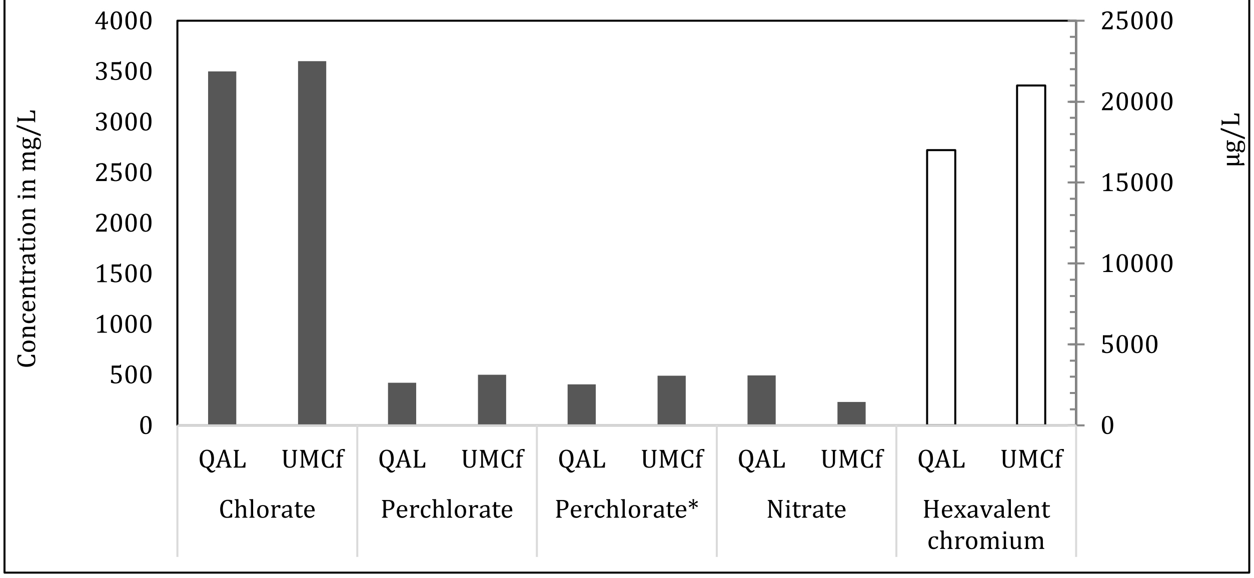


Figure 3.6: Characteristics of mixed QAL (CTMW 03 well) and UMCf (CTIW 01D) groundwater. *Perchlorate measured at Silver State Laboratory, NV.

Figure 3.7 shows the quality of CTIW 01S (QAL), CTIW 01D (UMCf), CTMW 03S (QAL), and CTMW 03D (UMCf) groundwater as provided by the Tetra Tech. The chlorate concentration was about 3450 mg/L, perchlorate about 620 mg/L, and Cr (VI) about 16500 µg/L in the QAL groundwater. The UMCf groundwater contained higher concentrations of chlorate at about 3800 mg/L, higher perchlorate at about 840 mg/L and higher Cr (VI) at about 18000 µg/L.

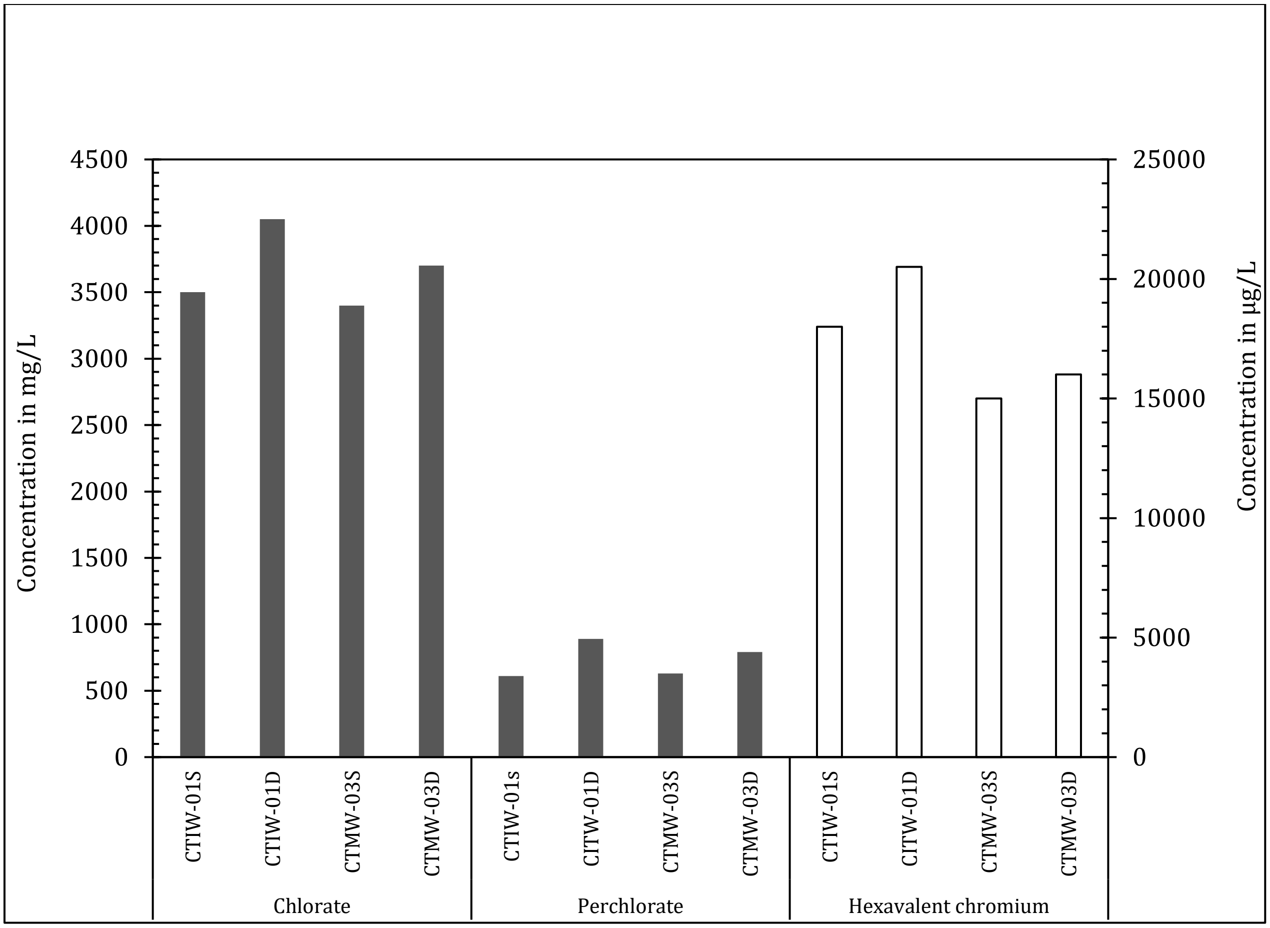


Figure 3.7: Groundwater from well CTIW 01D, CTIW 01S, CTMW 03, and CTMW 03D analysis obtained from Tetratech

CHAPTER 4 RESULTS AND DISCUSSIONS OF CHEMICAL REDUCTION

4.1. Batch Testing for Chemical Reduction of Cr (VI)

Six sets of secondary batch tests were conducted with each set comprising of six beakers. QAL and UMCf groundwaters were spiked with Cr (VI) for high (10,000 μg Cr^{+6}/L) and low (500 μg Cr^{+6}/L) concentrations testing. The batch testing was conducted with varying ratios from 1.5X to 5X times the stoichiometric requirement for CaSx and 5X to 50X times the stoichiometric requirement for ferrous sulfate. The testing matrix is shown in Table 2.3 in section 2.4.3 and further information can be found in Appendix C.

4.1.1 High Chromium Concentration Test

Tables 4.1 and 4.2 summarize the results of batch tests using CaSx and ferrous sulfate for removal of high concentration (~10,000 ppb) Cr (VI) in the groundwater. Chromium removal was >99% for groundwater of both sample depths (i.e. QAL and UMCf) when CaSx was used. All final Cr (VI) concentrations were <100 μg/L. For groundwater from both intervals, Cr (VI) concentration below 10 μg/L was obtained for 2X CaSx. Additional CaSx up to 5X did not promote higher removals. Indeed, observed removals were lower for 3X-5X than for 2X stoichiometric ratios. This unexpected result may be associated with color interference with the Cr (VI) analysis method used. As more CaSx is added, a yellow hue (due to hydrogen sulfide generation) is imparted to the water. An organe/red rust hue is also seen in samples as more ferrous sulfate is added to the water. Given the interference with Cr (VI) analysis using the Hach Method—where the color formed after adding the powder pillow was different from that expected—dissolved chromium concentrations were then measured by inductively coupled plasma (ICP). In addition, diluting the groundwater by 100X resolved the color issue during the test. The total dissolved chromium concentrations were measured in batch samples that were settled for 10 minutes, but not filtered. Samples with fewer entrained solids and sorbed/precipitated Cr (i.e. less turbidity) will exhibit lower chromium concentrations than those with higer sample turbidity. Therefore, when samples were turbid after settling they were then digested with acid prior to analysis by ICP.

Turbidity data in Tables 4.1 and 4.2 are turbidity values after settling for 10 minutes (Pictures in Appendix F). Larger sludge volume was observed with ferrous sulfate than with CaSx (e.g. in 250 mL of high chromium concentration groundwater < 1 mL with CaSx and < 3 mL with ferrous sulfate; for low chromium concentrations both coagulants generated low solids volumes (< 1 mL). The turbidity data also show that CaSx-generated solids settled more quickly than those from use of ferrous sulfate.

The pH values for the groundwater after coagulant treatment varied from 7.78 to 8.26 (CaSx) and 5.9 to 8.1 (ferrous sulfate). This difference in pH is expected given the caustic nature of CaSx and the acidic nature of ferrous sulfate. Notwithstanding, the final pH values obtained are within discharge standards (i.e. pH of 6-9) and are largely influenced by the high buffering capacity of the NERT groundwater.

Similar to CaSx, the use of ferrous sulfate resulted in > 99% removal of Cr (VI). However, at least 5X the stoichiometric ratio of ferrous sulfate are needed as compared to 2X for CaSx. Final chromium levels < 10 µg Cr^{+6}/L were not achieved with ferrous sulfate (Table 4.2). However, lower turbidity groundwater is obtained with the use of ferrous sulfate.

Table 4.1: Batch Precipitation Test for High Chromium Concentration in 250 mL groundwater using various stoichiometric ratios of calcium polysulfide (CaSx) (27% by wt)

Calcium Polysulfide (CaSx) (27% by wt)		**Groundwater from**							
Selected ratio times the stoichio. (1.5 moles CaSx/moles Cr^{+6})	**Volume of CaSx added to the groundwater**	**QAL, 25- 30 ft (initial concentration 10500 µg Cr^{+6}/L)**				**UMCf, 35-40 ft (initial concentration 9800 µg Cr^{+6}/L)**			
	mL of CaSx per 1000 L groundwater	**Final µg Cr $^{+6}$/L**	**% removal**	**Turbidity NTU**	**Total dissolved Chromium µg/L**	**Final µg Cr $^{+6}$/L**	**% removal**	**Turbidity NTU**	**Total dissolved Chromium mg/L**
1.5X	253	70	99.33	246	**9260**	20	99.80	256	8740
1.5X	253	90	99.14	251	**9160**	10	99.95	284	8770
2X	337	10	99.90	174	4190	10	99.95	201	7910
2X	337	10	99.86	181	4680	10	99.90	216	8600
3X	505	50	99.52	153	770	10	99.90	178	1030
3X	505	60	99.42	170	1640	30	99.69	222	750
4X	673	40	99.62	160	830	20	99.80	217	730
5X	842	70	99.33	146	860	20	99.80	284	820
5X	842	50	99.52	159	970	30	99.69	200	560

Table 4.2: Batch Precipitation Test for High Chromium Concentration in 250 mL groundwater using various stoichiometric ratios of ferrous sulfate (6%)

Ferrous Sulfate (6%) as Fe		**Groundwater from**							
Selected ratio times the stoichio. (3 moles Fe/mole Cr^{+6})	**Volume of $FeSO_4$ added to the groundwater**	**QAL, 25- 30 ft (initial concentration 10500 µg Cr^{+6}/L)**				**UMCf, 35-40 ft (initial concentration 9.8 mg Cr^{+6}/L)**			
	mL of $FeSO_4$ per 1000 L groundwater	**Final µg Cr^{+6}/L**	**% removal**	**Turbidity NTU**	**Total dissolved Chromium µg/L**	**Final µg Cr^{+6}/L**	**% removal**	**Turbidity NTU**	**Total dissolved Chromium µg/L**
5X	2236	60	99.43	154	9280	20	99.80	216	8620
5X	2236	70	99.33	148	9310	30	99.69	231	8490
10X	4472	30	99.71	166	310	40	99.59	287	2670
20X	8945	190	98.19	103	270	50	99.49	28	90
20X	8945	160	98.48	111	320	30	99.69	31	80
30X	13417	100	99.05	93	140	30	99.69	139	260
50X	22361	60	99.43	70	150	45	99.54	87	112
50X	22361	45	99.57	66	160	20	99.80	79	110

To determine the impact of CaSx and ferrous sulfate on the removal of nitrate and perchlorate—which were also present in the groundwater—the settled waters from the batch tests were analyzed for these contaminants (Tables C7 and C8 in Appendix C). As expected, the use of the coagulants had no impact on nitrate and perchlorate concentrations.

4.1.2 Effect of Solids in Groundwater

The batch tests were repeated to evaluate the impact of suspended solids addition on the hexavalent chromium removal in QAL using CaSx and in UMCf using ferrous sulfate (Table 4.3). For five times (5X) the stoichiometric ratio, Cr (VI) concentration was lowered to 20 µg/L on average when solids were added to the QAL groundwater to aid coagulation. However, statistical analysis of the Cr (VI) concentrations with and without addition of solids showed that, overall, there is no signicant difference in chromium removal when solids are added ($p > 0.05$). For ferrous sulfate (Table 4.4), the addition of solids had a significant impact on Cr (VI) removal from the UMCf groundwater ($p < 0.05$). However, both CaSx and ferrous sulfate addition did not generate an effluent with < 10 µg Cr^{+6}/L. CaSx at stoichiometric ratio two (2X) yielded in effluent Cr (VI) greater or equal to 10 µg Cr^{+6}/L in QAL water, as shown in Table 4.1.

The volume and weight of solids formed in the batch tests (i.e. the sludge) are shown in Tables 4.3 and 4.4. The pictures of the settling test are shown in Appendix F. Ferrous sulfate precipitation resulted in a greater volume of sludge compared to CaSx. The volume of sludge formed by CaSx was harder to measure because the sludge did not settle as quickly. For solids measurements, all the batch test contents were centrifuged for 10 minutes at 3000 rpm and the settled sludge was transferred to aluminum dishes to measure its weight. The weights of the settled sludges are shown in Table 4.3. A small portion of CaSx sludge was lost while transferring from graduated cylinder to a centrifuge bottle and then to aluminum dishes after centrifuging.

Table 4.3: Batch Precipitation Test for High Chromium Concentration in 250 mL groundwater from 25-30 ft (initial concentration= 10500 µg Cr^{+6}/L) using various stoichiometric ratios of calcium polysulfide (CaSx, 27%) to Evaluate the Effect of Solids on Chromium Removal

Groundwater treatment for Jar test	Calcium Polysulfide in Groundwater from QAL, 25- 30 ft with initial concentration 10500 µg Cr^{+6}/L					Solids	
	Selected ratio times the stoichiometric ratio (1.5 moles CaSx/moles Cr^{+6})	Volume of raw CaSx added to the groundwater	Final Hexavalent chromium				
		mL of CaSx per 1000 L groundwater	µg Cr^{+6}/L	% removal	Total Chromium µg/L	Volume (mL)	weight (g)
filtered through coffee filter	5X	842	50	99.52	8920	<1	0.0237
	5X	842	60	99.42	8760	<2	0.0201
	10X	1682	1080	89.71	8670	<3	0.03
1 g soil added to the filtered groundwater	5X	844	20	99.81	5740	4	0.2756
	5X	844	30	99.71	6230	4	0.2212
	10X	1682	440	95.81	5250	4	0.2559

Note: The batches were operated with 250 mL groundwater and solids were added at 1g/L (ie. 0.25 g/250 mL groundwater).

The volume of sludge was recorded after 10 minutes settling.

Table 4.4: Batch Precipitation Test for High Chromium Concentration in 250 mL groundwater from 35-40 ft(initial concentration= 9800 µg Cr^{+6}/L) using various stoichiometric ratios of Ferrous Sulfate (6%) to Evaluate the Effect of Solids on Chromium Removal

Groundwater treatment for Jar test	**Ferrous Sulfate in Groundwater from UMCf, 35-40 ft with initial concentration 9800 µg Cr^{+6}/L**					**Solids**	
	Selected ratio times the stoichio. (3 moles Fe/mole Cr^{+6})	**Volume of $FeSO_4$ added to the groundwater**	**Final Hexavalent chromium**				
		mL of $FeSO_4$ (6%) per 1000 L groundwater	**µg Cr/L**	**% removal**	**Total Chromium µg/L**	**Volume (mL)**	**weight (g)**
Groundwater filtered samples with coffee filter (20 µm pores)	5X	2236	90	99.69	7720	1	0.0247
	5X	2236	80	99.80	7470	1	0.0154
	10X	4472	50	99.80	4660	4	0.0355
1 g soil added to the groundwater filtered samples with coffee filter	5X	2236	20	99.80	4810	5	0.2851
	5X	2236	20	99.80	3740	5	0.2608
	10X	4472	40	99.69	2390	6	0.2925

Note: The batches were operated with 250 mL groundwater and solids were added at 1g/L (ie. 0.25 g/250 mL groundwater). The volume of sludge was recorded after 10 minutes settling.

4.1.3 Low Chromium Concentration Test

Table 4.5 and Table 4.6 summarize the results of coagulant treatments (i.e. CaSx and ferrous sulfate) on low chromium concentrations in NERT groundwater. None of the multiples of the calculated stoichiometric ratio resulted in <10 μg Cr^{+6}/L despite high % mass removals from 88-93%. As expected, total dissolved chromium concentrations measured by inductively coupled plasma (ICP) were higher than the values of Cr (VI) measured by the Hach Method. The total dissolved chromium samples were measured in unfiltered samples by ICP.

During the research, it was found that the QAL groundwater contained some substance that interferes with chromium measurements using the Hach Method. The method gave different readings for duplicate analyses of low level samples. This interference was confirmed by a QA/QC. As explained in Appendix A (Table A3), the Cr (VI) analysis with Hach kits for QAL always required dilution (preferably 100 times) to get correct readings. For these low concentration QAL batches, the final Cr (VI) readings are reported in Table 4.5 and Table 4.6 for CaSx and ferrous sulfate, respectively, with a dilution of 2 times. The samples for these batches were analyzed with a dilution of 100, 50, 10 and 2, and only the dilution by 2 resulted in readable data. Hach kits have detection limit of 10 μg/L, so a dilution of 100 times could not be used at all times. Therefore, the samples were analyzed with a dilution at least of 2 times. For UMCf, it was suspected that lack of solids resulted in poor Cr (VI) removal in CaSx batches. Soil was not added to any of the UMCf batches.

The sludge formed by CaSx did not settle well for these tests. The sludge formed by ferrous sulfate was fluffier, but settled comparatively faster. Therefore, the total dissolved chromium concentrations in batches with ferrous sulfate were comparatively lower in QAL. An average total dissolved chromium concentration of 436 μg/L in UMCf was not expected. It was suspected that this finding is due to lack of solids in the groundwater.

In summary, removal of chromium from the NERT groundwater by precipitation with CaSX and ferrous sulfate is more effective for higher concentrations than for lower chromium concentrations. The lack of suspended solids in the UMCf groundwater makes precipitation less effective by either coagulant.

Table 4.5: Batch Precipitation Test for Low Chromium Concentration in 500 mL groundwater using various stoichiometric ratios of calcium polysulfide (CaSx) (27% by wt)

Calcium Polysulfide (Raw CaSx= 27%)		**Groundwater from**					
Selected ratio times the stoichiometric ratio (1.5 moles CaSx/moles Cr^{+6})	**Volume added to the groundwater**	**QAL, 25- 30 ft (initial concentration 520 µg Cr+6/L)**			**UMCf, 35-40 ft (initial concentration 550 µg Cr+6/L)**		
	mL of CaSx per 1000 L groundwater	**Final µg Cr^{+6}/L**	**% removal**	**Total dissolved Chromium µg/L**	**Final µg Cr^{+6}/L**	**% removal**	**Total dissolved Chromium µg/L**
2X	17	60	88.46	430	360	34.55	470
2X	17	40	92.31	440	260	52.73	460
3X	26	60	88.46	410	160	70.91	460
3X	26	40	92.31	410	180	67.27	460
5X	43	40	92.31	400	80	85.45	460
5X	43	60	88.46	400	80	85.45	450

Table 4.6: Batch Precipitation Test for Low Chromium Concentration in 500 mL groundwater using various stoichiometric ratios of ferrous sulfate (6%)

Ferrous Sulfate (6%)		**Groundwater from**					
Selected ratio times the stoichio. (3 moles Fe/mole Cr^{+6})	**Volume added to the groundwater**	**QAL, 25- 30 ft (initial concentration 520 µg Cr^{+6}/L)**			**UMCf, 35-40 ft (initial concentration 550 µg Cr^{+6}/L)**		
	mL of $FeSO_4$ per 1000 L groundwater	**Final µg Cr^{+6}/L**	**% removal**	**Total Chromium µg/L**	**Final mg Cr^{+6}/L**	**% removal**	**Total dissolved Chromium µg/L**
10X	515	40	92.73	220	40	92.31	450
10X	515	60	89.09	230	40	92.31	450
25X	1278	100	81.82	180	40	92.31	430
25X	1278	40	92.73	220	20	96.15	440
50X	2575	60	89.09	160	40	92.31	420
50X	2575	20	96.36	170	40	92.31	430

After the batch tests were completed, the beakers and the blade of the stirrers were checked for possible scale formation. It was confirmed by visual inspection that no scaling occurred in both high and low concentration tests. The pictures of the stirrers are shown in Appendix F.

4.2 Chemical Coagulation Using Columns

Table 4.7 shows the statistical analysis of percent removal of Cr (VI) in three columns using CaSx. Two columns were fed with low-chromium concentration groundwater (1000 µg Cr^{+6}/L), one column packed with QAL soil (QAL column) and the other with UMCf soil (UMCf A column). A third column, packed with UMCf soil, was fed with high-chromium groundwater (10,000 µg Cr^{+6}/L) (UMCf B column). In the low concentration columns, 20X stoichiometric was used and fourty times (40X) was used for columns with high concentration chromium.

For both Cr (VI) and total dissolved chromium, removals were excellent and mostly about > 99%. In the first day, Cr (VI) removal in the QAL column was 56.66% and increased to 93% on the third day. The average removal, excluding the first day, was 95.6 ± 3.8%. The first day hexavalent chromium removal in UMCf A column was 5.55%, the second day the removal was 42.85%, and removal increased to 71.43% on the third day. The average removal excluding the first two days was 86.32 ± 8.0%. Comparing the QAL and UMCf A columns, QAL performed better than UMCf A. No cracks were observed in the soil of UMCf A column using visual inspection. The average removal shows that UMCf B performed better than the other two columns. In UMCf B, Day 1 Cr (VI) removal was 2.06%, 55.10% on the second day and increased to 99.8% on the third day. The average removal excluding the first two days was 99.51± 0.26%. The higher removal in UMCf B column is associated with the larger amount of calcium polysulfide used (40X the stoichiometric requirement) compared to the QAL and UMCf A (20X the stoichiometric requirement). Increasing the amount of CaSx to 40X stoichiometric had no major impact on Cr (VI) removal in the UMCf. Therefore, the addition of 20X stoichiometric of CaSx is sufficient to remove chromium from NERT groundwater.

Table 4.7: Statistical analysis of percent Cr removal in the columns for composite and grab samples.

	Removal (%)					
	Hexavalent Cr in grab samples			Total Dissolved Cr in composite samples		
	Low Cr (VI) Columns		High Cr (VI) column	Low Cr (VI) Columns		High Cr (VI) column
	QAL	UMCf A	UMCf B	QAL	UMCf A	UMCf B
Average	95.6 ± 3.8	86.32 ± 8.0	99.51± 0.26	99.27± 1.08	95.95±7.34	99.90 ± 0.20
Minimum	83.33	66.66	98.83	95.13	79.60	99.15
Maximum	100	95.00	99.80	99.89	99.87	100

Note: The statistical analysis ignored the first day in QAL 1000 µg/L and the first two days in the UMCf columns when the removal was below 60% in the columns.

Table 4.8 shows the percent frequencies of Cr concentration in the column effluents falling within selected ranges for low Cr concentration columns (QAL, and UMCf A) and for high Cr concentration column (UMCf B) during the injection period. In the QAL column, for most of the time (43.5%), the effluent Cr (VI) concentration was within range 50-100 µg/L. The Cr (VI), for about 30.4% of the time, was within 0 to 10 µg/L. For UMCf A, the effluent Cr (VI) concentration was within the range 50-100 µg/L for 43.5%; but for rest of the time, the concentration was above 100 µg/L. For UMCf B, most of the time (34.8%) the effluent Cr (VI) was within the 0-40 µg/L range and 30.4% of the time was within 50 to 100 µg/L. The frequency for the UMCf B column within the lowest concentration range, 20-30 µg/L, was 26.1%.

Table 4.8: Effluent concentration distribution for QAL, UMCf A, and UMCf B columns

Concentration range µg/L	% Frequency		
	Low Cr (VI) Columns		High Cr (VI) column
	QAL	UMCf A	UMCf B
0 to 10	30.4	0.0	0.0
10 to 20	26.1	0.0	0.0
20 to 30	0.0	0.0	26.1
30 to 40	0.0	0.0	**34.8**
40 to 50	8.7	0.0	0.0
50-100	**43.5**	**43.5**	30.4
100-200	17.4	21.7	0.0
400-1000	4.3	8.7	0.0
>1000	0.0	0.0	8.7

The performance of each column is detailed below.

4.2.1 Low Concentration Column Test

Figure 4.1 and Figure 4.2 show the effluent concentration of Cr (VI) in grab samples from the QAL and UMCf A columns over the operating period, respectively. Day 1 in each figure represents the first day when calcium polysulfide was injected. The data before CaSx injection is presented in Appendix D. The QAL and UMCf columns were fed 2X the stoichiometry for low Cr (VI), with a factor of safety of ten times—ie. effective ratio of 20X—considering poor mixing in soil.

The effluent Cr (VI) in QAL column on Day 2 was below 200 µg/L and 100 µg/L by Day 3 (Figure 4.1). The effluent Cr (VI) increased to 150 µg/L on Day 5, decreased below 100 µg/L on Day 6, and again increased on Day 8. The Cr (VI) fluctuated until Day 13, but remained below 200 µg/L. After Day 13, the chromium concentration remained below 100 µg/L even after stopping the calcium polysulfide on Day 31. The only exception was Day 21 when the concentration increased to 200 µg/L for an unknown reason. The data suggest that a reserve of CaSx built up in the column pores and continued to remove Cr from solution several days after stopping CaSx injection. The influent Cr concentration was increased to 10000 µg/L on Day 37 to test for breakthrough and to gauge the impact of residual CaSx in the column. Breakthrough was observed on Day 46, with effluent concentration exceeding 250 µg/L—fifteen days after the CaSx feed had been stopped.

The effluent hexavalent chromium in the UMCf A column on Day 2 was below 400 µg/L and continued to decrease to 50 µg/L on Day 5 (Figure 4.2). The effluent chromium concentration increased to 200 µg/L on Day 6. The Cr (VI) fluctuated but remained below 150 µg/L even after stopping the CaSx on Day 18. The influent Cr concentration was increased to 10000 µg/L on Day 30 and the column broke through exceeding 500 µg/L on Day 37.

Figure 4.3 compares effluent Cr (VI) in QAL (Days 1 to 30) and UMCf A (Days 1 to 17) columns during the CaSx injection period only. The effluent Cr (VI) concentrations in QAL column were numerically lower than that of UMCf A column. However, there is no significant statistical difference ($p > 0.05$) between the effluent Cr (VI) concentrations of both columns during the injection period. Therefore, injection of CaSx can be used at NERT to remove chromium from both QAL and UMCf groundwater. The better performance of the QAL column on some days might be because CaSx injection in QAL was performed twice a day while UMCf-A was injected once a day. The different injection mode was needed because of the higher flowrate of QAL column as compared to UMCf.

In the column injection ports, a white precipitate formed (Picture shown in Appendix F) which is likely a calcium carbonate precipitate given the NERT groundwater already exhibits high concentrations of calcium and alkalinity.

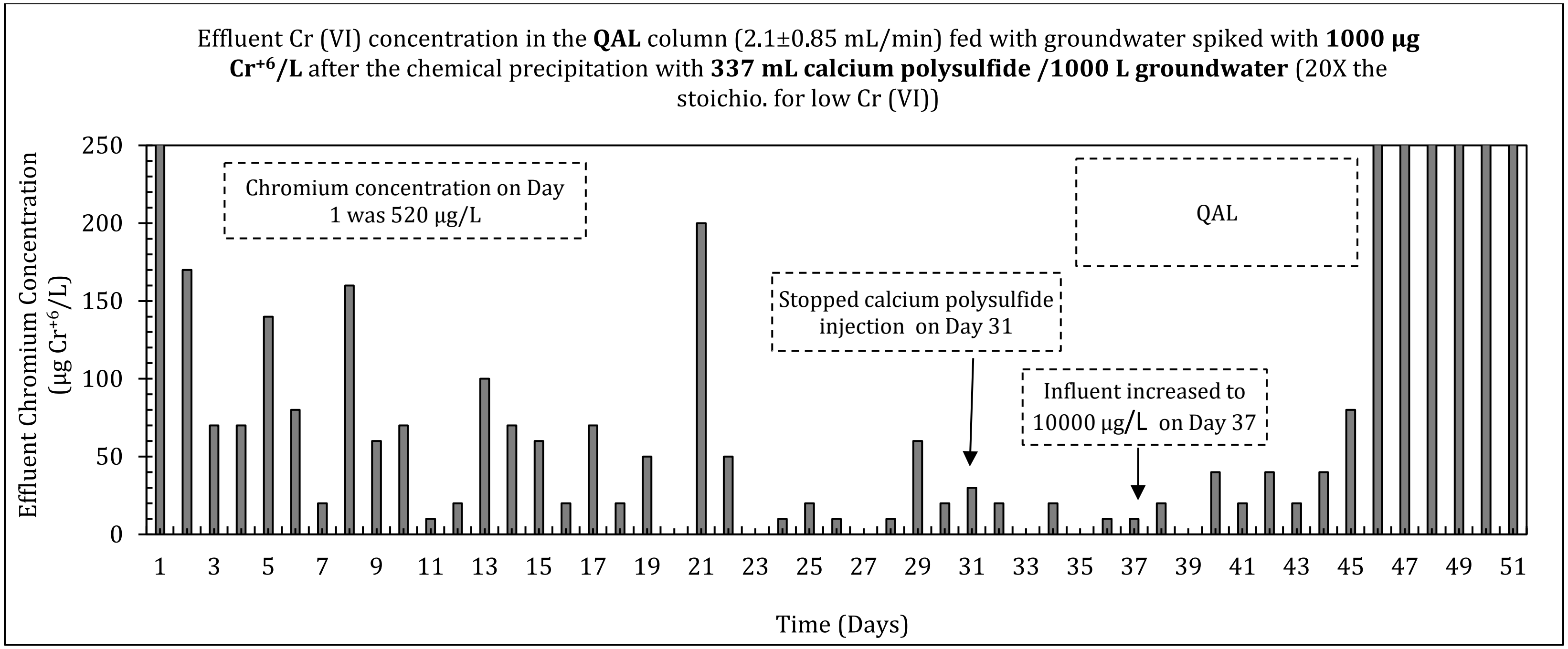


Figure 4.1: Effluent Cr (VI) concentrations in grab samples in the QAL A column after chemical precipitation of chromium with calcium polysulfide. (Calcium polysulfide was stopped on Day 31-represented by an arrow). The average influent hexavalent chromium concentration was 1,163± 121 µg/L (Days 1 to 36) and 1,183±163 µg/L (Days 37 to 51), and percent removal was 94±8% in the column during the injection period. The influent concentration was increased on Day 37 to 10000 µg/L.

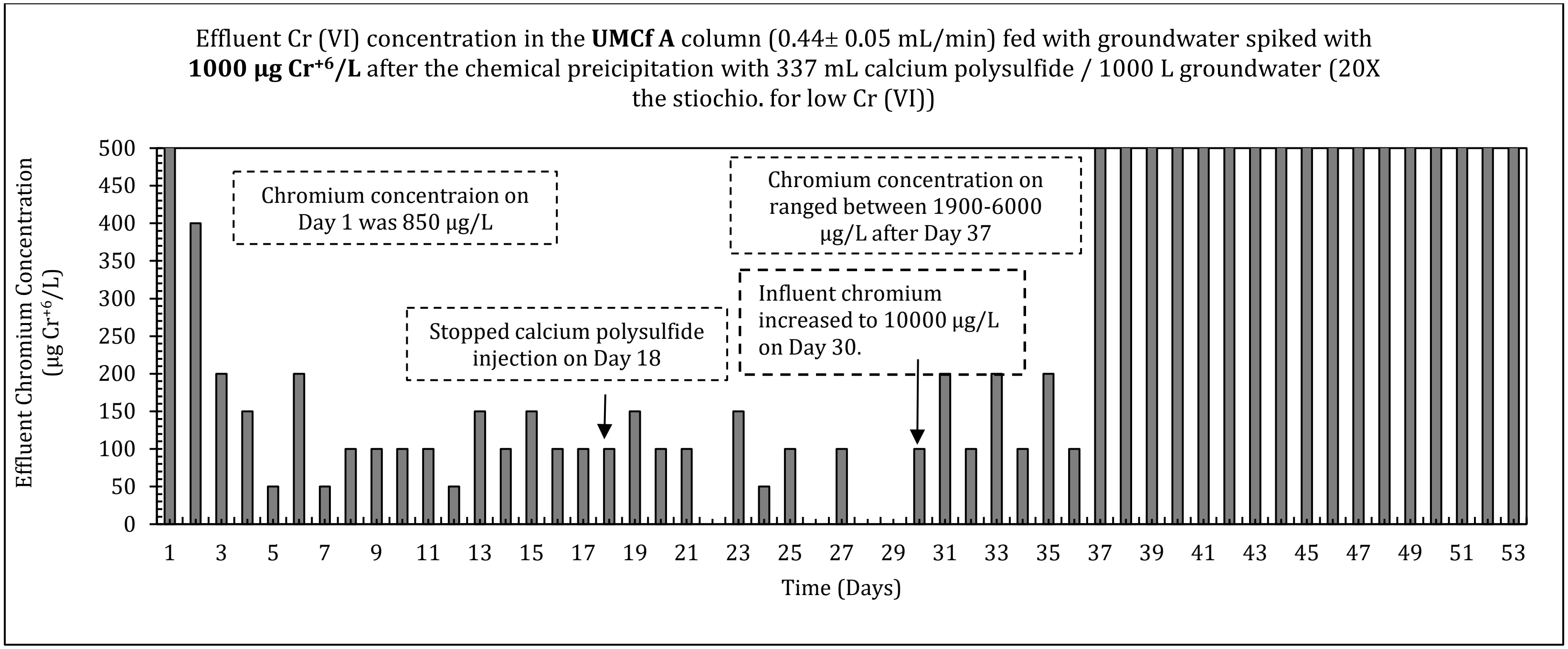


Figure 4.2: Effluent Cr (VI) concentrations in grab samples in the UMCf A column after chemical precipitation of chromium with calcium polysulfide. (Calcium polysulfide was stopped on Day 18 represented by an arrow). The average influent hexavalent chromium concentration was 876± 171 µg/L (Days 1 to 29) and 907±139 µg/L (Days 30 to 53), and percent removal was 86±8% in the column during the injection period. The influent concentration was increased on Day 30.

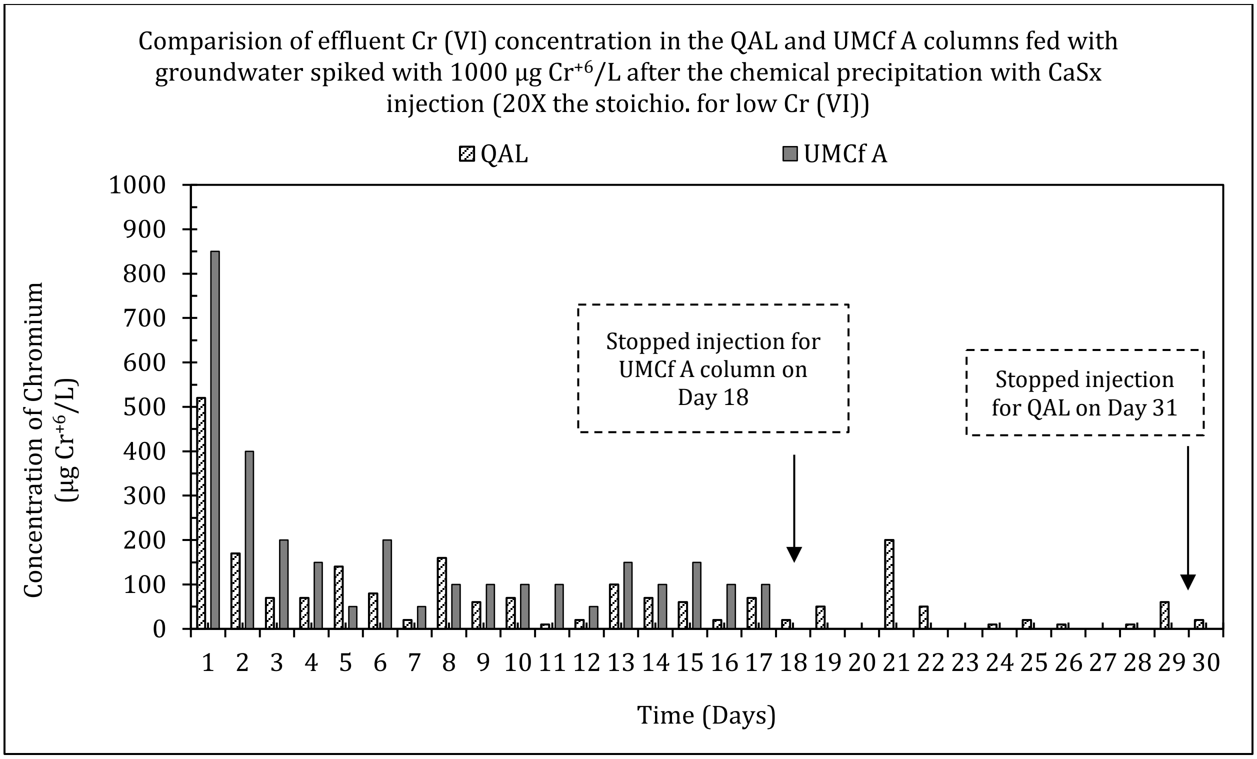


Figure 4.3: Comparision of effluent Cr (VI) concentrations in grab samples in the the QAL and UMCf A column during the injection of calcium polysulfide. (The days when the calcium polysulfide stopped are represented by arrows). The average influent hexavalent chromium concentration was 1163± 121 µg/L in QAL and 876± 171 µg/L in UMCf.

4.2.2 High Concentration Column Test

The effluent Cr (VI) concentrations in grab samples in UMCf B were below 50 µg/L by Day 3, increased to 100 µg/L on Day 8, and decreased below 50 µg/L on Day 9. The effluent Cr (VI) fluctuated, but remained below 100 µg/L throughout the injection period until Day 23—as shown in Figure 4.4. After stopping the CaSx injection, the effluent Cr (VI) in the column remained below 100 µg/L until Day 28 and increased to 150 µg/L on Day 29. After Day 31 the effluent Cr (VI) was again below 100 µg/L. Note that on Days 28 and 31, the effluent Cr (VI) was below detection limit (10 µg/L). After increasing the influent chromium concentration to 100000 µg/L on Day 36, the effluent Cr (VI) broke through exceeding 200 µg/L on Day 37. The result of this column test shows the removal of high concentration of chromium from the NERT groundwater is feasible, even when the contamination is located in the fine grained UMCf.

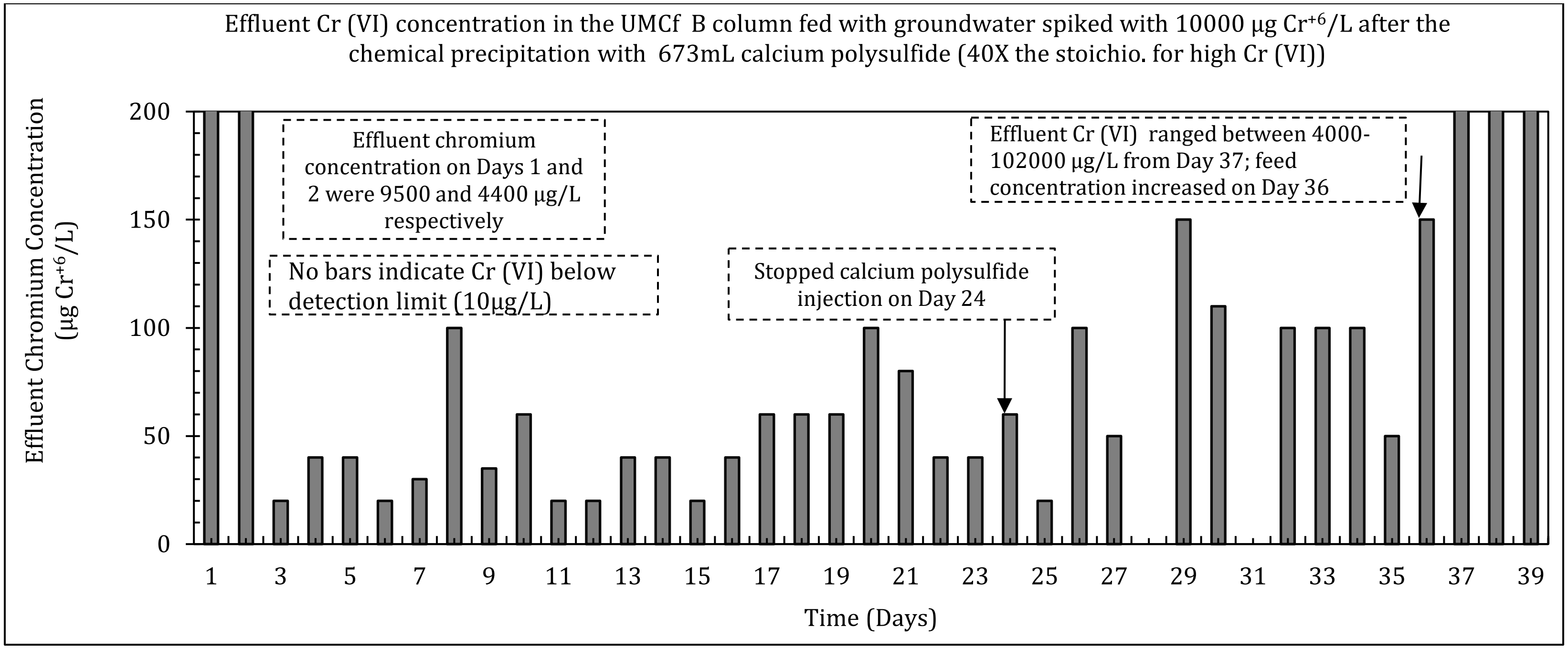


Figure 4.4: Effluent Cr (VI) concentrations in the UMCf B after chemical precipitation of chromium with calcium polysulfide. (CaSx was stopped on Day 24 represented by an arrow). The average influent Cr (VI) concentration was 9639± 465 µg/L and percent removal of 93±22% in the column during the injection period.

4.2.3 Total Dissolved Chromium Measured Using ICP for Low and High Concentration Columns

In the effluent of the columns, dissolved chromium was also analyzed. The analyses were performed in unfiltered, settled samples to mimic the natural entrapment of precipitates in the soil pores when CaSx is injected. Dissolved chromium concentrations measured by ICP in the effluent from QAL, UMCf A, and UMCf B columns are shown in Figures 4.5, 4.6, and 4.7, respectively. For all column samples, the dissolved Cr levels were below 10 µg/L. It is worth mentioning that the Cr (VI) analyses, as discussed in the previous section, were measured in grab samples while dissolved chromium was measured in 24-hour-composite samples from the effluent. Therefore, CaSx injection—at the ratios investigated—will result in chromium concentrations that are below the drinking water standard of 10 µg Cr/L for both low and high concentrations of chromium.

Figure 4.5 and Figure 4.6 show the dissolved chromium measured using ICP in 24-hour-composite samples for QAL and UMCf A, respectively. In QAL (Figure 4.5), the dissolved chromium reduced below 50 µg/L by Day 2 and below 20 µg/L on Day 3. The dissolved chromium increased in the effluent up to 23 µg/L by Day 5, but decreased below 20 µg/L by Day 6. It then was reduced below 2 µg/L by Day 10 and remained below 2 µg/L throughout the rest of the injection period. After stopping the injection, the dissolved chromium was measured once a week. On Day 35 (5 days after stopping the calcium polysulfide injection), the dissolved Cr was 0.95 µg/L. After increasing Cr concentration of the feed on Day 37, the chromium increased to 1 µg/L on Day 40 (3 days after increasing feed) and was about 10 µg/L on Day 48 (ie. 17 days after increasing the feed).

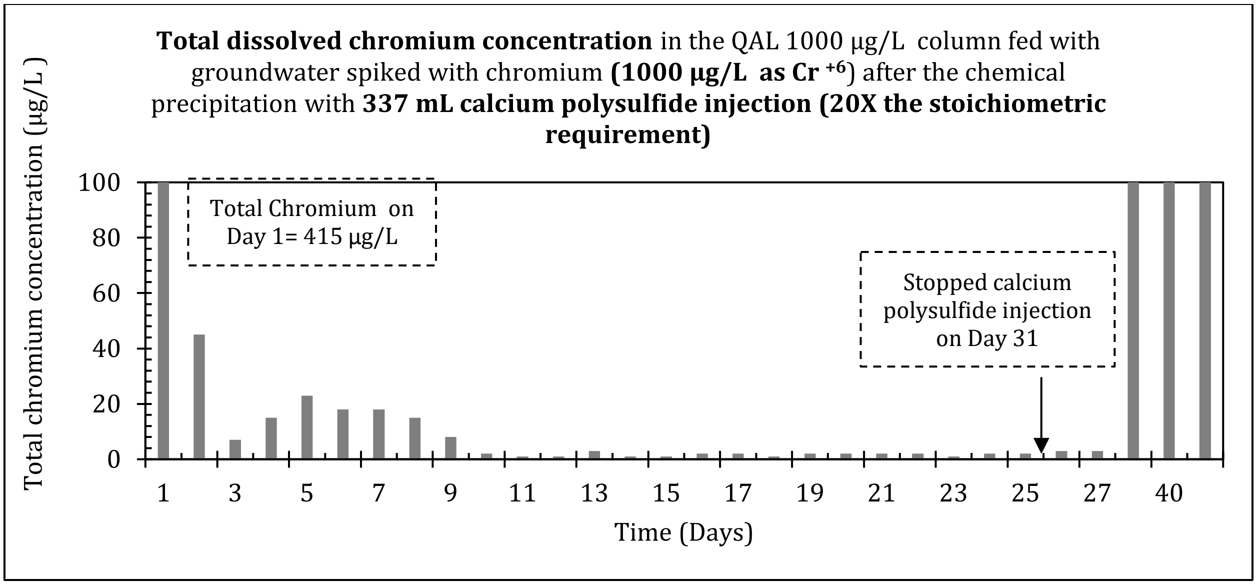


Figure 4.5: Total dissolved chromium concentrations measured in settled, but unfiltered composite samples in the QAL column throughout the study period. The vertical arrow indicates the day when the CaSx injection was stopped.

In the UMCf A column (Figure 4.6), the dissolved chromium concentration was below 40 µg/L by Day 4 and below 2 µg/L by Day 8. The concentration remained below the detection limit (10 µg/L) throughout the injection period and even after stopping the injection. After increasing the Cr concentration in the feed to 10000 µg/L on Day 31, dissolved chromium increased to 5 µg/L on Day 33 and continued to gradually increase with time. By Day 52, the dissolved chromium was 5514 µg/L (ie. 22 days after increasing the feed concentration).

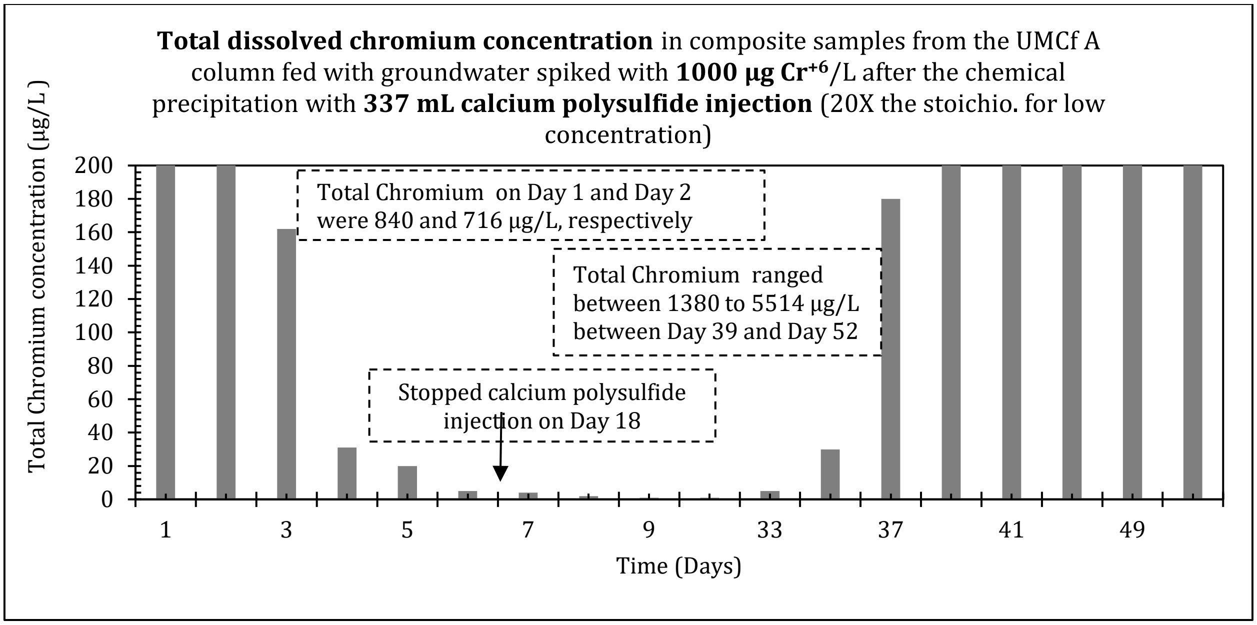


Figure 4.6: Total dissolved chromium concentrations measured in settled, but unfiltered composite samples in the UMCf A column throughout the study period. The vertical arrow indicates the day when the calcium polysulfide injection was stopped for each column.

In UMCf B column (Figure 4.7), the dissolved chromium concentration was 3 µg/L by Day 5 and remained below 3 µg/L throughout the injection period and even after stopping the injection. After increasing the Cr concentration of the feed to 10000 µg/L on Day 36, dissolved chromium increased to 74700 µg/L on Day 39 (ie. 3 days after increasing the feed concentration).

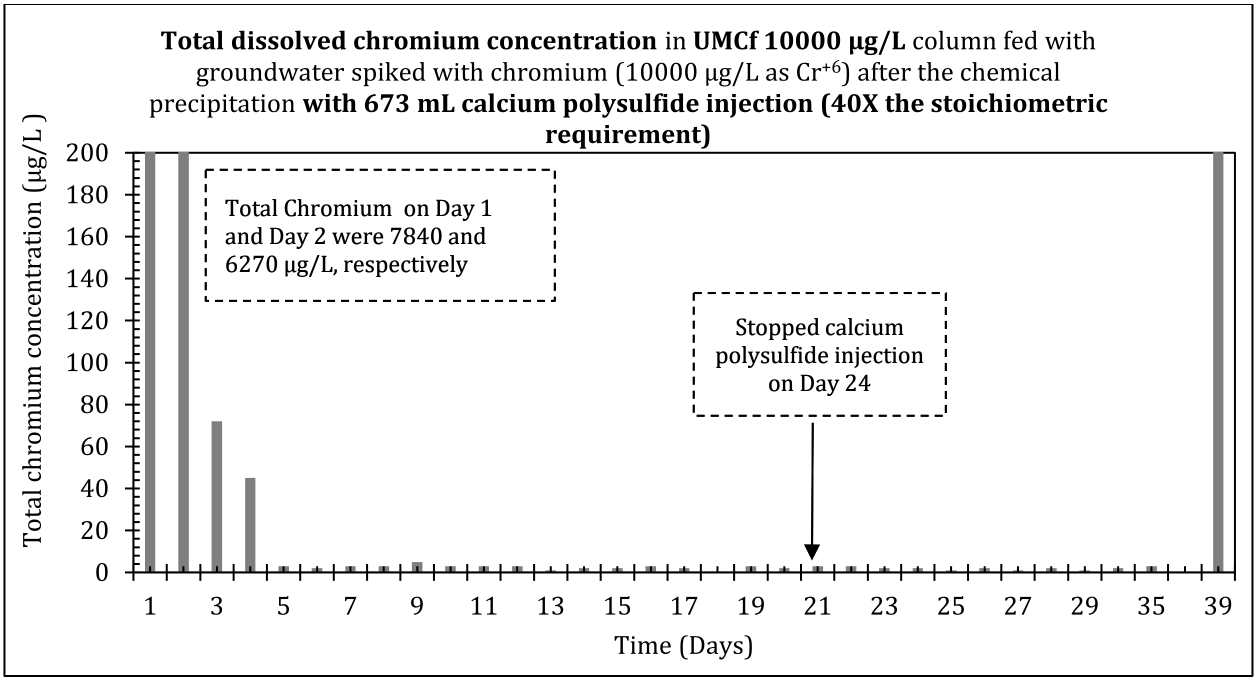


Figure 4.7: Dissolved chromium concentrations measured in settled, but unfiltered composite samples in the UMCf B columns throughout the study period. The vertical arrow indicates the day when the calcium polysulfide injection was stopped for each column.

4.2.4 CaSx Utilization

The total amounts of CaSx used were 24 mL/kg dry soil in QAL, 2.04 mL/kg dry soil in UMCf A, and 9.2 mL/kg dry soil in UMCf B column. Almost 10 times more CaSx was injected in the QAL column than in the UMCf column treating the same Cr (VI) concentration (1000 µg/L) because of the higher flowrate in the QAL column. Table 4.9 shows the mass of Cr (VI) entering the column (influent) and the volume of CaSx injected into the columns.

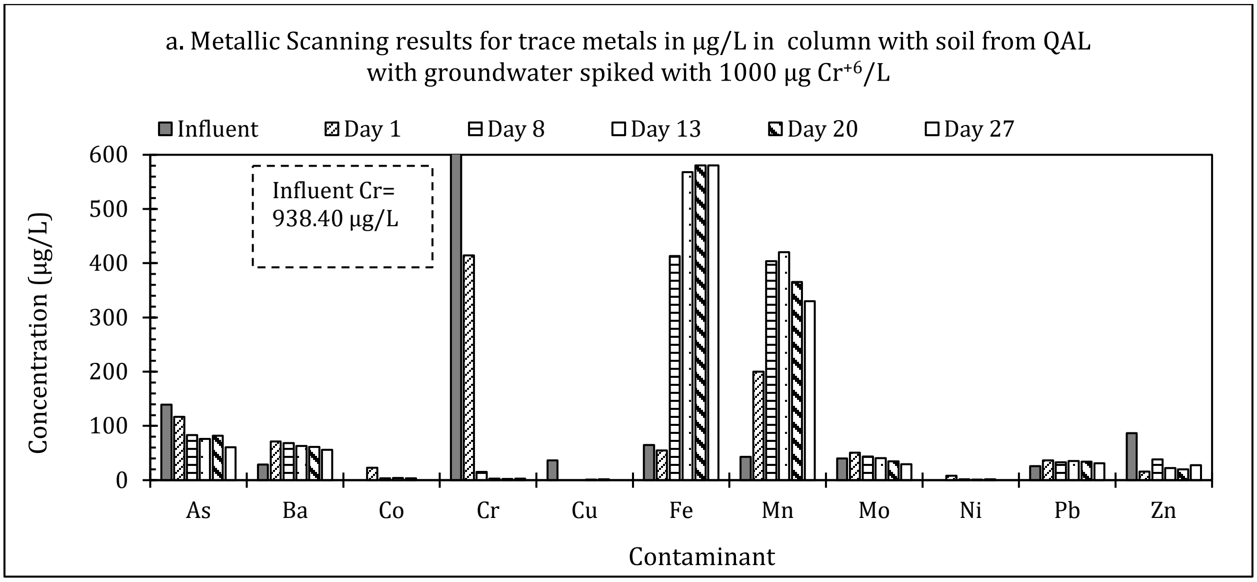
Table 4.9: Mass calculation of Cr (VI) in the influent and CaSx injected in the columns

Columns	Injection days	Cr mass (g) in the influent	Total CaSx injected to the columns (mL)	CaSX injected (mL CaSx/g influent Cr)
QAL	30	0.114	60	526.3
UMCf A	17	0.0088	5.1	579.5
UMCf B	23	0.227	23	101.3

4.2.5 Metallic Scanning for Low and High Concentration Columns

Figures 4.8 (a) and (b) show the results of trace metal and major element analyses for the influent groundwater and effluent from the QAL column, on days 1, 8, 13, 20, and 27. **Barium, molybdenum, and lead concentrations in the effluent samples gradually increased on Day 8**, but slightly decreased with time. Iron concentration in the effluent samples continuously increased with time. However, barium concentrations are below 100 µg/L, iron below 600 µg/L, lead below 40 µg/L, and manganese below 400 µg/L. **Manganese concentration increased up to the Day 13 sample and decreased after Day 20**. The manganese concentration in the effluent was almost 3 times the concentration in the influent groundwater on Day 27.

By Day 27, arsenic concentration decreased by half and zinc concentration by a third in the effluent compared to the influent groundwater. Since the chromium was removed in the columns, it was expected for total dissolved chromium to decrease. The total dissolved chromium was non-detectable from Day 13 and Day 20 in the effluent samples, but increased to 2 µg/L on Day 27. Copper, present in the influent, was not detected in any effluent samples. The concentrations of major elements aluminum, calcium, potassium, magnesium, sodium, sulfur, and, silicon were unchanged from influent to effluent (Figure 4.8 b).



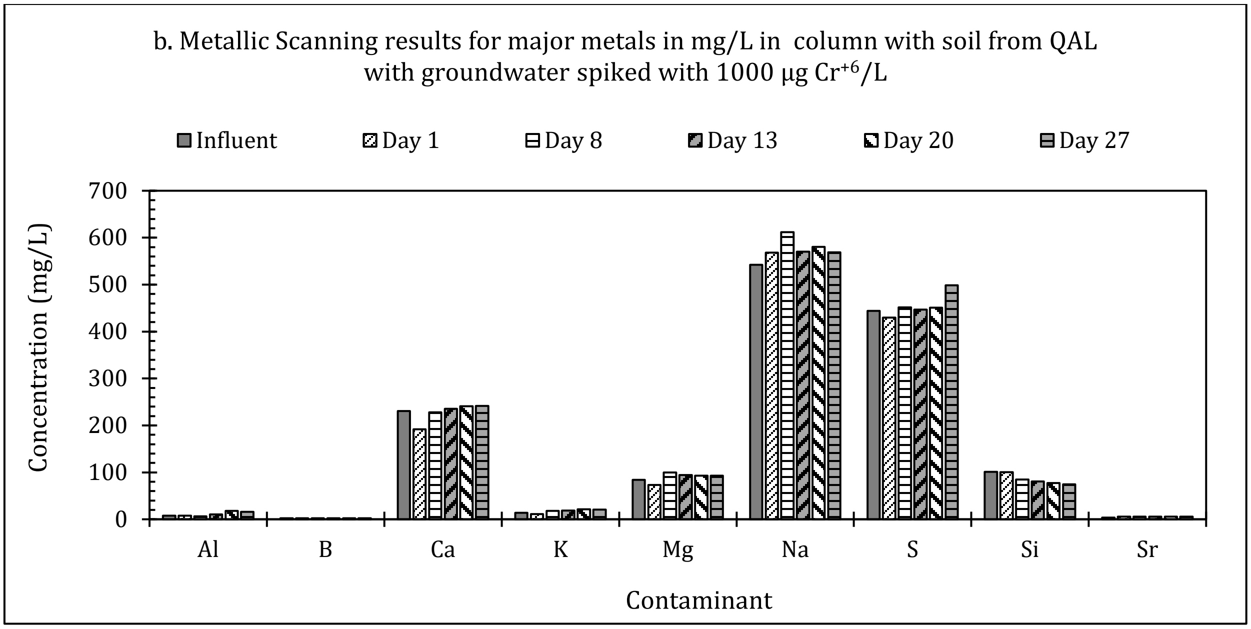
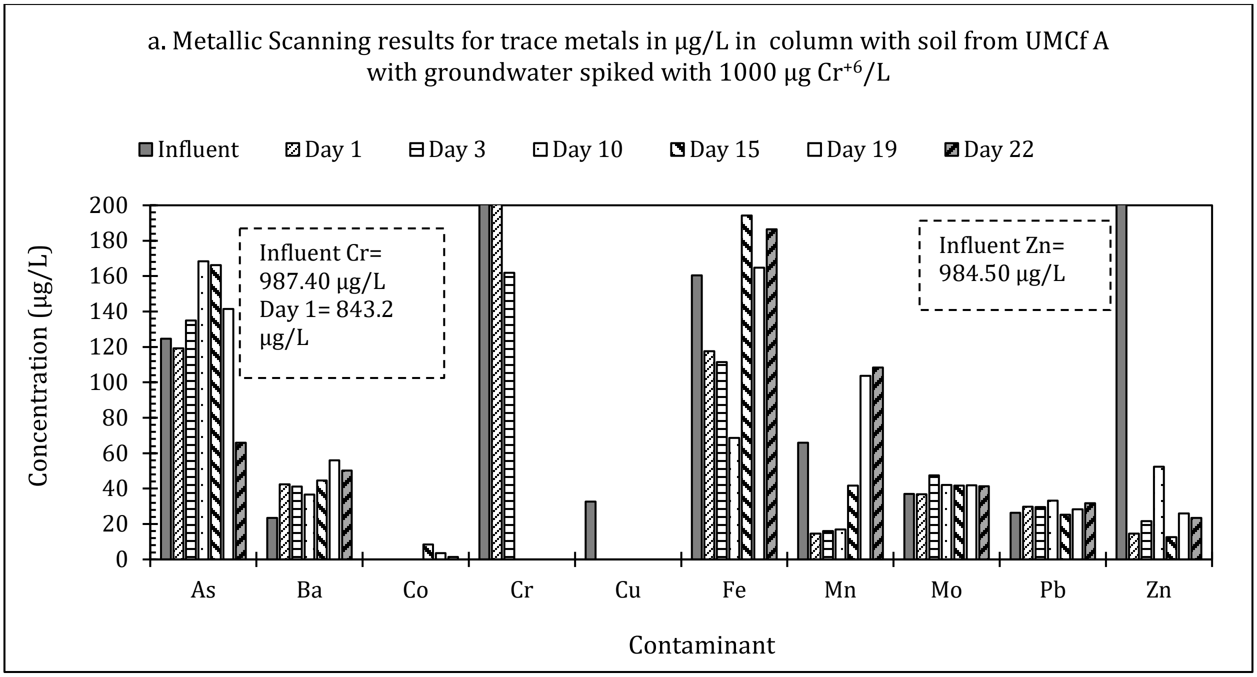


Figure 4.8: Total metal concentrations in the QAL in µg/L (a) mg/L (b).

Figure 4.9 (a) and (b) show the results of trace metal and major element analyses for the influent groundwater and effluent from the UMCf A column on Days 1, 3, 10, 15, 19 and 22. Arsenic concentration increased with time, but decreased by half on Day 22 (last sample). Barium increased over time and doubled by Day 22. **Iron and manganese concentrations in the effluent samples decreased until Day 10 and gradually increased afterwards**. Iron concentration was almost the same as the influent groundwater and Mn almost doubled in the effluent by Day 22. Molybdenum and lead remained the same as the influent groundwater. Since the chromium was removed in the columns, it was expected that total dissolved chromium would decrease. The total dissolved chromium was non-detectable from Day 10 in the effluent samples. Zinc was almost 50 times less in Day 22 samples compared to the influent groundwater. Note that copper is present only in the influent.

The concentrations of aluminum, calcium, potassium, magnesium, sodium, sulfur, and silicon in the effluent remained almost the same as the influent groundwater (Figure 4.9 b).



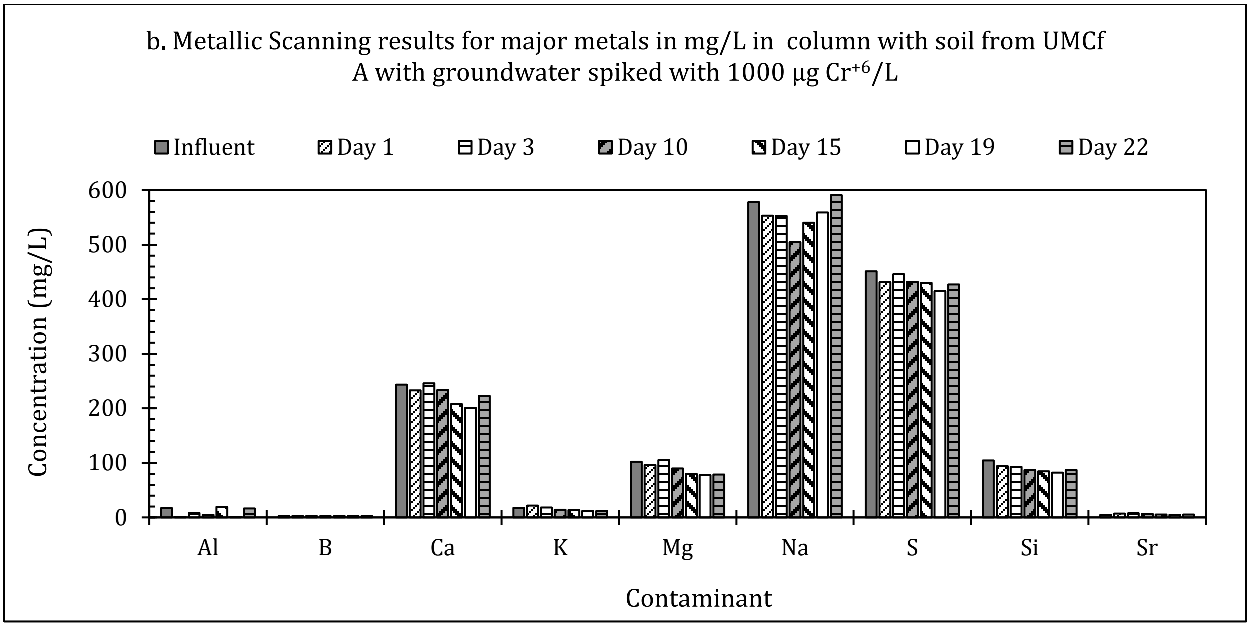
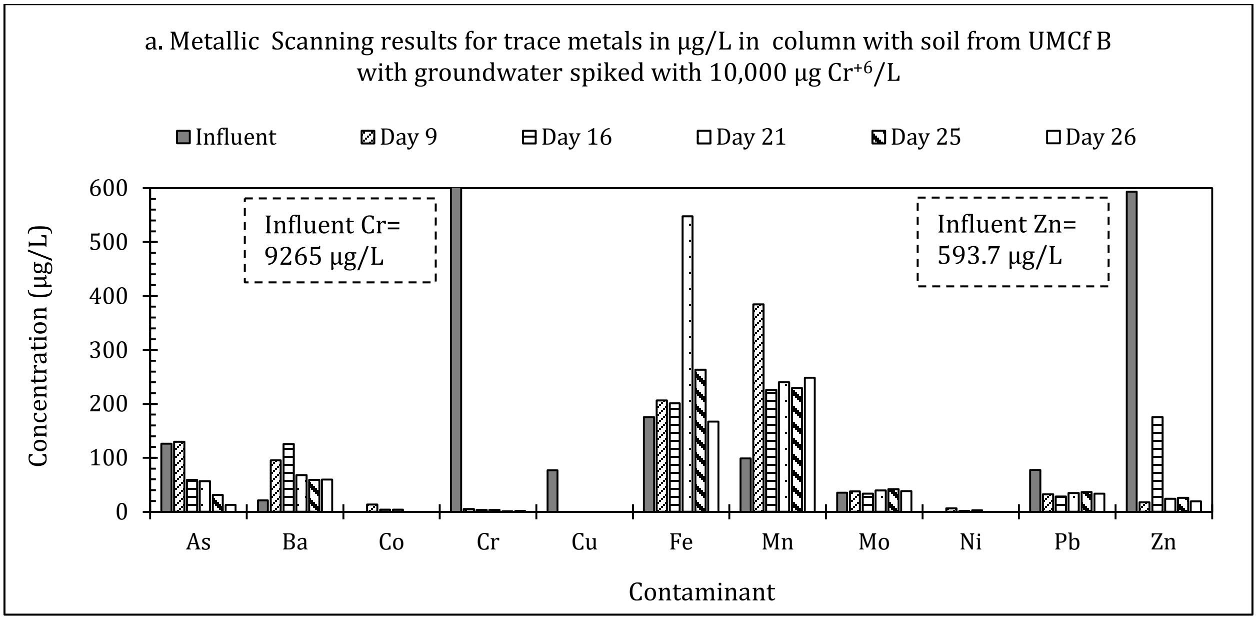


Figure 4.9: Total metal concentrations in the UMCf A in µg/L (a) mg/L (b).

Figure 4.10 (a) and (b) shows the analytical results for trace metal and major element analyses for the influent groundwater and effluent from the UMCf B column on Days 9, 16, 21, 25, and 26. Arsenic concentration decreased with time and was 100 times lower than the influent groundwater on Day 26 (last sample). Barium concentration tripled by Day 21 and decreased afterwards such that the effluent concentration on Day 26 was the same as the influent groundwater. **Iron and manganese concentrations in the effluent samples increased on Day 21 and Day 9, respectively, and both decreased in following days**. Iron was almost the same as the influent groundwater, and Mn was double the groundwater on Day 26. The molybdenum concentration remained the same as the influent groundwater. The chromium decreased to non-detectable values from Day 9 in the effluent samples. Lead concentration decreased to half that in the influent and stabilized. The zinc concentration deceased by 30 times from the influent concentration to the Day 26 effluent samples. The concentrations of aluminum, calcium, potassium, magnesium, sodium, sulfur, and silicon in the effluent remained relatively unchanged from the influent groundwater concentrations (Figure 4.10 b).

In summary, the impact of CaSx injection on the release of other elements present in the aquifer is small—with most elemental concentrations remaining very low (generally <100 ppb) and stable. Arsenic concentrations generally decreased with polysulfide addition. Lead concentrations increased in QAL slightly but remained <50 ppb. Iron and managanese increased, but both concentrations were below 600 μg/L.



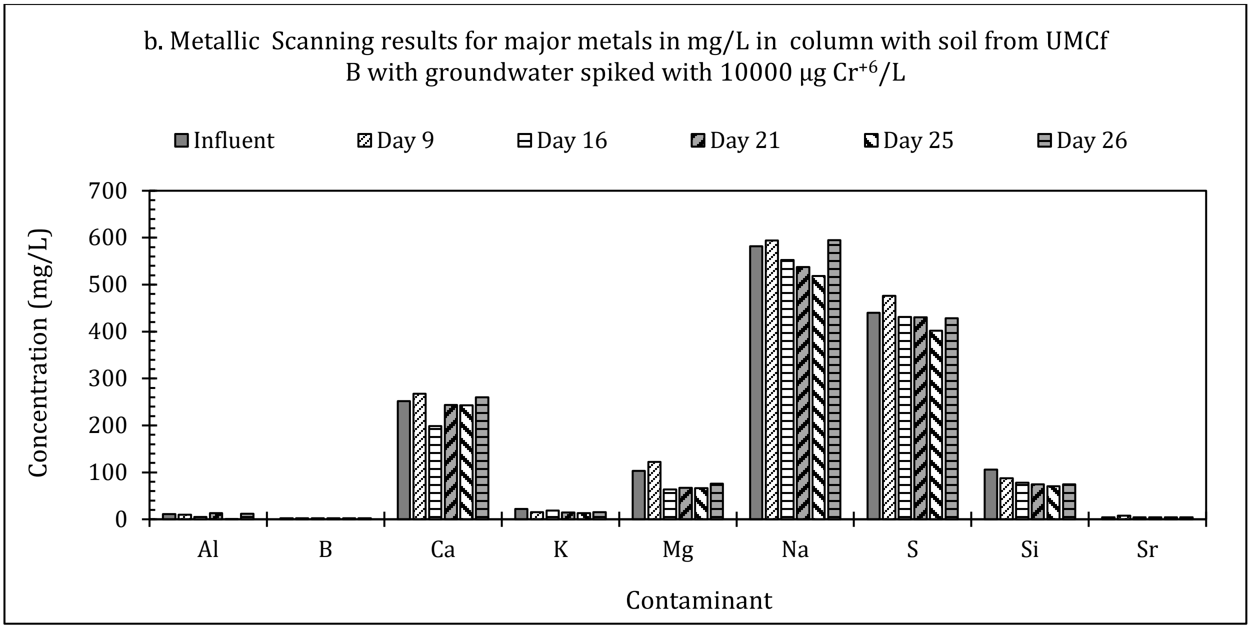


Figure 4.10: Total metal concentrations in the UMCf B in µg/L (a) mg/L (b).

CHAPTER 5 RESULTS AND DISCUSSIONS OF BIOLOGICAL REDUCTION

5.1 Batch Biological Test

5.1.1 Phase I Batch Microcosm Testing using EOS-PRO, Industrial Sugar Wastewater (ISW), a Mixture of EOS-PRO and ISW, and Molasses as Substrate

The methodology for the phase I batch microcosm testing can be found in section 2.6.1. The experimental matrix used in the microcosm tests is depicted in Appendix E (Table E.5). The estimated initial COD added to all microcosms was 12,000 mg/L, either as EOS-PRO, Industrial Sugar Wastewater, or a mixture of both—hence the use of the term "COD equivalent" to represent the organic content, independent of the source. Figure 5.1 shows the COD values in the microcosms for EOS-PRO, Industrial Sugar Wastewater, and the mixture of the two at 1.25 parts of Industrial Sugar Wastewater to 1 part EOS-PRO (Mix). The COD values confirm that there was more than sufficient carbon substrate to support biodegration in both QAL and UMCf.

<u>Microcosm COD Levels</u>

Notice that for the entire experimental period, the COD of EOS-PRO and Mix bottles had a lower value than that of the Industrial Sugar Wastewater. The reason for this disparity is the absorption of EOS-Pro oil into the soil, leaving less oil in the liquid phase. The wastewater does not absorb into soil and therefore the soluble COD is higher. Also, notice that the initial COD values for the samples with Industrial Sugar Wastewater were much higher than the estimated 12,000 mg/L. The higher values of COD in Mix and Industrial Sugar Wastewater relate to the nature of the the Industrial Sugar Wastewater. The Industrial Sugar Wastewater contains liquid as well as some biodegradable solids. It is thought that with time the solids dissolved thereby increasing the soluble COD (i.e. measured in filtered samples). Since the solids present have been shown to dissolve with time and become soluble COD for bacterial use, it is not very likely the solids would clog the aquifer.

Figure 5.1 shows the COD for the EOS-PRO, Industrial Sugar Wastewater, and the mixture (Mix) microcosms. The COD for EOS-PRO microcosm on Day 3 was about 20% less than the initial estimated COD. From Day 3 to Day 36, the COD decreased continuously—indicating it was being used up. On Day 40, more COD was injected into the bottles to assure enough susbstrate to feed the biodegradation of the contaminants. For both QAL and UMCf, after addition of more COD on Day 40 the decrease in COD levels was less prominent; this is especially true for UMCf, where the COD levels of Industrial Sugar Wastewater stayed basically the same from Day 44 to Day 99.

The COD was not measured on the microcosm of Days 7 and 11 as they were from the same bottle sampled on Day 3. However, starting on Day 19, the COD was measured in the microcosms that had been previously sampled. Because the biodegradation took longer than planned—starting on Day 19—we did not sacrifice each bottle as with previous sampling. Instead, 20 mL of liquid was taken and the bottle was kept again in the shaker for future sampling. Resampling was done when significant degradation was not observed. This was necessary to assure enough bottles would be available for longer periods of incubation. The COD levels in the microcosms resampled for a second time were lower because oil is lost with continuous sampling. Sampling is performed by allowing the microcosm sample to sit for 8 hours—to assure the fine solids settle—before clear liquid from the top is removed. During settling, a film of oil forms on top and is removed with the liquid, thereby decreasing the total amount of oil present. Note that the same microcosms were resampled on: Day 3, Day 7 and Day 14; Day 19 and Day 26; Day 44 and 50; Day 71 and Day 82; and Day 92 and Day 99.

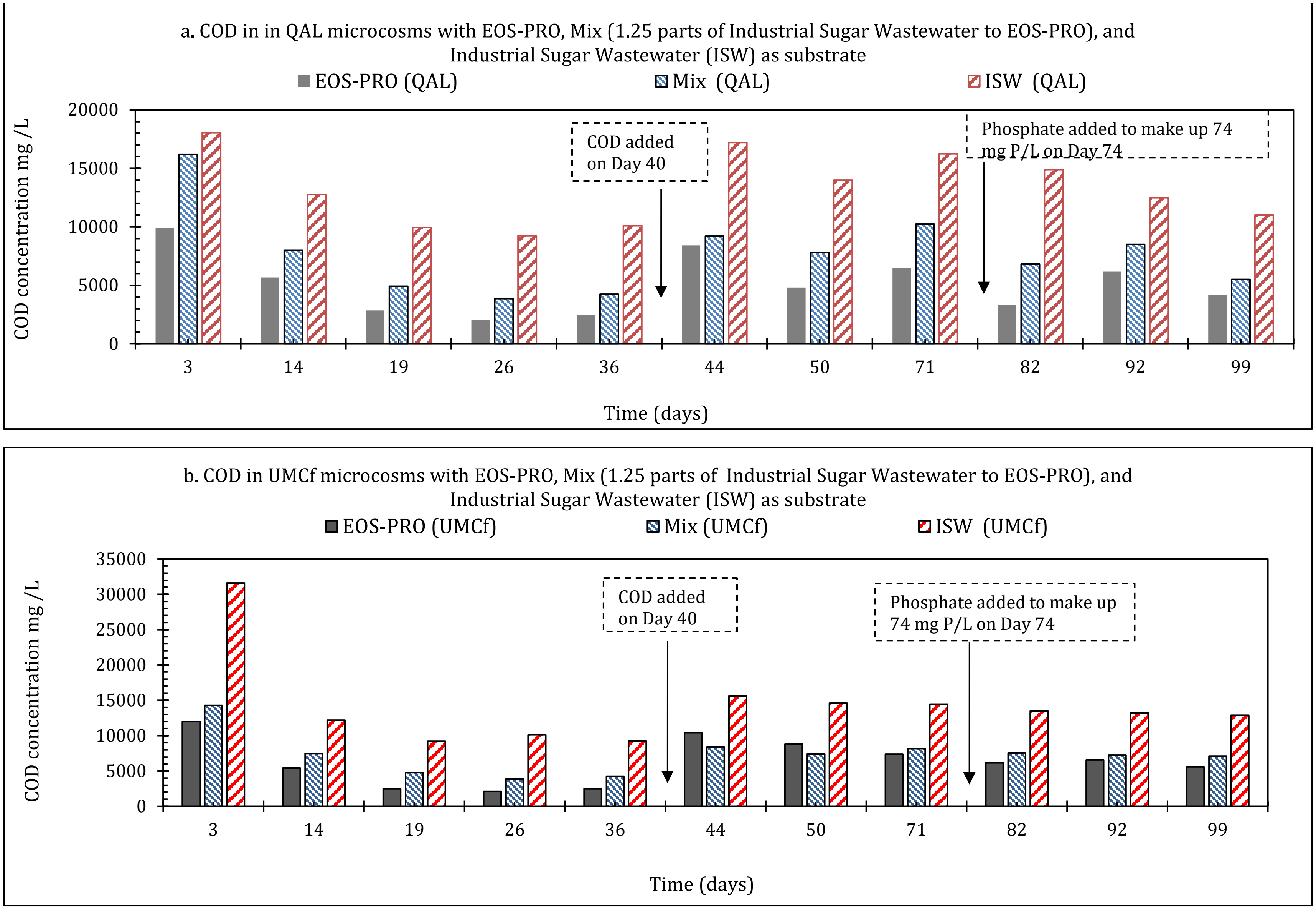


Figure 5.1: COD concentration in filtered samples in QAL (a) and UMCf (b) microcosms.

Figure 5.2 shows the COD in QAL and UMCf microcosms with Molasses as the substrate. Note that phosphate addition was needed because the Molasses used did not contain significant amounts of phosphate. The COD continuously decreased—showing that molasses was being used. The COD was reduced to about 18% of the initial estimated COD on Day 3, about 50% on Day 19, and 67% on Day 99 in both QAL and UMCf.

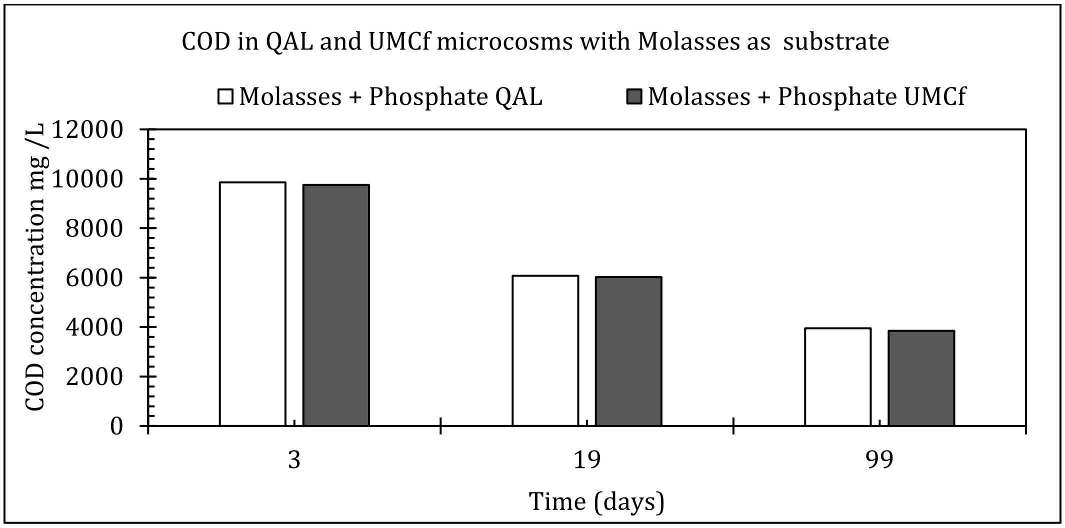
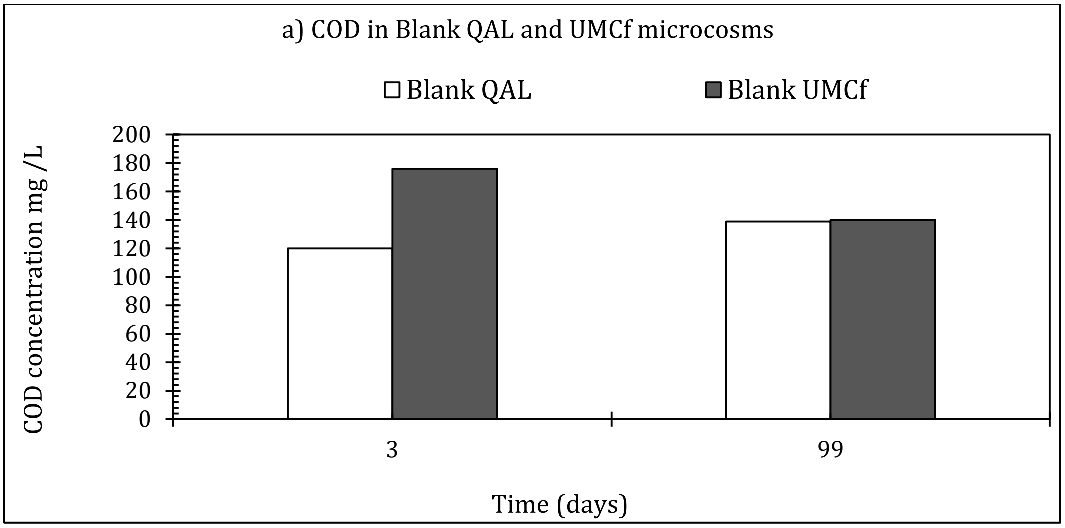
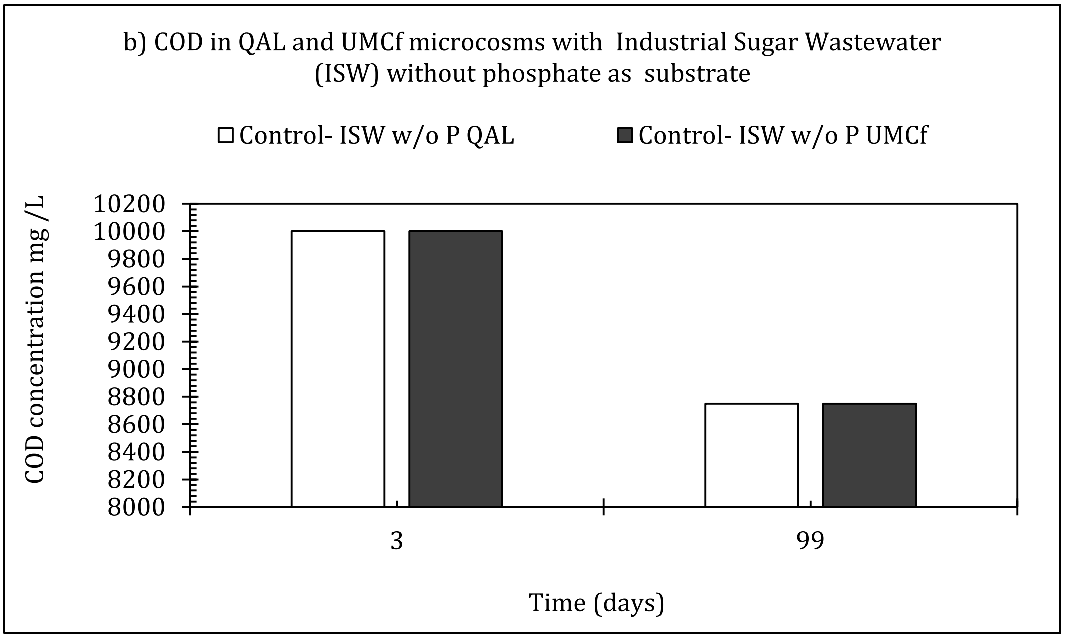


Figure 5.2: COD concentration in filtered samples in QAL and UMCf using Molasses with phosphate as substrate

Figure 5.3 shows the COD in the control microcosms: blank (a), Industrial Sugar Wastewater without phosphate (b), and Molasses without phosphate (c). Notice that the COD of QAL and UMCf, without the addition of any extra substrate, is very small and below 180 mg/L. There is little variation between Day 3 and Day 99 CODs showing that not much degradation took place. For the phosphate blanks—where additional phosphate was not added—notice that on Day 99, the COD decreased by about 27% and 12% for Industrial Sugar Wastewater without phosphate and Molasses without phosphate, respectively. This was true for both QAL and UMCf. These results point to some level of degradation occurring—supported by the small amount of phosphate available in the substrates.



a) COD in Blank QAL and UMCf microcosms



b) COD in QAL and UMCf microcosms with Industrial Sugar Wastewater (ISW) without phosphate as substrate

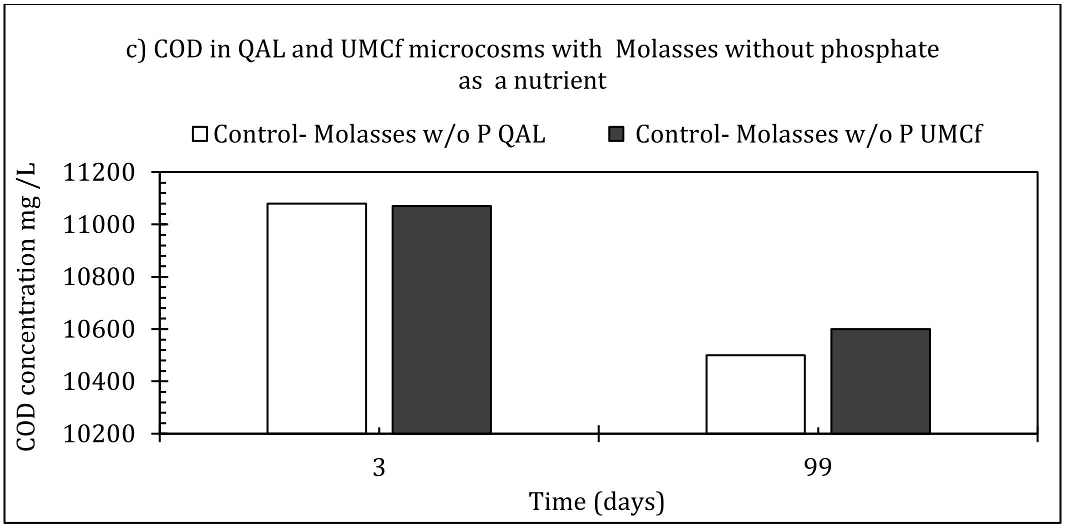


Figure 5.3: COD in QAL and UMCf control microcosm: blank (a), Industrial Sugar Wastewater without phosphate (b), and Molasses without phosphate (c).

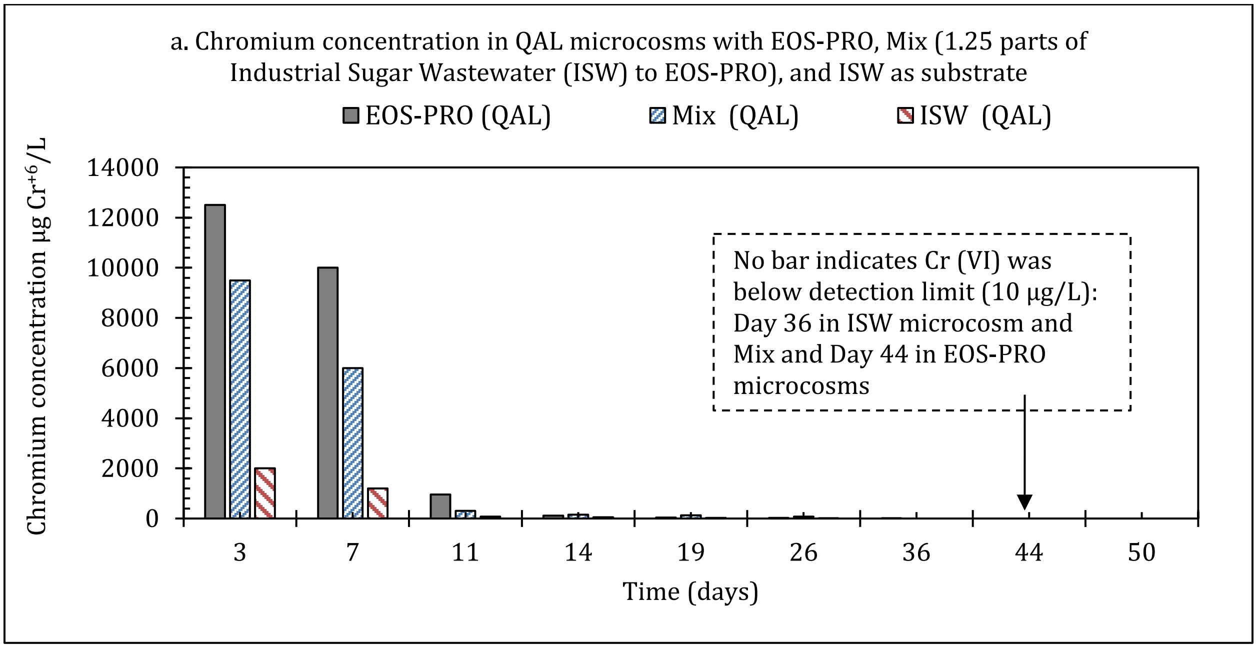
Notice that the COD remaining in the liquid phase of the microcosm was above 2,000 mg/L in all cases. Therefore, the amount of substrate used was much more than needed. However, one has to consider the application of these substrates in the field. Because EOS-PRO oil absorbs into the soil, as it is applied to the groundwater the oil will remain in the aquifer for bioremediation. Industrial Sugar Wastewater is soluble and highly biodegradable and it was shown here to help speed up bioremediation. However, in an aquifer, it will flow with the groundwater and may end up in the aquifer discharge area (i.e. the Las Vegas Wash in the case of NERT). For field application, future optimization of substrate dosage will be necessary because it will dictate well spacing, application frequency of substrate, and monitoring schedule. In addition, as will be discussed below, not all substrates impacted biological reduction in the same manner. While Industrial Sugar Wastewater was very effective in supporting chromium degradation, it was not preferred by bacteria to reduce nitrate, chlorate, or perchlorate.

Cr (VI) Degredation

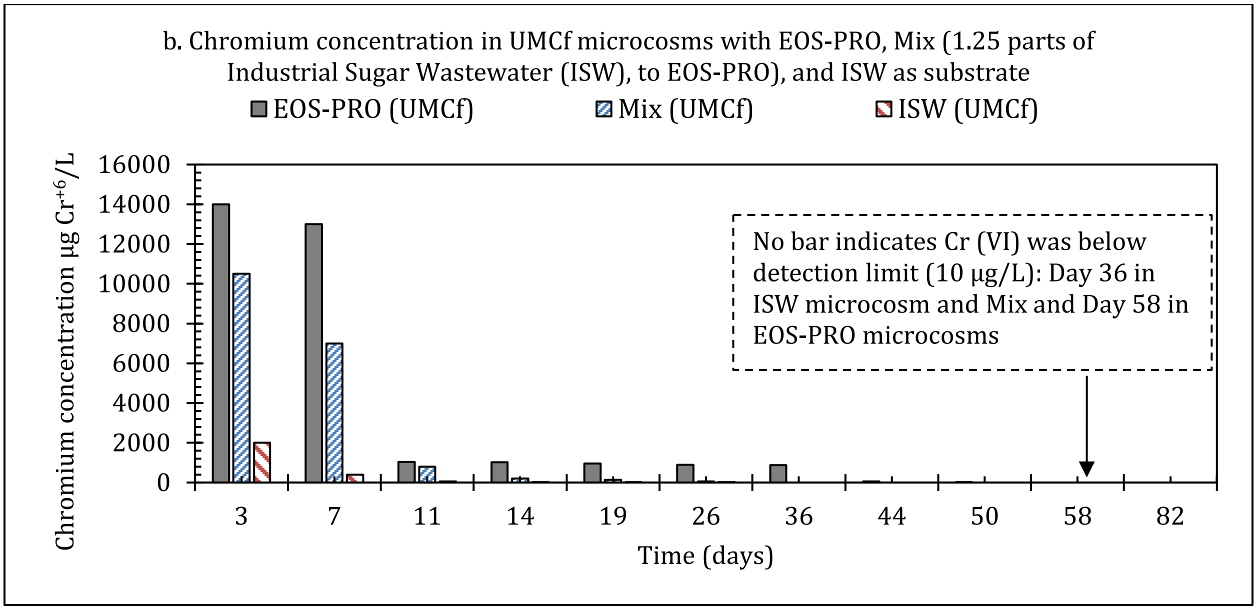
The Cr (VI) degradation in QAL microcosms is shown in Figure 5.4. On Day 3, the Cr (VI) was about 2000 µg/L in the Industrial Sugar Wastewater, about 10000 µg/L in EOS-PRO, and 13000 µg/L in the Mix microcosms. On Day 11, the Cr (VI) decreased to 80 µg/L in Industrial Sugar Wastewater, 300 μg/L in Mix, and 960 μg/L in EOS-PRO microcosms. Cr (VI) in EOS-PRO microcosms was about 10 μg/L and the Mix and Industrial Sugar Wastewater microcosms were below detection limit (10 μg/L) by Day 36. Therefore, the results show that all substrates used can support chromium reduction. However, Industrial Sugar Wastewater alone or mixed with EOS-PRO promotes faster degradation rates. To reach Cr (VI) concentrations below 100 μg/L, it took the Industrial Sugar Wastewater substrate 11 days as compared to 19 days for EOS-PRO. Nonetheless, all substrates studied promoted chromium reduction in the alluvial (QAL), from 14,000 μg/L to < 10 μg/L within 36 days.

Figure 5.4 (b) shows the Cr (VI) degradation in UMCf microcosms. On Day 3, the Cr (VI) was less than 2000 μg/L in the Industrial Sugar Wastewater, about 10000 μg/L in EOS-PRO, and about 14000 μg/L in the Mix microcosms. On Day 11, the Cr (VI) decreased further to 50 μg/L in Industrial Sugar Wastewater, 800 μg/L in Mix, and 1040 μg/L in EOS-PRO microcosms. On Day 36, Cr (VI) in the Mix and Industrial Sugar Wastewater microcosms were below detection limit (10 μg/L). The degradation was much slower for EOS-PRO microcosms, and only on Day 58 was the Cr (VI) was below detection limit (10 μg/L). Chromium reduction in the UMCf groundwater can also be achieved using any of the three substrates studied.

For both QAL and UMCf, the addition of a highly biodegradable substrate—Industrial Sugar Wastewater—promotes faster degradation rates. Chromium reduction rates in the UMCf were slower than those for QAL. Although 10 μg/L remaining chromium was obtained within 36 days for UMCf—using Industrial Sugar Wastewater or a mixture of EOS-PRO oil and Industrial Sugar Wastewater—it took 58 days for EOS-PRO alone to reach these levels. It is suspected that the reason for the slower degradation in the presence of EOS alone relates to the slower release of EOS-PRO oil from the UMCf as compared to QAL. Therefore, for UMCf remediation it is advantageous to supplement with a highly biodegradable substrate. Using a highly biodegradable substrate alone is not recommended because of the high concentrations of co-contaminants present. These co-contaminants significantly raise the required substrate dosages because of the lower COD available from soluble substrates. Emulsified oil has a COD of 2,000,000 mg/L as compared to 100,000 mg/L for sugar, a soluble substrate. Therefore, the amount of sugar needed to perform the same remediation work would be 20 times that of emulsified oil. Notwithstanding amounts required, in the future economical evaluations will be needed to decide the pros and cons for the use of various carbon substrates at NERT.


a. Chromium concentration in QAL microcosms with EOS-PRO, Mix (1.25 parts of Industrial Sugar Wastewater (ISW) to EOS-PRO), and ISW as substrate

No bar indicates Cr (VI) was below detection limit (10 μg/L): Day 36 in ISW microcosm and Mix and Day 44 in EOS-PRO microcosms


b. Chromium concentration in UMCf microcosms with EOS-PRO, Mix (1.25 parts of Industrial Sugar Wastewater (ISW), to EOS-PRO), and ISW as substrate

No bar indicates Cr (VI) was below detection limit (10 μg/L): Day 36 in ISW microcosm and Mix and Day 58 in EOS-PRO microcosms

Figure 5.4: Cr (VI) in QAL (a) and UMCf (b) microcosms with EOS-PRO, Mix, and Industrial Sugar Wastewater as substrate.

In both QAL and UMCf microcosms, the majority of the Cr (VI) (88% in QAL and 91% in UMCf) was removed by Industrial Sugar Wastewater by Day 3. Given the presence of microbes in the experiments, one may assume that the degradation was biotic. However, there is also a possibility of abiotic reduction. In this study, no investigation was performed to separate biotic and abiotic reduction of Cr (VI). However, Chen et al. (2015) demonstrated that sugarcane molasses can reduce Cr (VI) to Cr (III) in the absence of bacteria. The reaction mechanism was proven to be that Cr (VI) readily accepts electrons from the phenolic hydroxyl group of polyphenol present in molasses, and it is then reduced to Cr (III). In the process, the polyphenol is converted to a quinone. Since the Industrial Sugar Wastewater used in this study also results from plant products, there is possibility phenolic groups were present, but phenol analyses were not performed.

Appendix E (Section E.3) shows the potential abiotic chemical contribution of Industrial Sugar Wastewater on Cr (VI) reduction for the the NERT groundwater (about 50%). The tests shown in Appendix E—performed after the microcosm study had been completed—show some possibility of abiotic reduction. Although there is a possibility of abiotic reduction, biotic reduction also took place in the microcosms where EOS-PRO alone was used. Notwithstanding the distinction between biotic and abiotic reduction, while slower than Industrial Sugar Wastewater, Mix microcosms removed Cr (VI) faster than EOS-PRO microcosms.

Figure 5.5 shows the Cr (VI) reduction in microcosms where molasses was used as a substrate. By Day 7, about 70% of the Cr (VI) was removed in QAL microcosms and about 60% in UMCf microcosms. By Day 19, Cr (VI) was reduced by about 80% in QAL microcosms and 75% in UMCf microcosms. The Cr (VI) on Day 50 was below the detection limit (10 µg/L) for both. Reduction in UMCf was slower than in QAL, as seen in the microcosms using EOS-PRO and Industrial Sugar Wastewater. Nonetheless, the results show that molasses can also be used a substrate to reduce Cr (VI) at this site. Given the microcosms using molasses generated a significant amount of methane gas—enough to explode several of the microcosm bottles—bio-reduction is likely to have occurred. However, abiotic reduction was not evaluated.

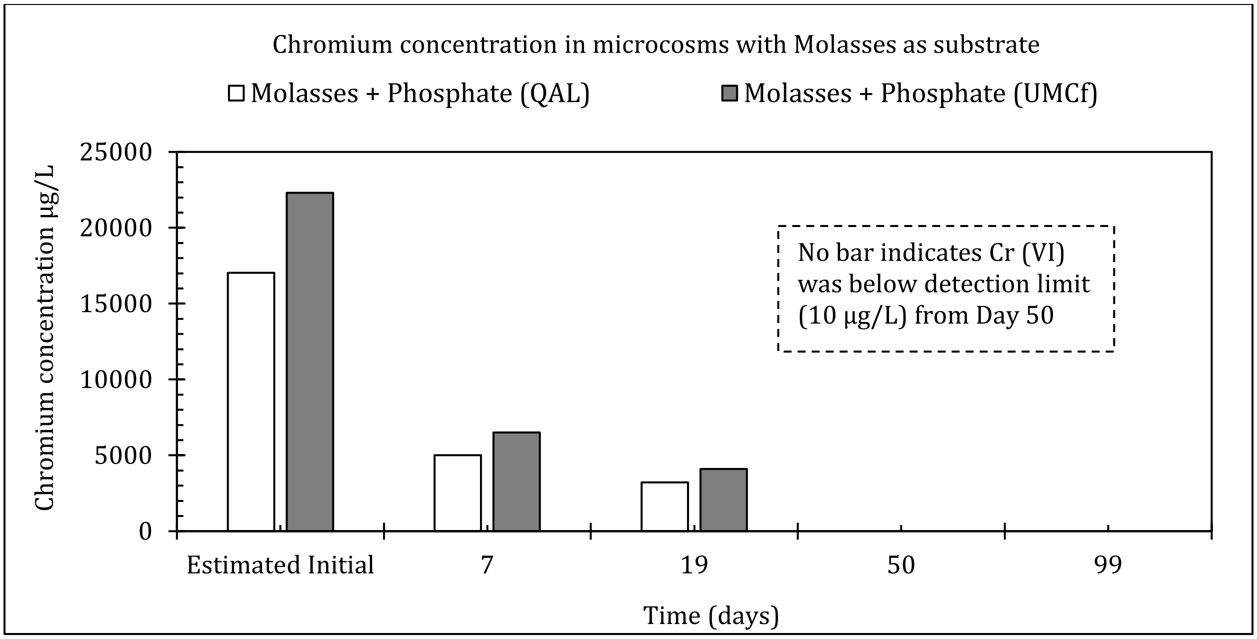
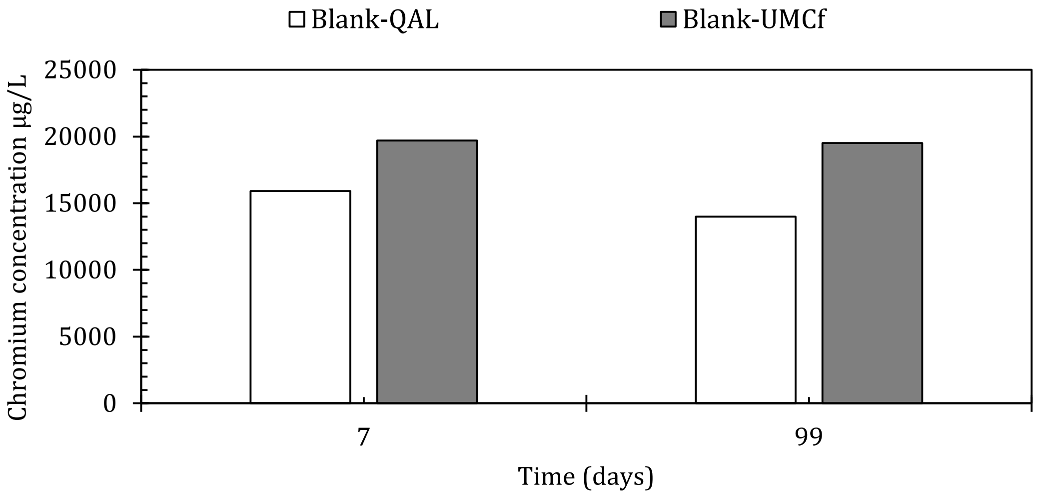
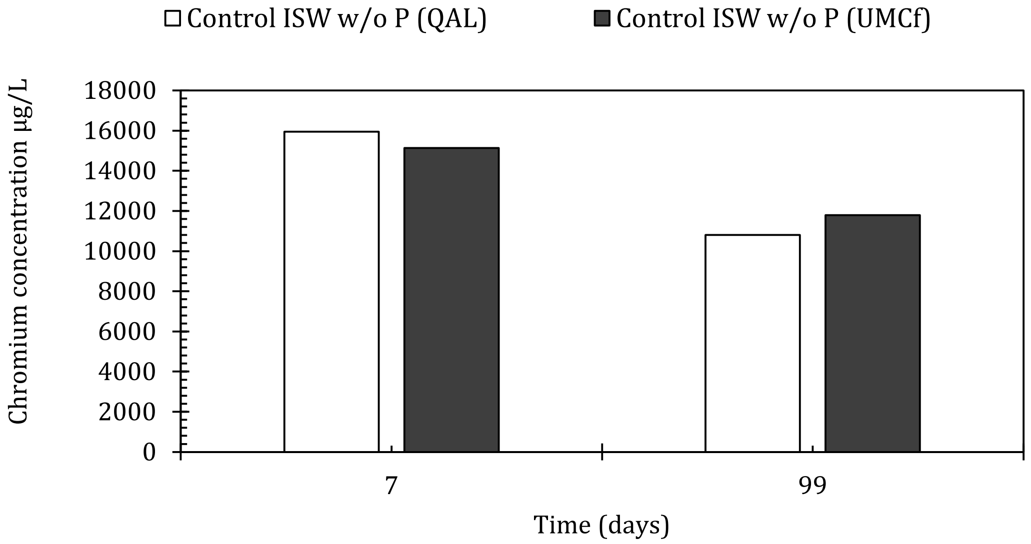


Figure 5.5: Cr (VI) in microcosms with Molasses as substrate with phosphate.

The Cr (VI) concentrations in the blank microcosms are presented in Figure 5.6 (a). Cr (VI) concentration on Day 7 remained almost same through Day 99 indicating that Cr (VI) will not be reduced at this site if substrate is not added. The control microcosms with Industrial Sugar Wastewater without phosphate indicated about 30% Cr (VI) was removed on Day 7 and about 50% on Day 99 in QAL. About 11% Cr (VI) was removed on Day 7 and about 30% on Day 99 in the UMCf microcosms (Figure 5.6 b). The results indicate that phosphate, in addition to the small amount present in the Industrial Sugar Wastewater, is needed to promote faster degradation. The results also revealed, as found in earlier tests, that degradation in QAL is faster than in UMCf. The control microcosms with Molasses without phosphate indicated that about 7% Cr (VI) was removed by Day 7 and about 80% by Day 99 in QAL and UMCf microcosms (Figure 5.6 c). The results further support the need for phosphate addition to promote fast degradation.



a. Chromium concentration in blank microcosms (No substrate added)



b. Chromium concentration in Industrial Sugar Wastewater (ISW) without Phosphate (Control) microcosms(Estimated Initial: QAL- 22297 µg/L and UMCf- 17038 µg/L)

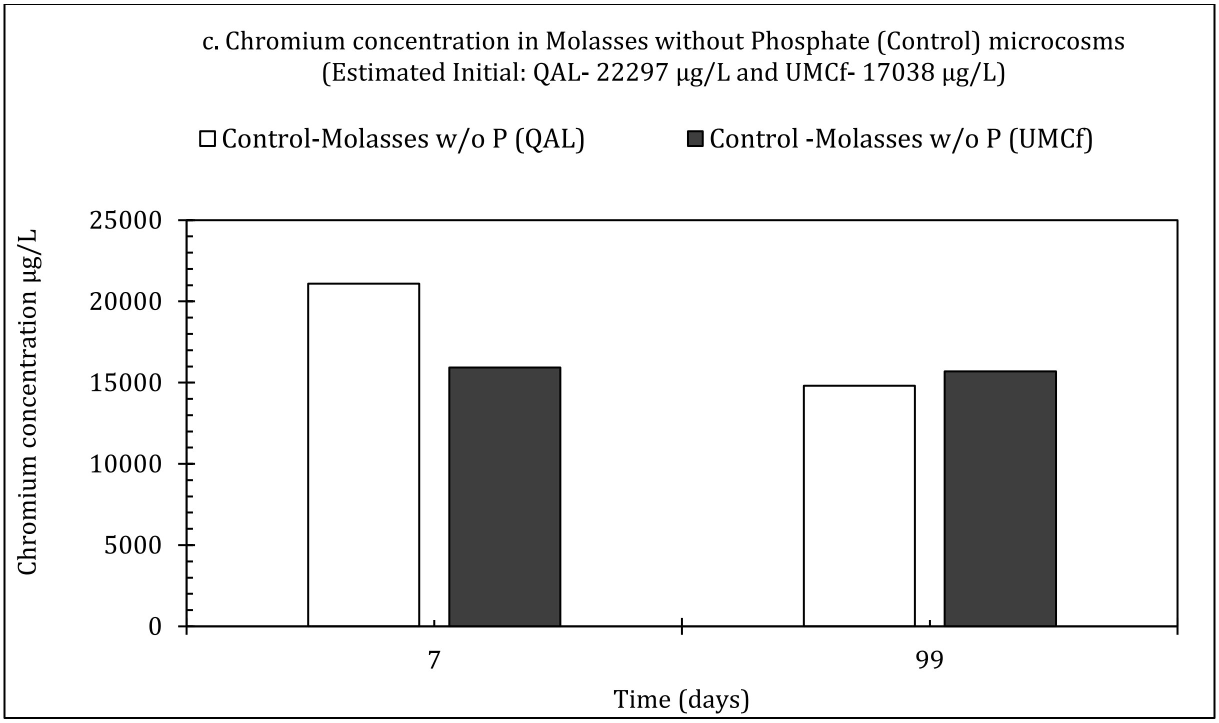
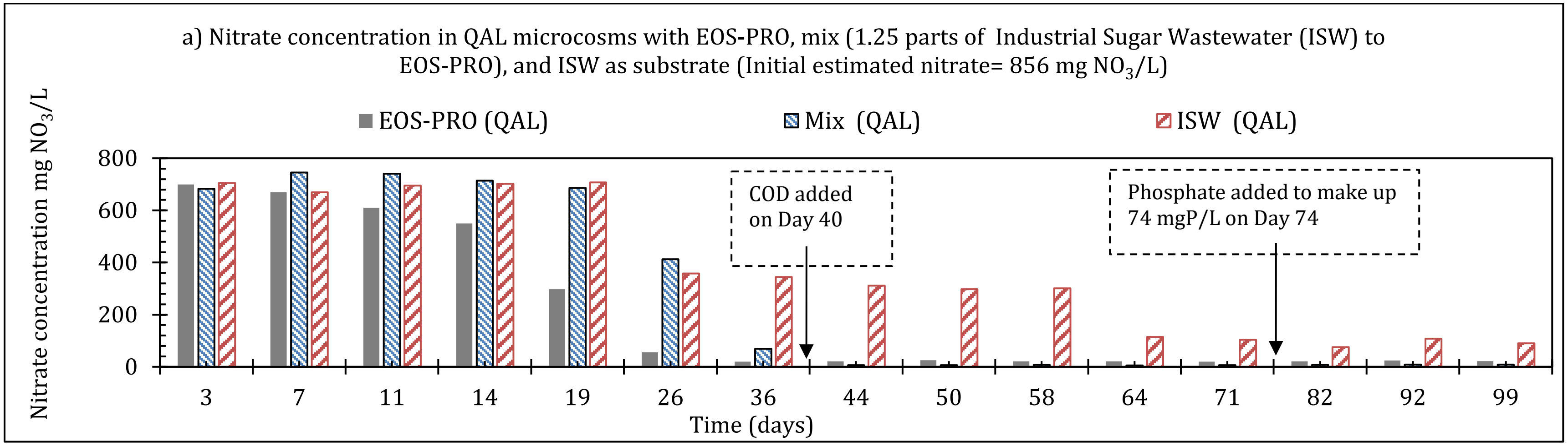


Figure 5.6: Cr (VI) in QAL and UMCf control microcosm- blank (a), Industrial Sugar Wastewater without phosphate (b), and Molasses without phosphate (c).

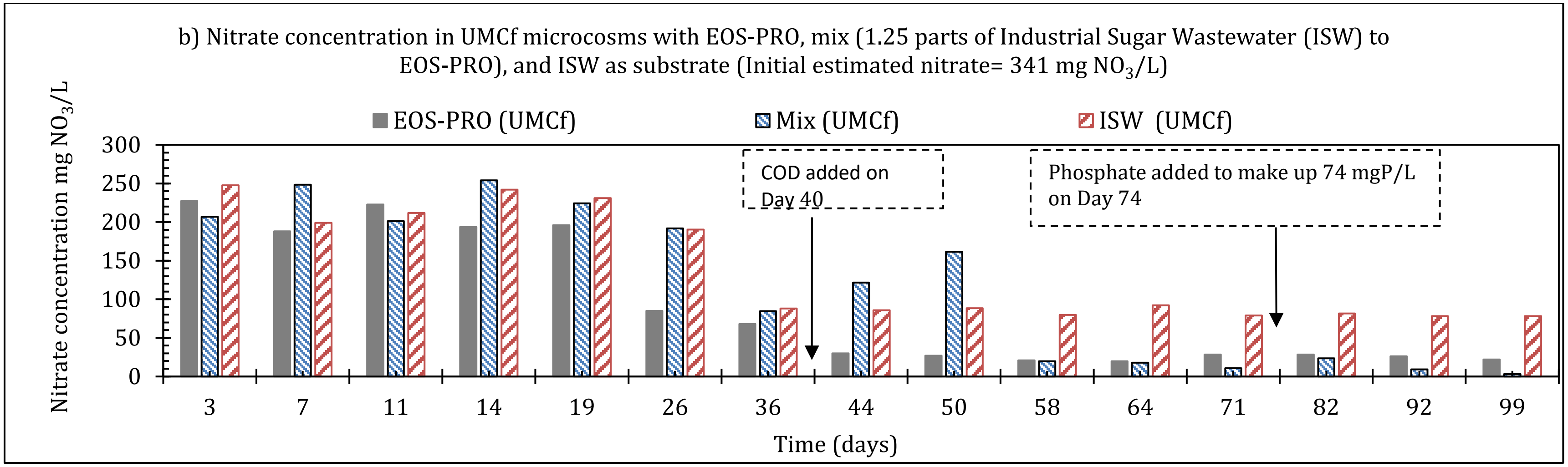
Nitrate Reduction

Nitrate reductions in the QAL and UMCf microcosms are depicted in Figures 4.7 (a) and (b). As expected, significant nitrate reduction occurred only after chromium was almost completely degraded, since Cr (VI) is a preferred electron acceptor to nitrate. Notice that the nitrate concentrations found at this site are extremely high and above 600 mg/L for QAL and 200 mg/L for UMCf. Significant nitrate reduction was observed Day 19 and Day 26, respectively, in QAL and UMCf microcosms when EOS-PRO and a mixture of EOS-PRO and Industrial Sugar Wastewater were used. However, Industrial Sugar Wastewater alone did not support nitrate reduction well and much slower reductions were observed. While EOS-PRO alone promoted significant nitrate reduction by Day 19, with Industrial Sugar Wastewater significant reduction was not observed until Day 26. The nitrate data is consistent with the COD data discussed earlier. For microcosms fed Industrial Sugar Wastewater, the COD values were high—indicating the Industrial Sugar Wastewater was not being used sufficiently fast. Similar to that observed for Cr (VI), biological nitrate reduction is slower in UMCf compared to that in QAL. By Day 44, almost all nitrate was degraded in QAL microcosms a compared to > 99 days for UMCf.

Figure 5.7 (b) shows the nitrate concentrations in the UMCf microcosms. The nitrate concentration decreased slightly by Day 26 for all microcosms, which was after Cr (VI) degradation. After adding substrate on Day 40, only Mix and Industrial Sugar Wastewater microcosms showed higher nitrate concentrations on Day 44. Nitrate concentrations in the EOS-PRO microcosms did not increase, indicating some nitrate is present in the Industrial Sugar Wastewater. The nitrate concentration further increased on Day 50 in Mix and Industrial Sugar Wastewater microcosms. On Day 58, the nitrate concentrations decreased to about 20mg/L as NO_3 in EOS-PRO and Mix microcosms. However, nitrate concentration remained about 80 mg/L as NO_3 in Industrial Sugar Wastewater microcosm even by Day 99.



a) Nitrate concentration in QAL microcosms with EOS-PRO, mix (1.25 parts of Industrial Sugar Wastewater (ISW) to EOS-PRO), and ISW as substrate (Initial estimated nitrate= 856 mg NO_3/L)



b) Nitrate concentration in UMCf microcosms with EOS-PRO, mix (1.25 parts of Industrial Sugar Wastewater (ISW) to EOS-PRO), and ISW as substrate (Initial estimated nitrate= 341 mg NO_3/L)

Figure 5.7: Nitrate concentration in QAL (a) and UMCf (b) microcosms with EOS-PRO, Mix, and Industrial Sugar Wastewater as substrate

Figure 5.8 shows the nitrate concentration in the molasses microcosms. The dark color of molasses interfered with nitrate analysis using the Hach method. Therefore, nitrate was analyzed using ion chromatography. The nitrate was below detection limit (1 mg/L as NO_3) by Day 19 in both QAL and UMCf as shown in Figure 5.8 on Day 19. Molasses is a well documented substrate for nitrate biodegradation (Lindow, 2004). Soluble chromium concentration on Day 19 was about 3000-4000 µg/L in the QAL and UMCf microcosms. It seems Cr (VI) and nitrate were degraded simultaneously in the molasses microcosms.

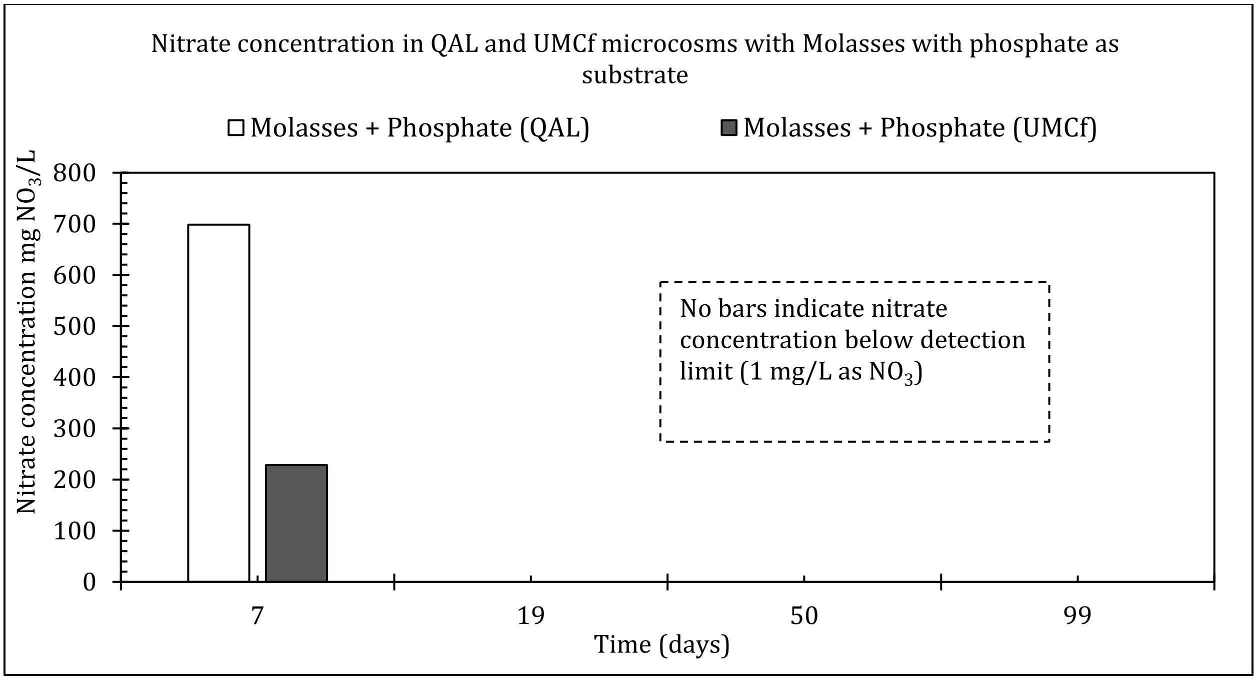
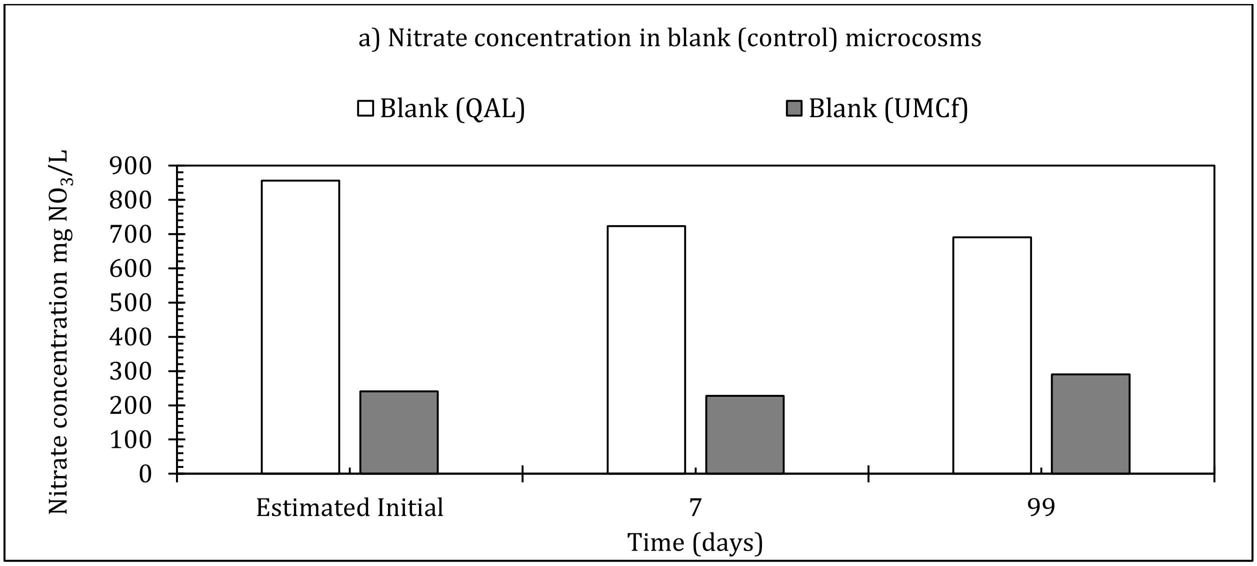
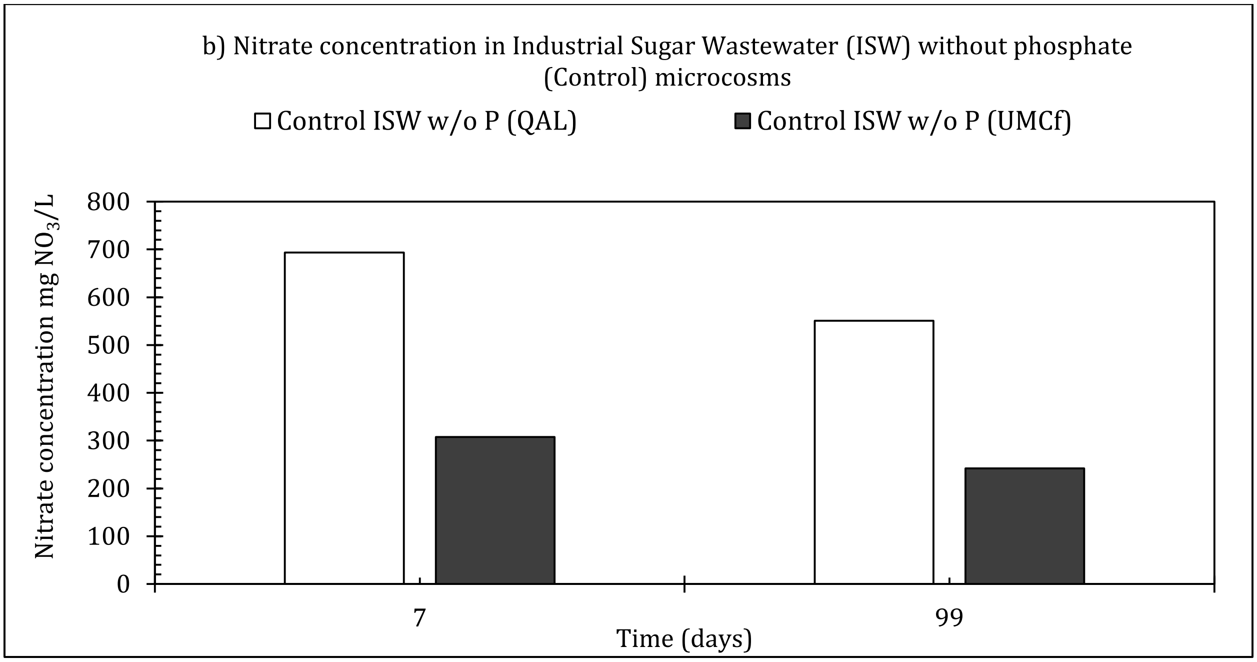


Figure 5.8: Nitrate concentration measured by IC for QAL and UMCf microcosms with Molasses with phosphate as substrate.

The nitrate concentration in the control microcosms are presented in Figure 5.9. Figure 5.9 (a) shows that the nitrate concentration in the Blank (without substrate) remained almost the same throughout the period for both QAL and UMCf. By Day 99, in microcosms with Industrial Sugar Wastewater without phosphate and Molasses without phosphate the concentration reduction was about 1-2% (Figure 4.9 (b) and Figure 4.9 (c), respectively). This small decrease is within experimental analysis error. Therefore, for degradation of nitrate to occur at the AP site of NERT, a substrate and phosphate—as a supplemental nutrient—is needed.





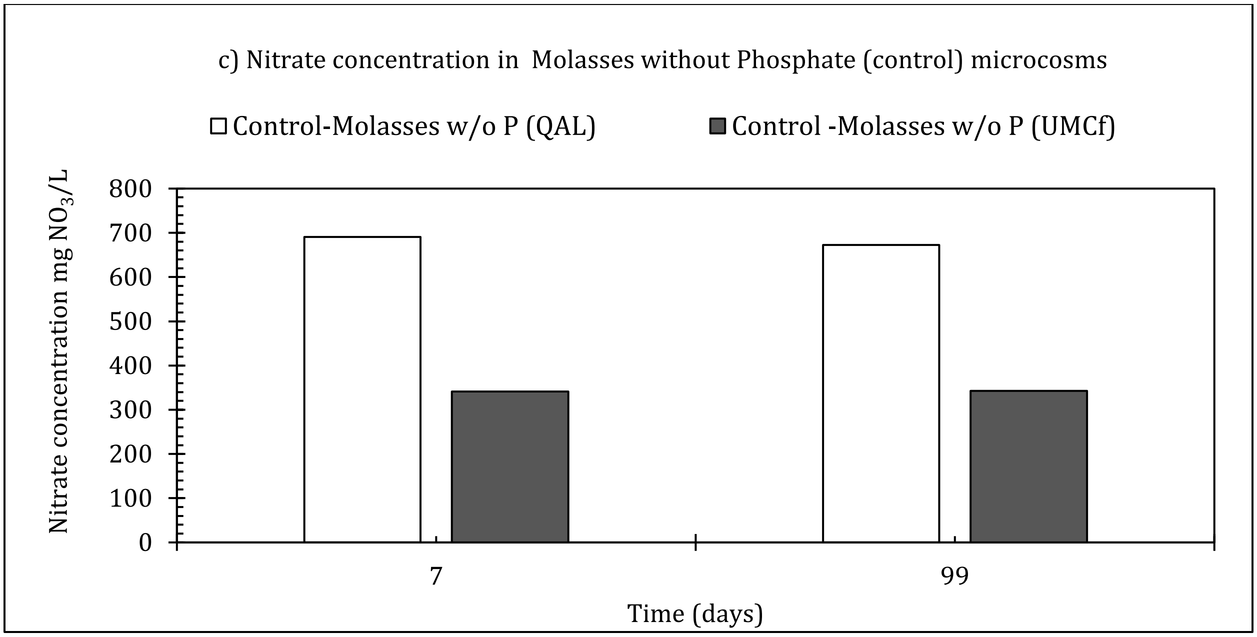


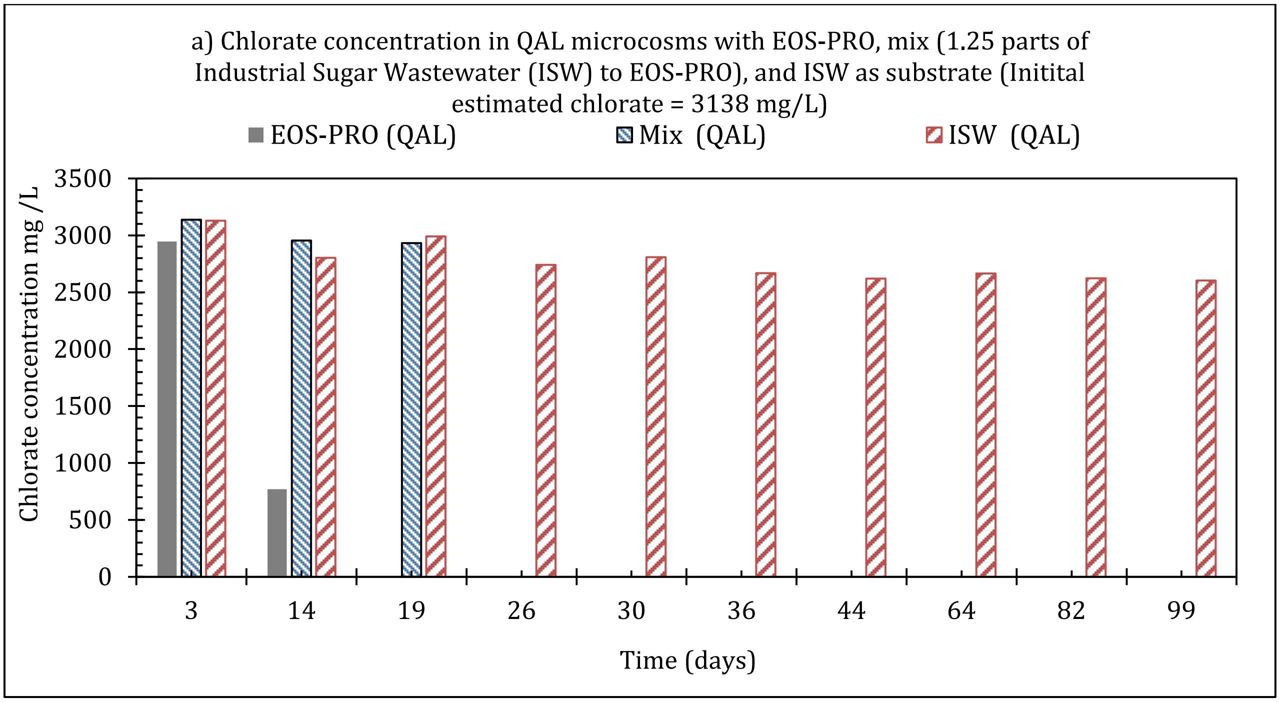
Figure 5.9: Nitrate concentrations in control microcosms: blank (a), Industrial Sugar Wastewater without phosphate (b), and Molasses without phosphate (c).

Chlorate Reduction

Figure 5.10 (a) shows the chlorate concentration in the QAL microcosms. Chlorate degradation was observed on Day 14 (about 75%) in the EOS-PRO microcosms, which was the same day when nitrate degradation was observed. Therefore, there was some concomitant degradation of nitrate and chlorate. The data reveals that EOS-PRO supports chlorate reduction very well, while Industrial Sugar Wastewater does not. Chlorate concentrations in microcosms where Industrial Sugar Wastewater was used did not change much over the course of the experiment. However, the opposite was noted for Cr (VI) reduction. While chromium reduction is supported by all substrates tested, especially by Industrial Sugar Wastewater, the degradation of nitrate and chlorate is better supported by EOS-PRO oil.

Chlorate concentration was below detection limit (5 mg/L) on Day 19 in the EOS-PRO microcosm. For the Mix microcosm, chlorate degradation was not observed until after Day 19 and was below the detection limit on Day 26. For Industrial Sugar Wastewater, only about 26% of the chlorate was removed by Day 99.

Figure 5.10 (b) shows the chlorate concentration in the UMCf microcosms. Chlorate degradation was observed on Day 36 in the EOS-PRO microcosms (about 39%), which was the same day when nitrate degradation was observed in UMCf microcosms with EOS-PRO. The chlorate concentration was below detection limit (5 mg/L) for the EOS-PRO microcosm on Day 71 only. For Mix microcosms, chlorate degradation was not observed until Day 44 and was below the detection limit on Day 82. For Industrial Sugar Wastewater microcosms, only about 8% of the chlorate degraded by Day 99. The lower degradation of chlorate in Industrial Sugar Wastewater suggests that Industrial Sugar Wastewater did not support chlorate degradation as compared to EOS-PRO.



a) Chlorate concentration in QAL microcosms with EOS-PRO, mix (1.25 parts of Industrial Sugar Wastewater (ISW) to EOS-PRO), and ISW as substrate (Initital estimated chlorate = 3138 mg/L)

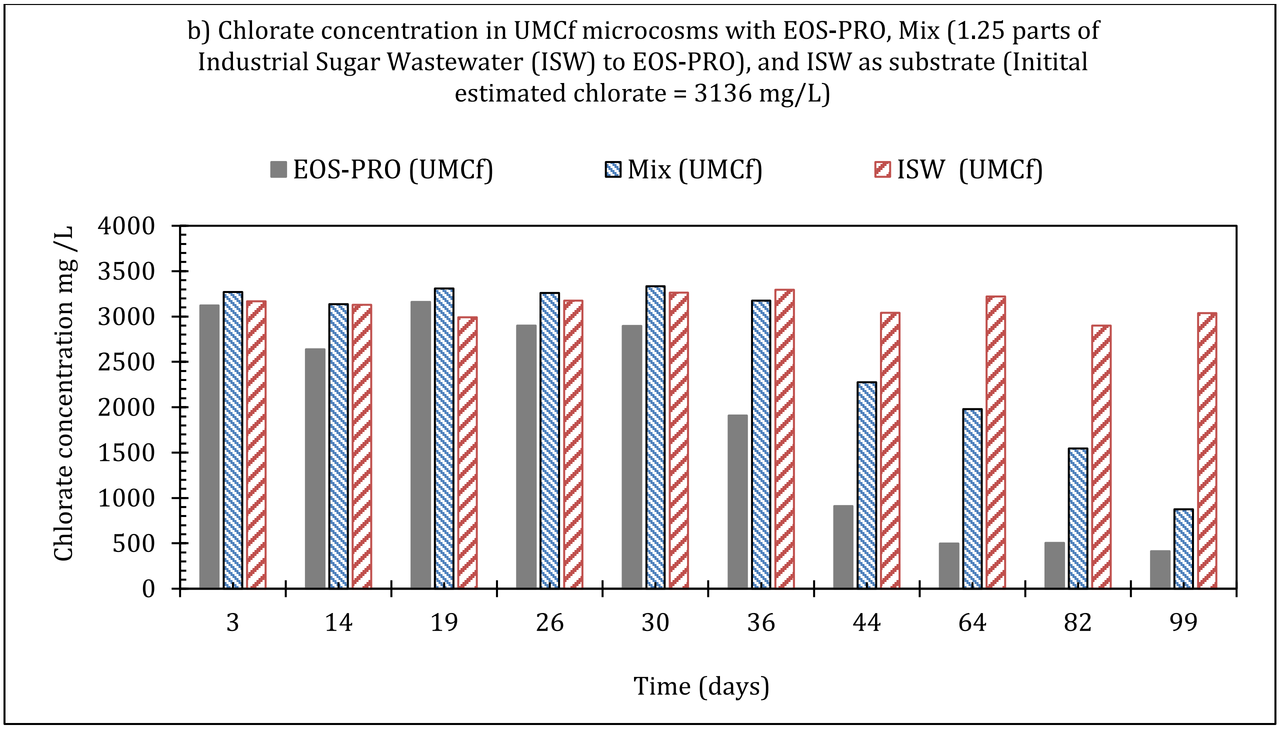

b) Chlorate concentration in UMCf microcosms with EOS-PRO, Mix (1.25 parts of Industrial Sugar Wastewater (ISW) to EOS-PRO), and ISW as substrate (Initital estimated chlorate = 3136 mg/L)

Figure 5.10: Concentration of chlorate in QAL (a) and UMCf (b) microcosms with EOS-PRO, Mix, and Industrial Sugar Wastewater as substrate

Figure 5.11 shows the chlorate concentrations in the QAL and UMCf microcosms using Molasses as substrate. The chlorate degradation was noted on Day 36 in both QAL and UMCf microcosms. Note that nitrate was below detection limit by Day 19 when measured with ion chromatography (IC). Therefore, similar to EOS-PRO, molasses promotes the reduction of several of the contaminants of concern.

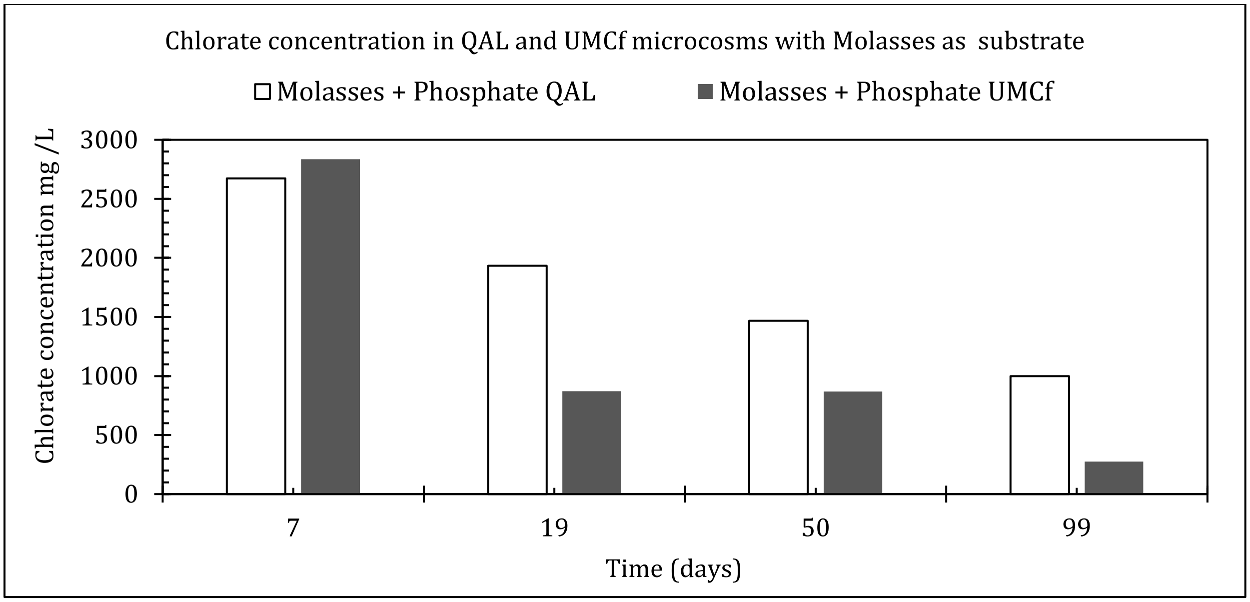
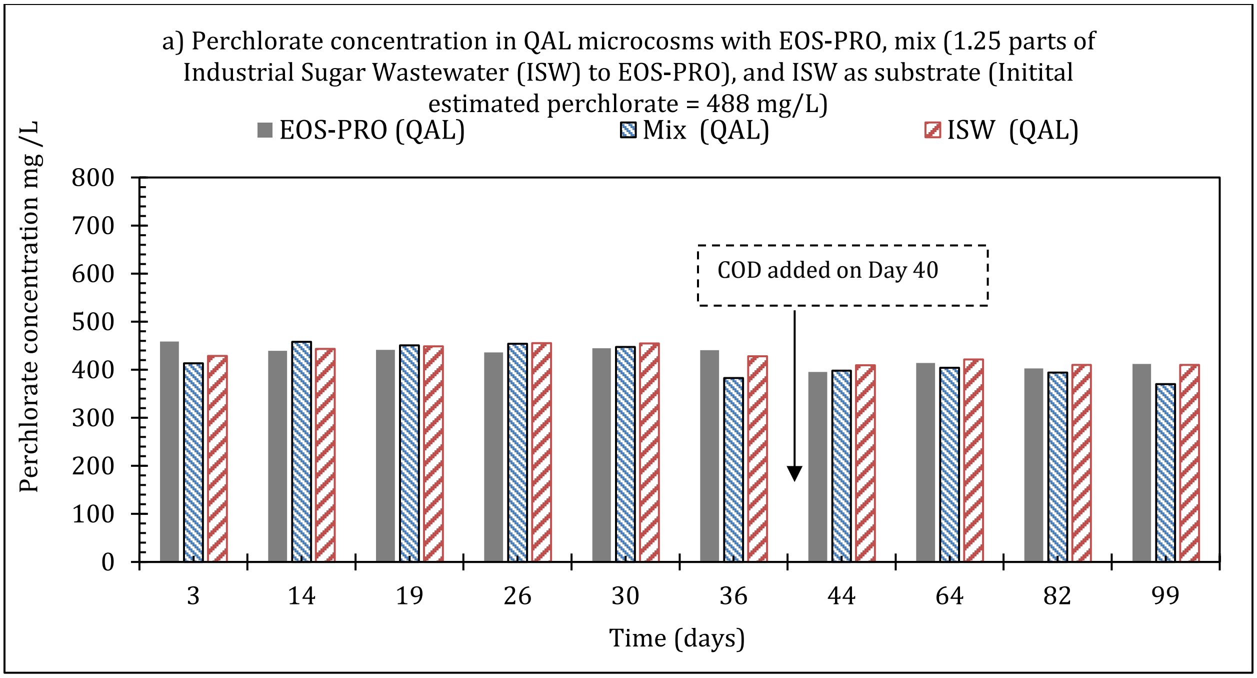


Figure 5.11: Chlorate concentration in QAL and UMCf microcosms with Molasses as substrate.

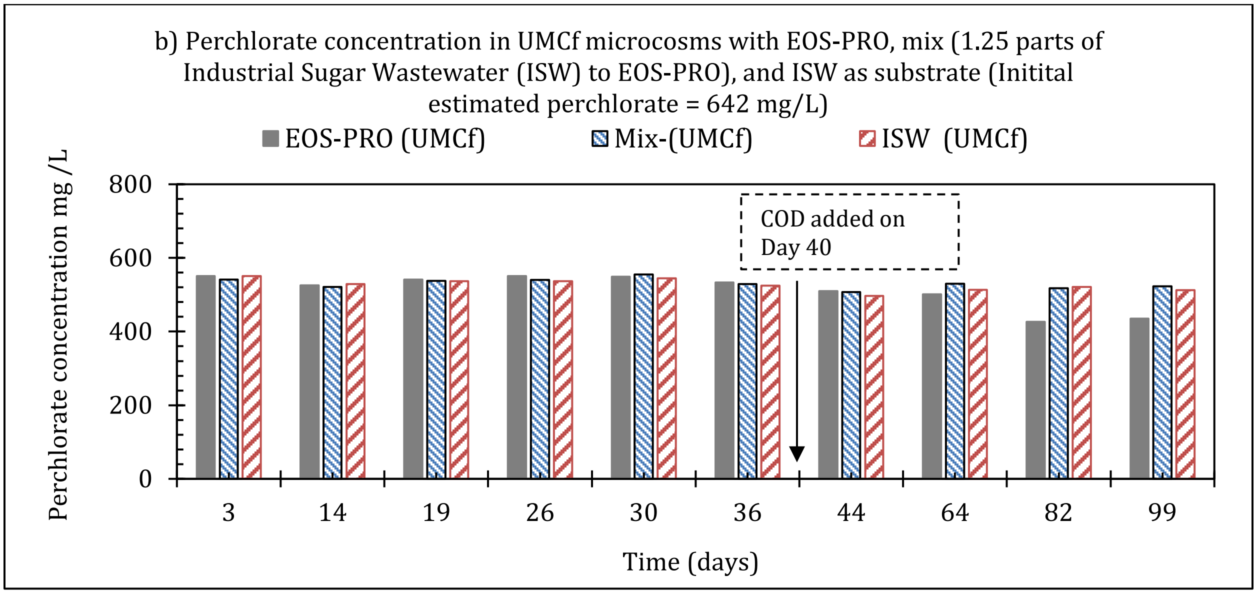
It is important to note that while chromium, perchlorate, and chlorate concentrations in the QAL and UMCf waters were similar, the nitrate concentration in QAL was approximately three times that of UMCf. This is important because significant chlorate degradation happened only after nitrate was significantly degraded. In the AP area, nitrate degradation is taking up a large percentage of the time required for remediation.

Perchlorate Reduction

Only very minor perchlorate degradation was observed in any of the microcosms during the 99 days of operation. In the microcosms fed with EOS, a 17-20% decrease was observed after Day 82 for both QAL and UMCf. Perchlorate concentration in the microcosms with EOS-PRO, Mix, and Industrial Sugar Wastewater are presented in Figure 5.12. Molasses microcosms are presented in Figure 5.13. Perchlorate reduction should follow that of chlorate, but that was not the case for QAL, since all the chlorate was already degraded in the EOS-PRO feed bottles.



a) Perchlorate concentration in QAL microcosms with EOS-PRO, mix (1.25 parts of Industrial Sugar Wastewater (ISW) to EOS-PRO), and ISW as substrate (Initital estimated perchlorate = 488 mg/L)



b) Perchlorate concentration in UMCf microcosms with EOS-PRO, mix (1.25 parts of Industrial Sugar Wastewater (ISW) to EOS-PRO), and ISW as substrate (Initital estimated perchlorate = 642 mg/L)

Figure 5.12: Perchlorate concentration in QAL (a), and UMCf (b) microcosms.

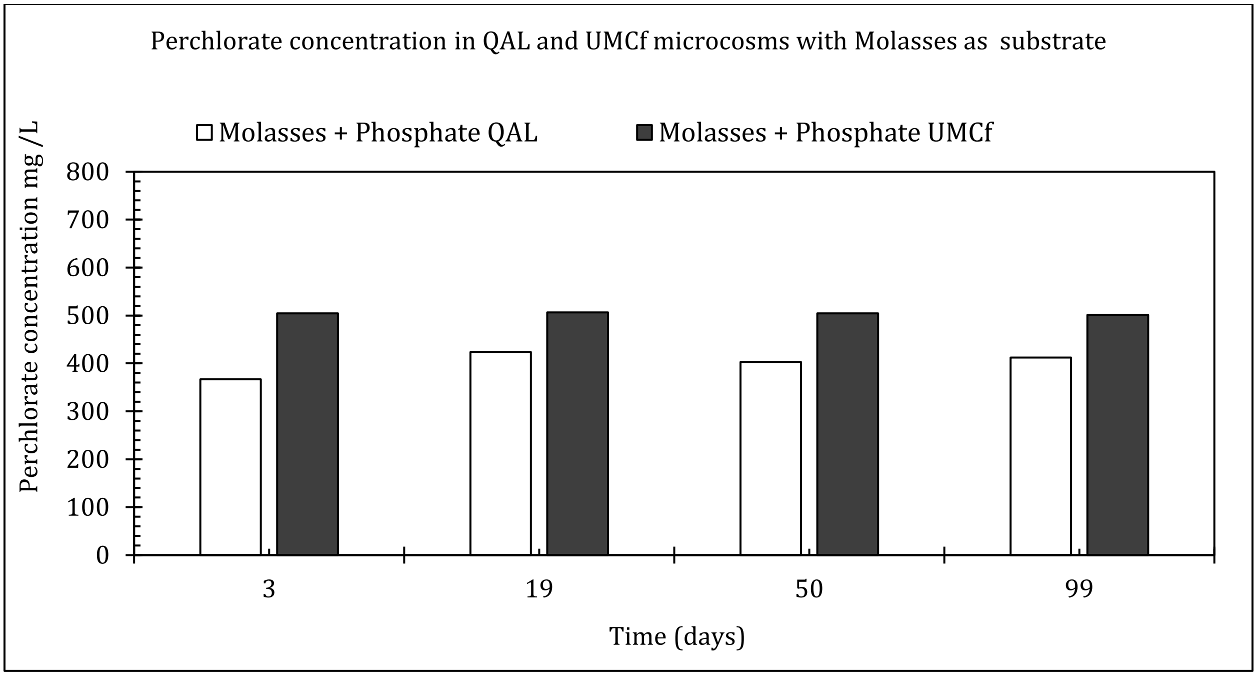
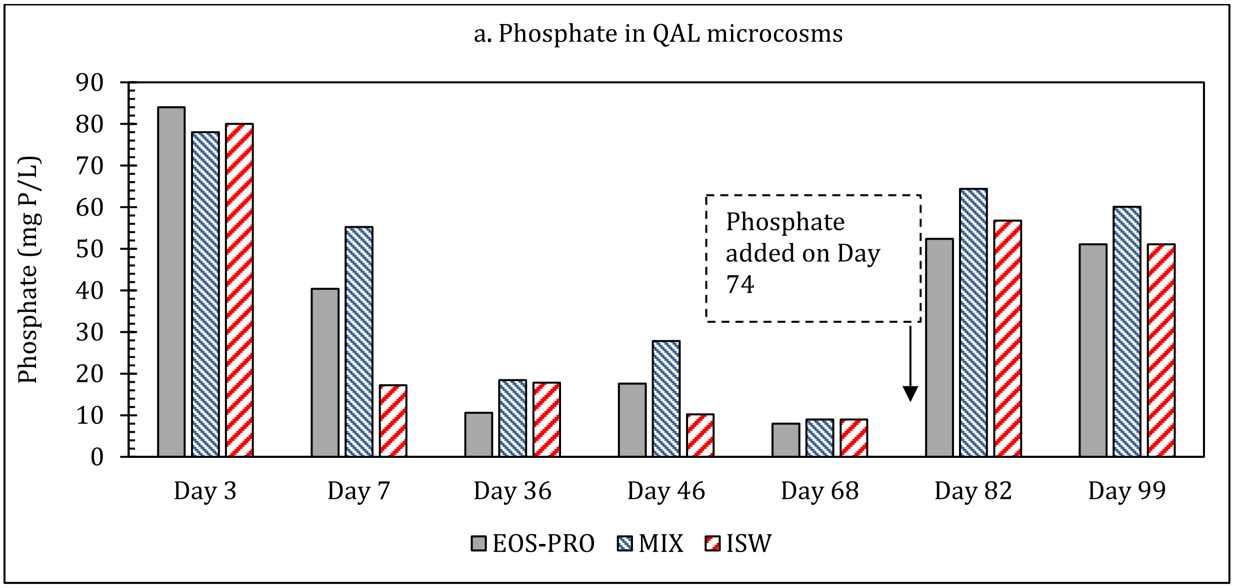


Figure 5.13: Perchlorate concentration in Molasses in QAL and UMCf microcosms.

Phosphate Concentration

Figure 5.14(a) and Figure 5.14 (b) show the phosphate concentrations measured in QAL and UMCf microcosms, respectively. It is important to note that the Industrial Sugar Wastewater itself contains 51.2 mg P/L, while EOS-PRO oil has 72 mg P/L. Therefore, additional phosphate was added to the microcosms that used Industrial Sugar Wastewater or a mixture of oil and Industrial Sugar Wastewater. Phosphate concentrations decreased gradually and on Day 68, the phosphate value was below 10 mg P/L in all three (EOS, ISW, and Mix) QAL microcosms and below 50 mg P/L for UMCf, EOS fed microcosms. The decrease in phosphate concentration matches the biological reduction observed in the microcosms. Notice that the phosphate on Day 3 was higher than the anticipated value. This finding is similar to the trend seen for the COD value. It is believed that the juice pulp from the Industrial Sugar Wastewater dissolves as microcosms are mixed and the dissolution contributes additional COD and phosphate beyond that originally calculated for the liquid alone.

To ensure the phosphate concentration was not limiting biodegradation, additional phosphate was injected into the microcosms on Day 74 to achieve phosphate concentrations of 70 mg P/L in QAL and UMCf microcosms. QA/QC evaluation detected that excess phosphate had been added to the UMCf EOS-PRO bottle and the phosphate in these bottles was higher than intended. Nonetheless, the microcosms were not limited by phosphate. By Day 99, phosphate concentrations were more than 50 mg P/L and 140 mg P/L in QAL and UMCf microcosms, respectively.



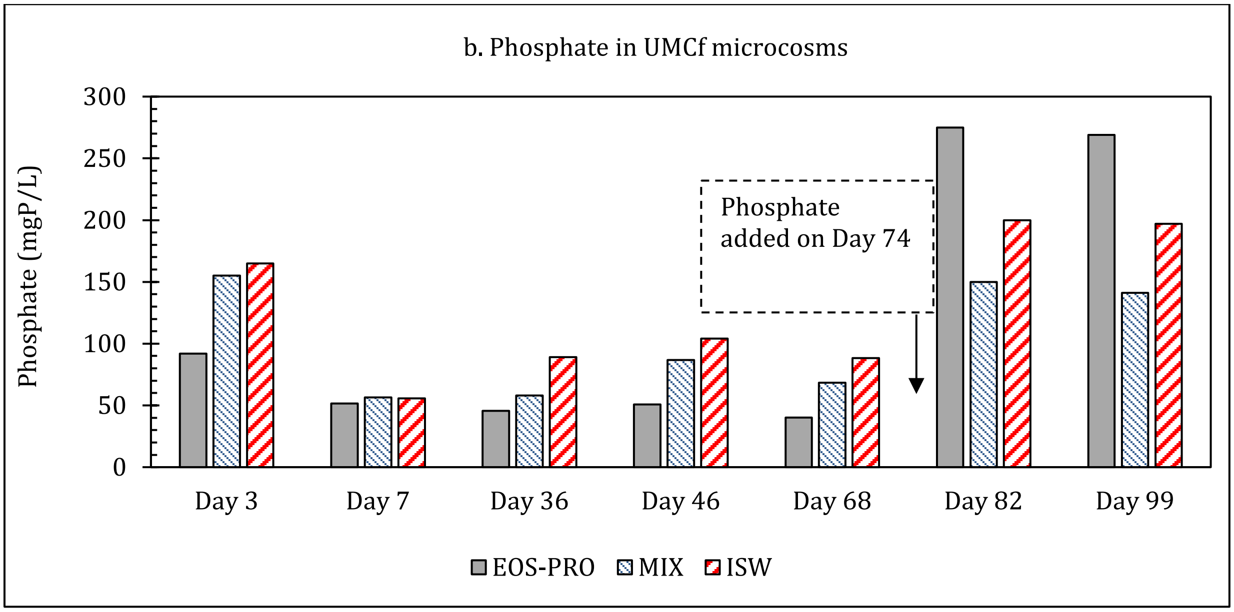
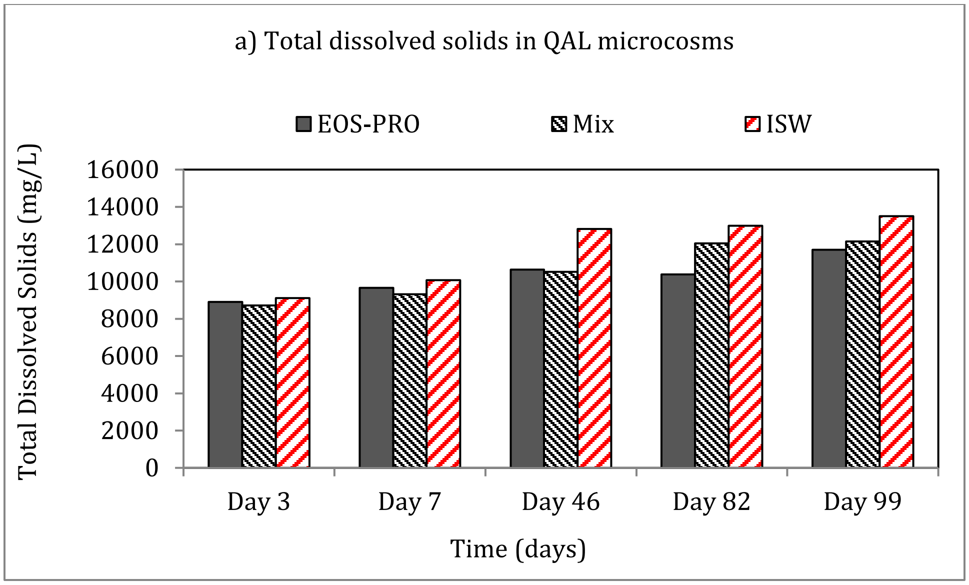


Figure 5.14: Phosphate concentration in the QAL (a) and UMCf (b) microcosms.

Total Dissolved Solids (TDS) Levels

Figure 5.15 (a) depicts the total dissolved solids (TDS) in the QAL microcosms. On Day 3, the TDS was about 8000 mg/L and gradually increased. The microcosms were a closed system and the source of increased TDS is interpreted as being the result of continuous dissolution of TDS contained in the soil as well as the dissolution the Industrial Sugar Wastewater pulp. The TDS in the Industrial Sugar Wastewater microcosm was higher because of substrate's high TDS content, including much sugar. On Day 99, the TDS in the QAL microcosms was more than 11,700 mg/L which was 30 to 48% more TDS than that of Day 3. The highest amount of TDS was 13,500 mg/L in Industrial Sugar Wastewater microcosms.

Figure 5.15 (b) shows the TDS in the UMCf microcosms. On Day 3, the TDS was about 9,000 mg/L and gradually increased. On Day 99, TDS in the UMCf microcosms was more than 12,200 mg/L which was 21-33% more TDS compared to Day 3. The highest amount of TDS was 12,290 mg/L in Industrial Sugar Wastewater microcosms. It is well known that TDS levels as low as 0.5% (5,000 mg/L) can reduce perchlorate degradation rates by half their unaffected value (Gingras and Batista 2002). The TDS of the AP area groundwater is > 8,000 mg/L (> 0.8%) and is likely the main reason for the slow perchlorate degradation. However, nitrate and chlorate were degraded in the microcosms, albeit slower than desired.


a) Total dissolved solids in QAL microcosms

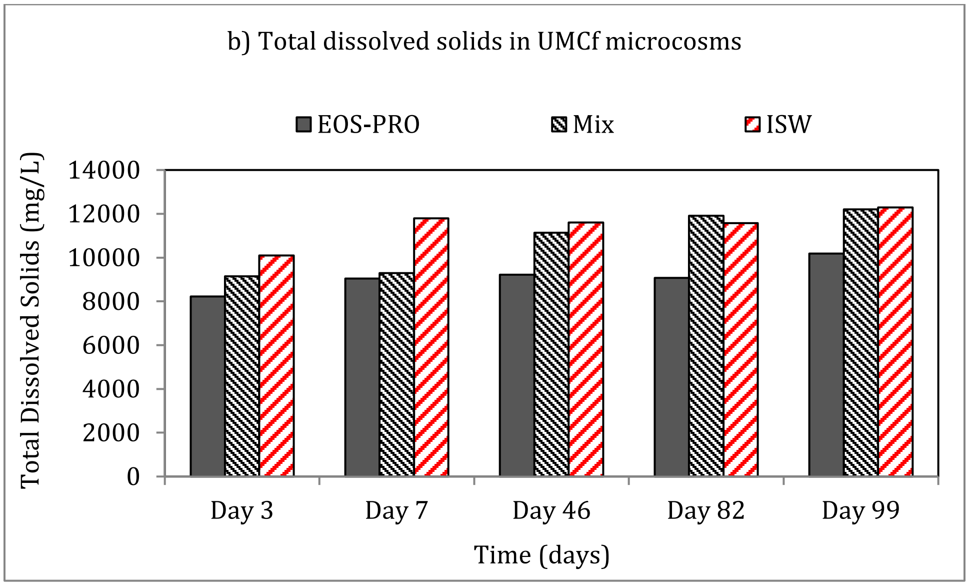
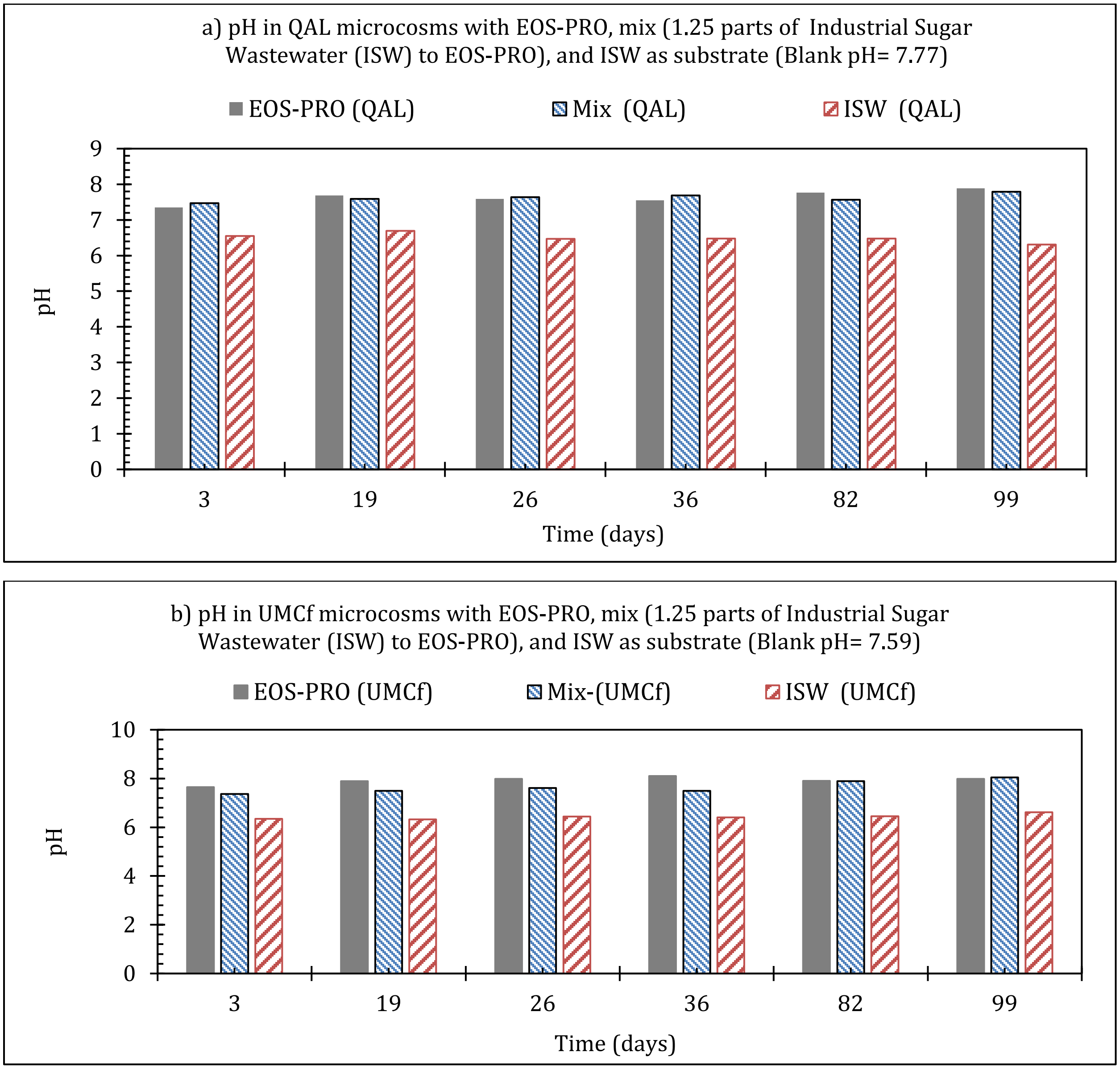

b) Total dissolved solids in UMCf microcosms

Figure 5.15: Total dissolved solids in QAL (a) and UMCf (b) microcosms.

PH Levels

The pH levels of the microcosms are shown in Figures 5.16 (a) and 5.16 (b). The pH of the Industrial Sugar Wastewater was 5.4. However, when mixed with the groundwater of NERT—which has an excellent buffering capacity—the pH was about 6.5. For the other microcosms fed with EOS-PRO, the pH was one order of magnitude higher at around 7.5. The pH levels of both microcosms are conducive to biological reduction and pH is not expected to have had a major impact on slower degradation kinetics.


a) pH in QAL microcosms with EOS-PRO, mix (1.25 parts of Industrial Sugar Wastewater (ISW) to EOS-PRO), and ISW as substrate (Blank pH= 7.77)

b) pH in UMCf microcosms with EOS-PRO, mix (1.25 parts of Industrial Sugar Wastewater (ISW) to EOS-PRO), and ISW as substrate (Blank pH= 7.59)

Figure 5.16: pH in QAL (a) and UMCf (b) microcosms.

Microbial Classification

The bacterial counts and microbial diversity found in the Phase I batch microcosm investigation are depicted in Table 5.1. Since the primary objective of the research was chromium reduction, chromium reducing bacteria were targeted in addition to overall bacteria diversity (Table 5.2). Microbial diversity and total bacterial number were examined in the beginning of the test (Day 4) and toward the end (Day 64). For the QAL soil microcosms fed with a mixture of EOS-PRO and Industrial Sugar Wastewater (ISW), the bacteria count per gram of soil was 4.57E+08 on Day 4 and 3.87E+08 on Day 64; for UMCf it was 2.99E+08 and 1.07E+08 on Days 4 and 64, respectively. Therefore, in the beginning of the test, the number of bacteria in QAL microcosm was 1.5 times that observed in UMCf. The lower number found in the UMCf was expected since deeper soils typically contain smaller number of bacteria compared to shallow ones. By Day 64, QAL microcosm had 3.6 times more bacteria than UMCf.

The QAL microcosms fed wtith EOS-PRO alone had a bacterial count of 8.02 E+7 per gram of soil on Day 64. Microcosms fed EOS-PRO alone had 3.7 times less bacteria than the mixture of EOS-PRO and Industrial Sugar Wastewater on Day 64. Therefore, the addition of the highly biodegradable Industrial Sugar Wastewater promotes the growth of a larger number of bacteria. One must keep in mind that these are total number of bacteria and not all of them may be involved in the degradation of the contaminants in question. When looking at specific bacteria, chromium reducing bacterial count was 1.7 E+08 on Day 64. This is about 27.6% of the total number of bacteria found for Day 64 (3.87 E+08).

The diversity of the bacteria community in the microcosms is shown in Figure 5.17. The complete diversity of bacteria is shown in Appendix G. For Day 4, over 70% of the bacteria were identified in QAL and UMCf as *Pseudomonas* and about 20% were *Acinetobacter*—well known denitrifying bacteria (Carlson and Ingraham, 1983; Lee et al., 2017). With time, at Day 64 the number of *Acinetobacter* decreased significantly and *Clostridium* and *Comamonas* become more prevalent. *Clostridium* has been reported as a chromium-resistant bacterium and is also involved in fermentation processes (Nguema and Luo, 2012; Formanek et al., 1997).

Table 5.1: Microbial Numbers and Diversity for the Phase I Microcosms Using Universal Primer

	QAL (EOS-PRO and Industrial Sugar Wastewater)				UMCf (EOS-PRO and Industrial Sugar Wastewater)			
	Day 4		Day 64		Day 4		Day 64	
Organism/ g soil	**4.57E+08**		**3.87E+08**		**2.99E+08**		**1.07E+08**	
	Pseudomonas sp	69.69%	Pseudomonas sp	64.92 %	Pseudomonas sp	80.21 %	Pseudomonas sp	67.71%
	Acinetobacter sp	19.82 %	Clostridium sp	6.36 %	Acinetobacter sp	19.08 %	Comamonas sp	8.85%
Classification of bacterial species	Arthrobacter sp	3.22 %	Sedimentibacter sp	6.09 %	Arthrobacter sp	0.17 %	Clostridium beijerinckii	8.23%

Table 5.2: Microbial Numbers and Diversity for the Phase I QAL Microcosms using Primer Specific for Chromium Reducing Bacteria

	QAL (EOS-PRO and Industrial Sugar Wastewater)		QAL (EOS-PRO alone)	
	Day 64 (Using primer for chromium reducer)		Day 64	
Organism/ g soil	**1.07E+08**		**8.02E+07**	
	Pseudomonas sp	89.97 %	Pseudomonas sp	79.62 %
	Acinetobacter psychrotolerans	5.45 %	Aeromonas sp	7.88 %
Classification of bacterial species	Pseudomonas salinarum	1.41 %	Acinetobacter sp	5.34 %

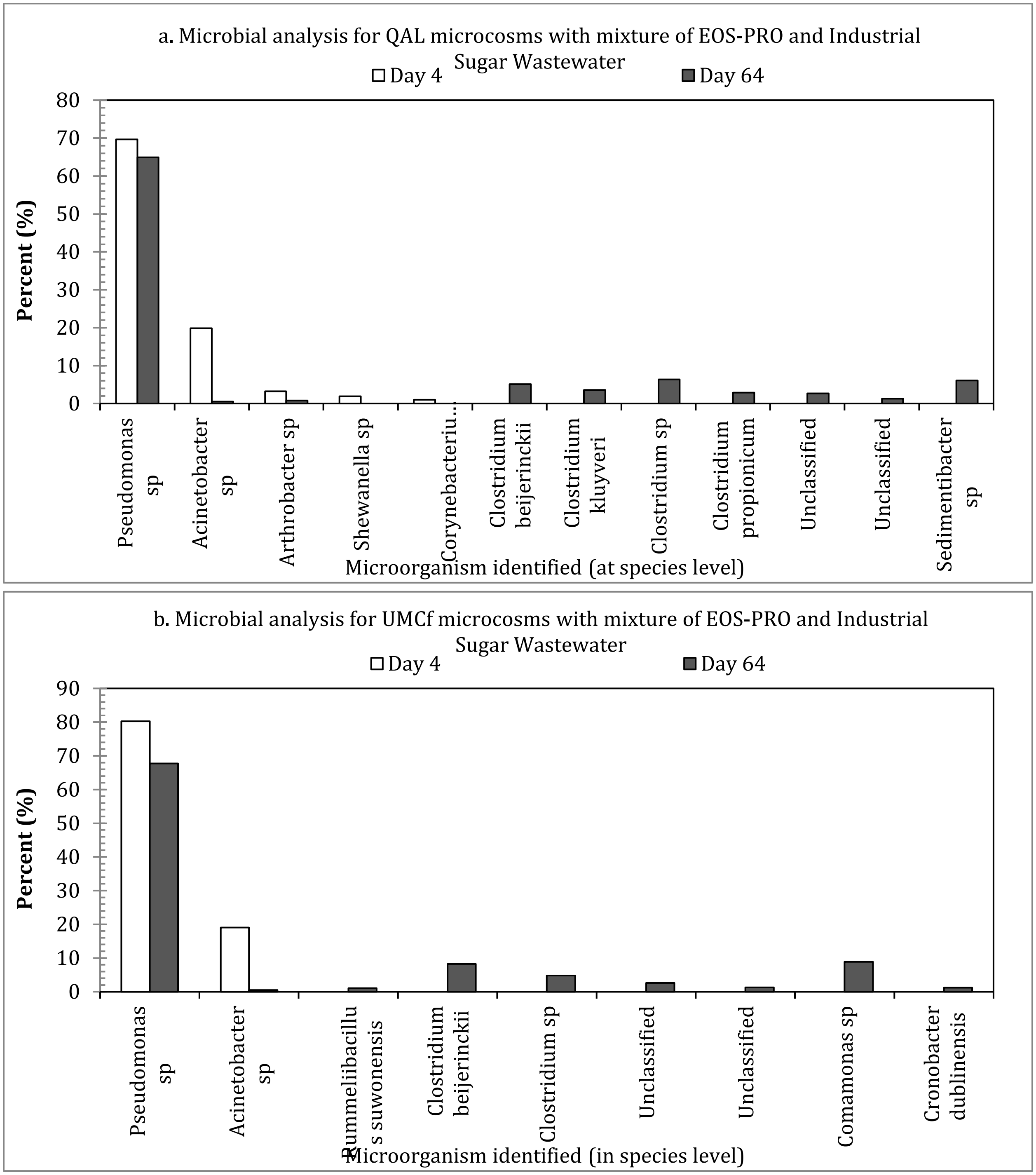


Figure 5.17: Microbial diversity for MIX microcosms for QAL (a) and UMCf (b) microcosms.

Figures 5.18 and 5.19 show the percentages of major chromium reducing bacteria in microcosms fed with a mixture of EOS-PRO and ISW and EOS-Pro alone on Day 64. The vast majority of the bacteria were identified as *Pseudomonas sp.* —at about 90% for QAL fed the Mix and about 80% for QAL fed EOS-PRO alone. *Pseudomonas* have been identified often as chromium reducing bacteria (Megharaj et al., 2003; Dogan et al., 2011). Note also the presence of a halotolerant bacterim, *Pseudomonas salinarum*. Although present at only about 1.5% of total, the presence of bacteria that can grow in high levels of salt (i.e. TDS) is encouraging, given that high salt levels are known to negatively impact the growth of non-salt tolerant bacteria.

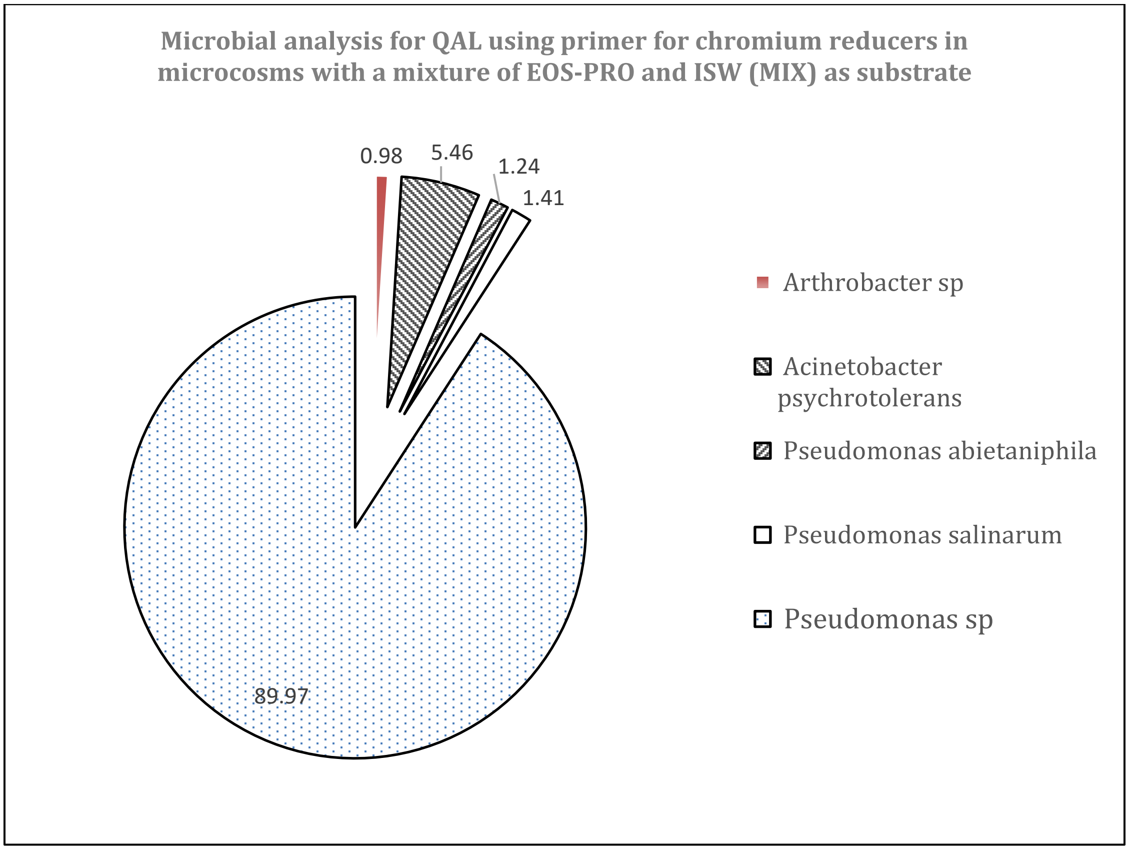


Figure 5.18: Microbial diversity for MIX microcosms in QAL using known primer for chromium reducing bacteria.

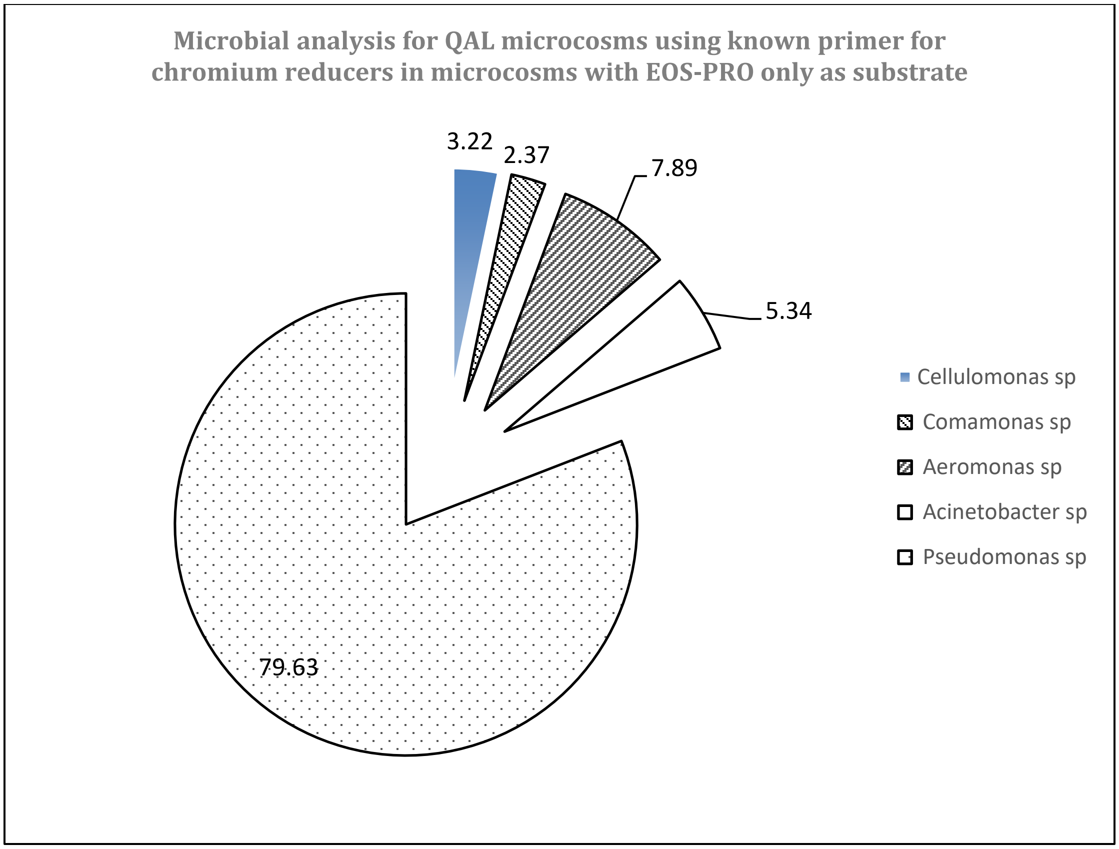


Figure 5.19: Microbial diversity for EOS-PRO microcosms for QAL.

5.1.2 Phase II Microcosms with a Mixture of EOS-PRO and Industrial Sugar Wastewater as Substrate (3 parts of EOS-PRO and 12 parts of Industrial Sugar Wastewater) and with Di-ammonium Phosphate

The set of microcosms shown in this section were prepared using a mixture of Industrial Sugar Wastewater and EOS-PRO. In addition, di-ammonium phosphate was added to supply nitrogen after all nitrate had been biodegraded. The experimental matrix used in these microcosm tests is depicted in Appendix E (Table E.6) and the experimental methodology is introduced in section 2.6.2.

Cr (VI) Degradation

Figure 5.20 shows the Cr (VI) reduction in QAL and UMCf microcosms. In QAL microcosms, the Cr (VI) was less than 1000 μg/L by Day 4, while the Cr (VI) was still about

6000 μg/L in UMCf microcosms. By Day 11, Cr (VI) in QAL was about 80 μg/L and in UMCf was about 1000 μg/L. The Cr (VI) was below detection limit in both the microcosms sampled on Day 18. In the preliminary microcosms, Cr (VI) was below detection the limit (< 10 μg/L) only on Day 36 in Mix microcosms and on Day 11 in Industrial Sugar Wastewater microcosms. This highly biodegradable Industrial Sugar Wastewater is easily used up by bacteria and promotes fast reduction. In this experiment, the amount of Industrial Sugar Wastewater added to each microcosm bottle was 12% by volume; in the preliminary microcosms it was 5% by volume in Mix and 6% by volume in Industrial Sugar Wastewater only bottles.

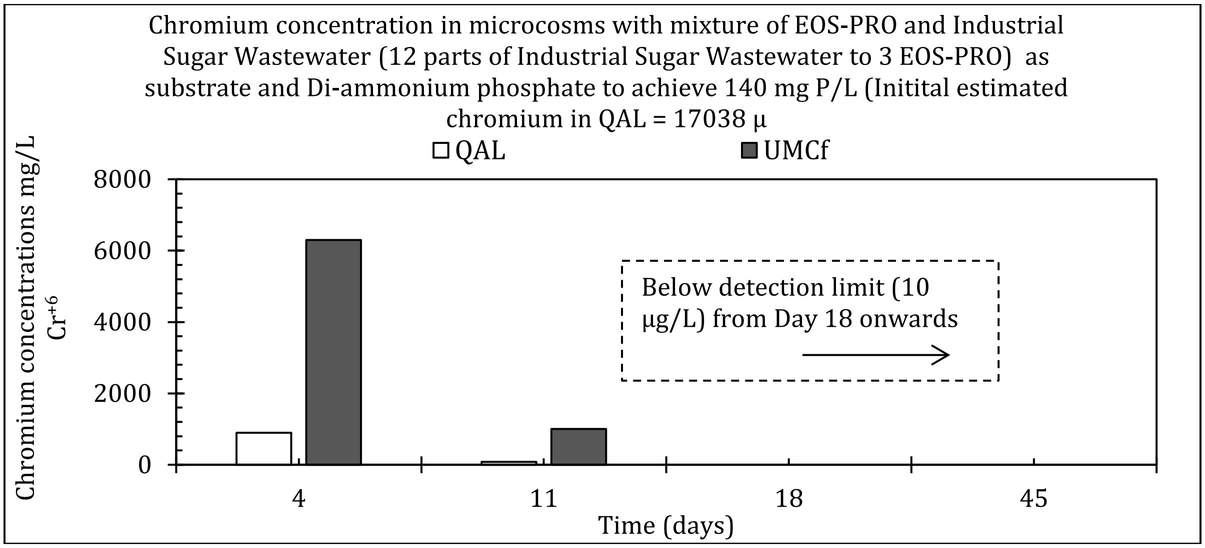


Figure 5.20: Cr (VI) concentrations in QAL and UMCf microcosms with a mixture of EOS-PRO and Industrial Sugar Wastewater as substrate.

Microcosm COD Levels

The targeted COD in the microcosms was 12000 mg/L. The Day 4 COD was about 14000 mg/L in QAL and 13000 mg/L in UMCf microcosms. The cause of the increase between Days 1 and 4 was suspected to be caused by the COD in the Industrial Sugar Wastewater that is released as the biodegradable solids dissolve. The COD decreased gradually and COD was about 54% of the starting concentration in QAL microcosm and

50% in UMCf microcosms on Day 146. There was still significant COD remaining and therefore the microcosms were not limited by the availability of substrate.

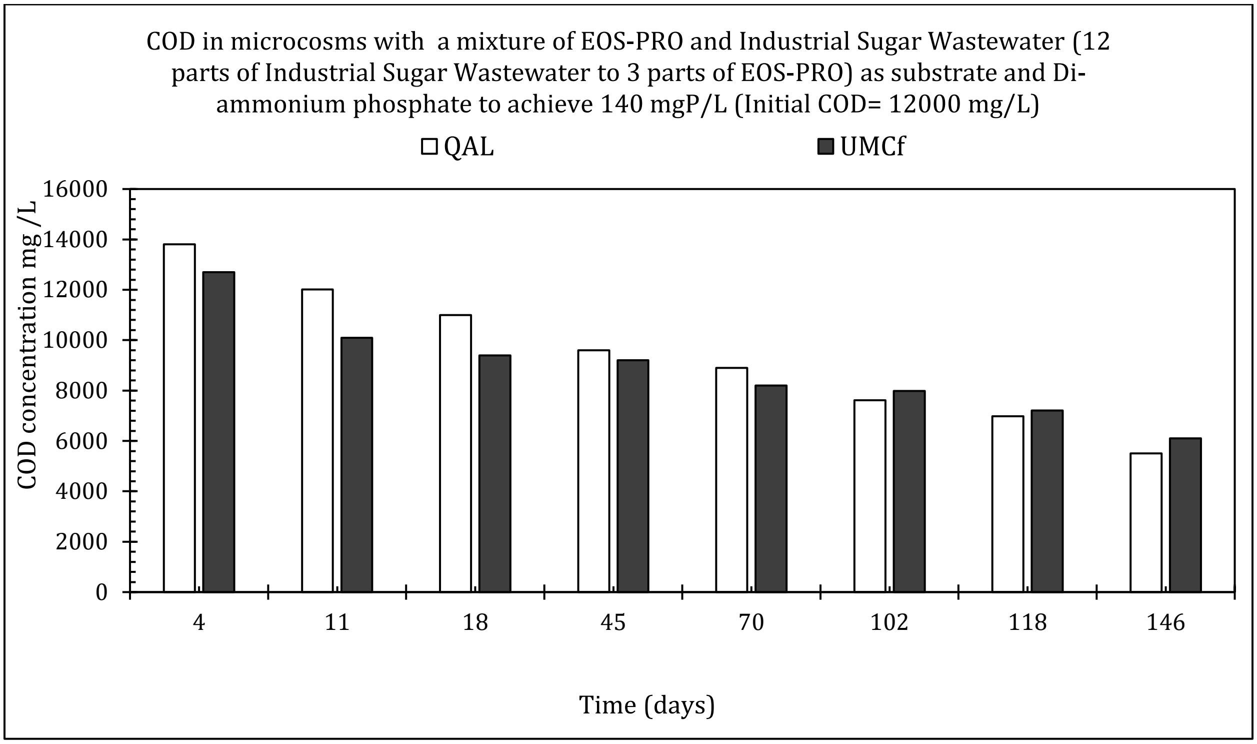


Figure 5.21: COD in QAL and UMCf microcosms with a mixture of EOS-PRO and Industrial Sugar Wastewater as substrate.

Nitrate Reduction

Figure 5.22 shows the nitrate degradations in QAL and UMCf microcosms. In QAL microcosms, the nitrate was less than 60 mg/L as NO_3 and about 300 mg/L as NO_3 in UMCf microcosms by Day 45. By Day 70, nitrate was about 10 mg/L as NO_3 in QAL and remained about 300 mg/L as NO_3 in UMCf. The non-degradation of nitrate in the UMCf was unexpected, since degradation occurred in the preliminary microcosms. The non-degradation of nitrate (Figure 5.22), chlorate (Figure 5.23), and perchlorate (Figure 5.24) may have been caused by: (a) the presence of more Industrial Sugar Wastewater than in the preliminary microcosms, or (b) a very low level of bacteria in the soil. Supporting the first theory, in the preliminary microcosms it was also found that nitrate degradation was much slower for microcosms containing only Industrial Sugar Wastewater as compared to those containing only EOS-PRO or a Mix of EOS-PRO and Industrial Sugar Wastewater. Supporting the second theory, although soil samples were refrigerated, the clayey nature of the UMCf caused the soil harden and pelletize in the refrigerator. The microcosm test described here was performed several weeks after the first, preliminary one. Microbial counts can be found at the end of this section, just before section 5.1.3.

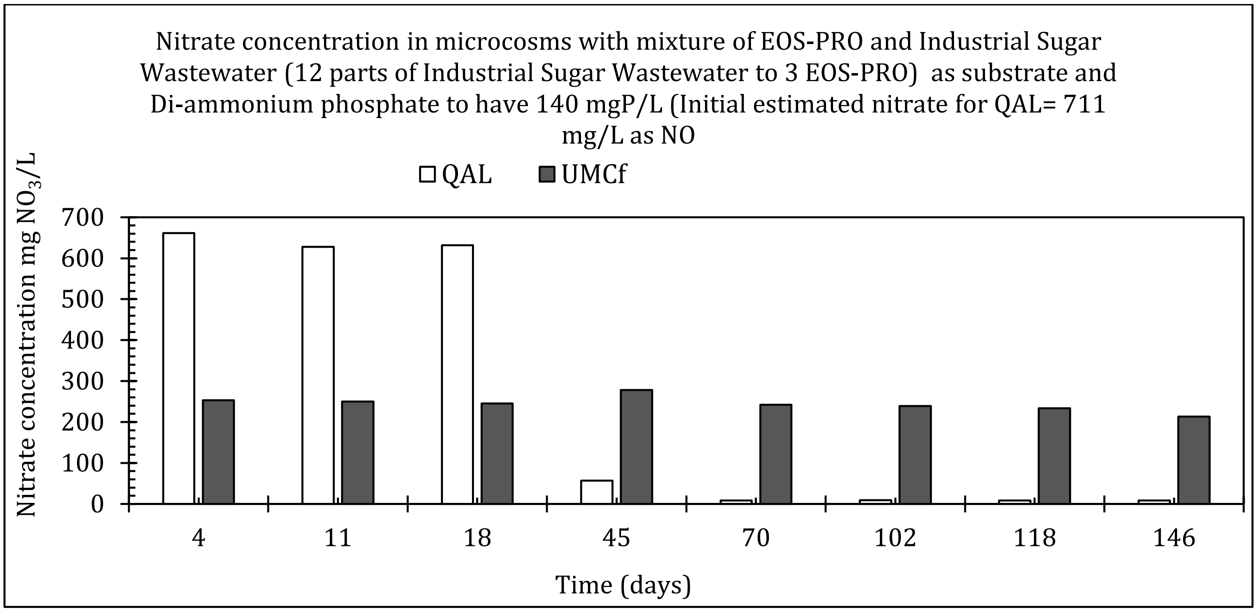


Figure 5.22: Nitrate concentration in QAL and UMCf microcosms with a mixture of EOS-PRO and Industrial Sugar Wastewater as substrate.

Chlorate Reduction

Figure 5.23 shows the chlorate degradation in QAL and UMCf microcosms. In QAL microcosms, the chlorate did not degrade by Day 18, but was below detection limit on Day 45. In the preliminary microcosms with more oil and less Industrial Sugar Wastewater, chlorate degraded in QAL in the presence of EOS-PRO and the Mix, but did not degrade in the presence of Industrial Sugar Wastewater alone. The same was observed for UMCf in the preliminary microcosms, but chlorate degradation was much slower. In Phase II, performed with higher Industrial Sugar Wastewater added, no chlorate degradation was observed in the UMCf.

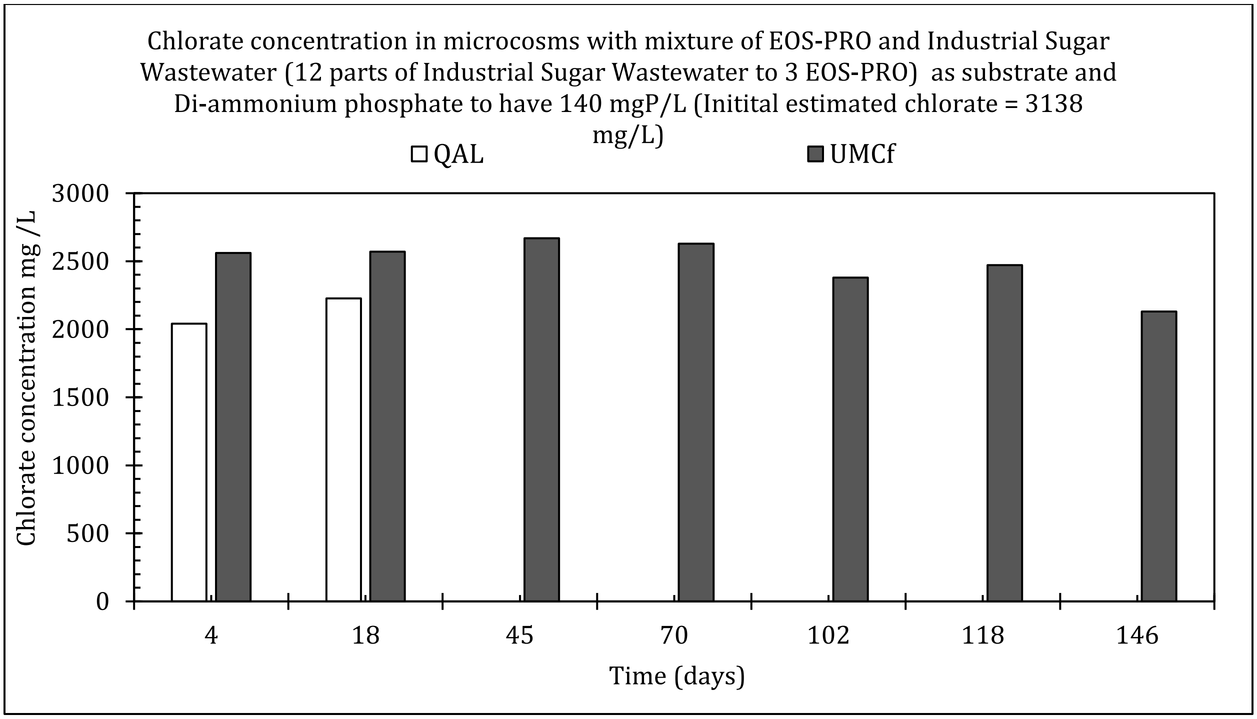


Figure 5.23: Chlorate concentration in QAL and UMCf microcosms with a mixture of EOS-PRO and Industrial Sugar Wastewater as substrate.

Perchlorate Reduction

After 146 days of residence time, perchlorate degradation was not observed in either QAL or UMCf. In the preliminary microcosms, only minor degradation was observed after 99 days incubation. Interestingly, the UMCf microcosms presented evidence of a very reducing environment (e.g. very strong odor indicative of sulfate reduction) compared to QAL microcosms. The caps of some of the bottles puffed up (i.e. indicative of presence of methane), indicating the presence of gas. One can envision fermentation of the Industrial Sugar Wastewater, but cannot explain why that did not happen in the QAL bottles.

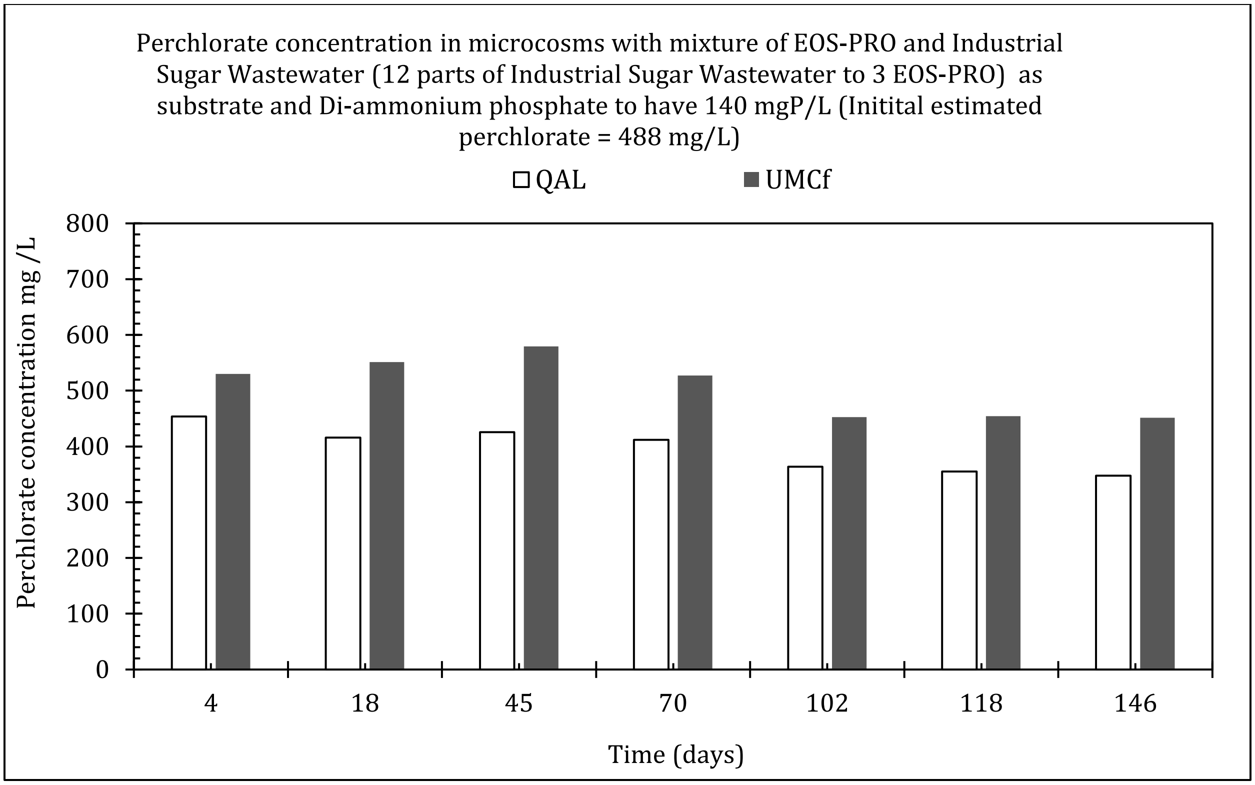


Figure 5.24: Perchlorate concentration in QAL and UMCf microcosms with a mixture of EOS-PRO and Industrial Sugar Wastewater as substrate.

PH Levels

The pH levels in the microcosms were about one unit pH lower than that of the preliminary micirocosms, due to the higher amount of Industrial Sugar Wastewater added (Figure 5.25). Nonetheless, both QAL and UMCf exhibited pH values that are conducive to biological reduction of the contaminants of concern.

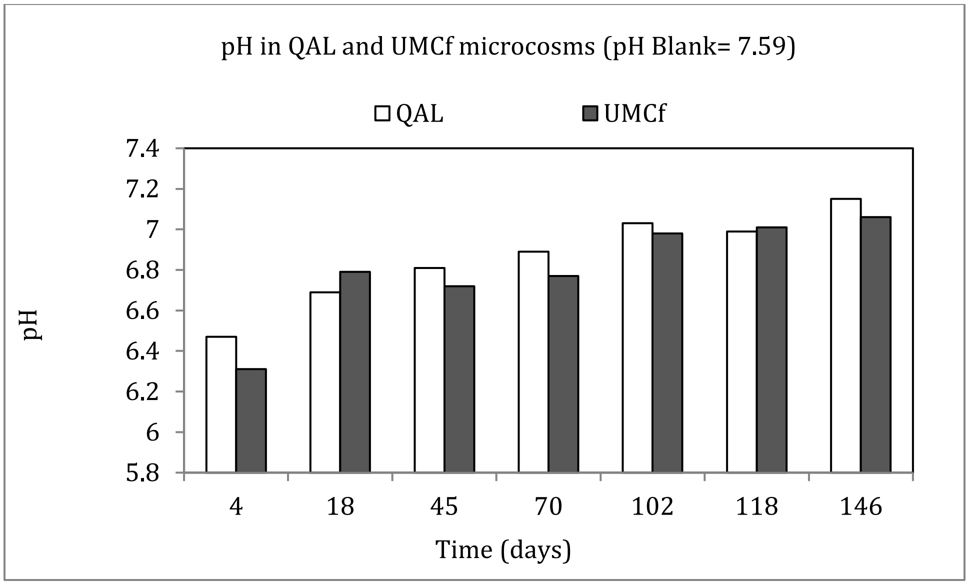


Figure 5.25: pH in the microcosms

Total Dissolved Solids (TDS) Levels

The TDS in the microcosms on Day 4 was 12000 mg/L in QAL and 10000 mg/L in UMCf (Figure 5.26). TDS was observed to increase gradually with time. Again, it is likely the high TDS might have played a role in the slower degradation observed, similar to that seen in the preliminary microcosms.

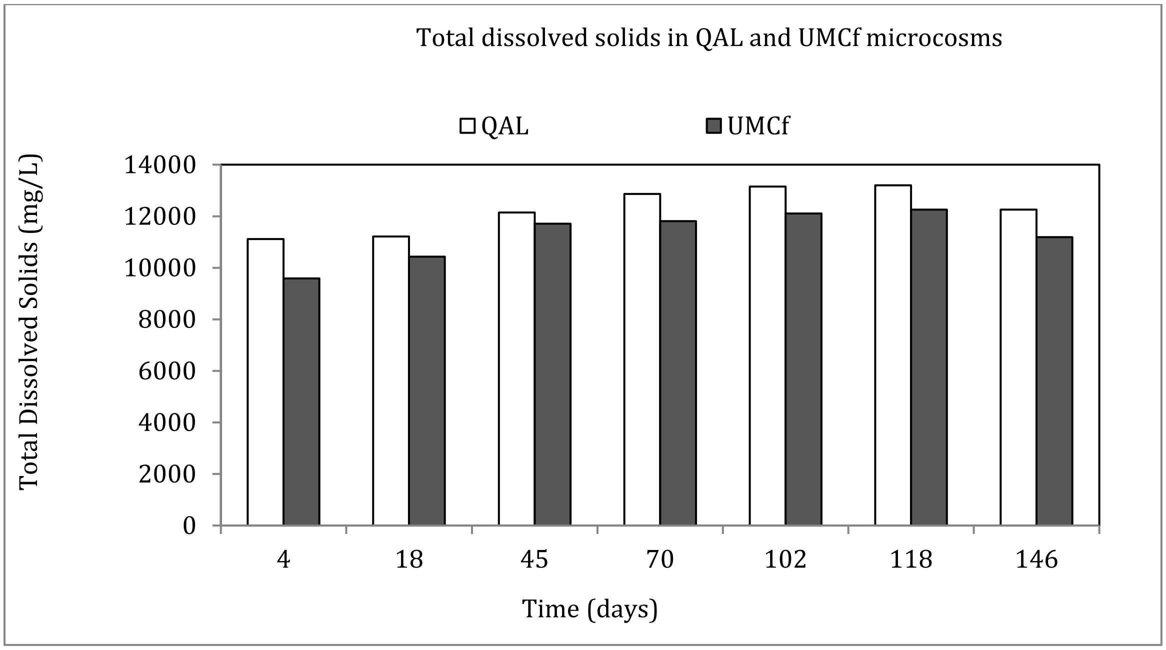


Figure 5.26: TDS in QAL and UMCf microcosms with a mixture of EOS-PRO and Industrial Sugar Wastewater as substrate.

Microbial Classification

The total number of bacteria present in the original soils, before adding substrate to the microcosms, was determined to be 2.07E+06 and 1.35E+04, for QAL and UMCf, respectively (Tables 5.3 and 5.4). Therefore, the QAL soil contained 153 times more bacteria than UMCf. As expected, the addition of a carbon substrate resulted in significant increase in the number of bacteria present. By Day 18, the number of bacteria increased approximately 230 times and 1,890 times for QAL and UMCf, respectively. However, with time the amount of bacteria present decreased; on Day 102, bacteria numbers in both UMCf and QAL had decreased by about 50%,

The diversity of bacteria in Phase II microcosms is depicted in Figure 5.27. The predominance of bacteria changed significantly between the original soil and the microcosms. While both QAL and UMCf soils where rich in *Pseudomonas* and UMCf also contained some *Phenylobacterium*, the microcosms on Day 18 contained completely different species. Notice that this finding is different from that of Phase 1 microcosms (Table 5.1), where *Pseudomonas* and *Acinetobacter* persisted during the testing period. A major difference between Phase I and Phase II microcosms was the freshness of the soil. Phase 1 microcosms were performed within two weeks of soil collection while Phase II, after six months of collection. Although the soils were kept refrigerated, the age of the samples may have played a role in the loss of *Pseudomonas* and *Acinetobacter*.

The majority of the bacteria in the QAL and UMCf microcosms was *Clostridium beijerinskii*, *Corybacterium*, or *Sporolactobacillus nakayamae*. However, on Day 102 the dominant species was identified as *Rummeliibacillus suwonensis*. There are several reports of nitrate, chromium, and other contaminant reduction by *Clostridium* and *Pseudomonas* (Inglett et al., 2011; Carlson and Ingraham, 1983; Dogan et al., 2011; Megharaj et al., 2003; Nguema and Luo, 2012). *Corynebacterium* has been identified as a chromium tolerant species (Viti et al., 2001). *Rummeliibacillus suwonensis* is a rare bacterium. Its role in biodegradation is not established, but it has been identified in soils (Her and Kim, 2013). It is important to note that the vast majority of bacteria identified in the microcosms are spore forming—that is, they are bacteria that thrive under unfavorable conditions.

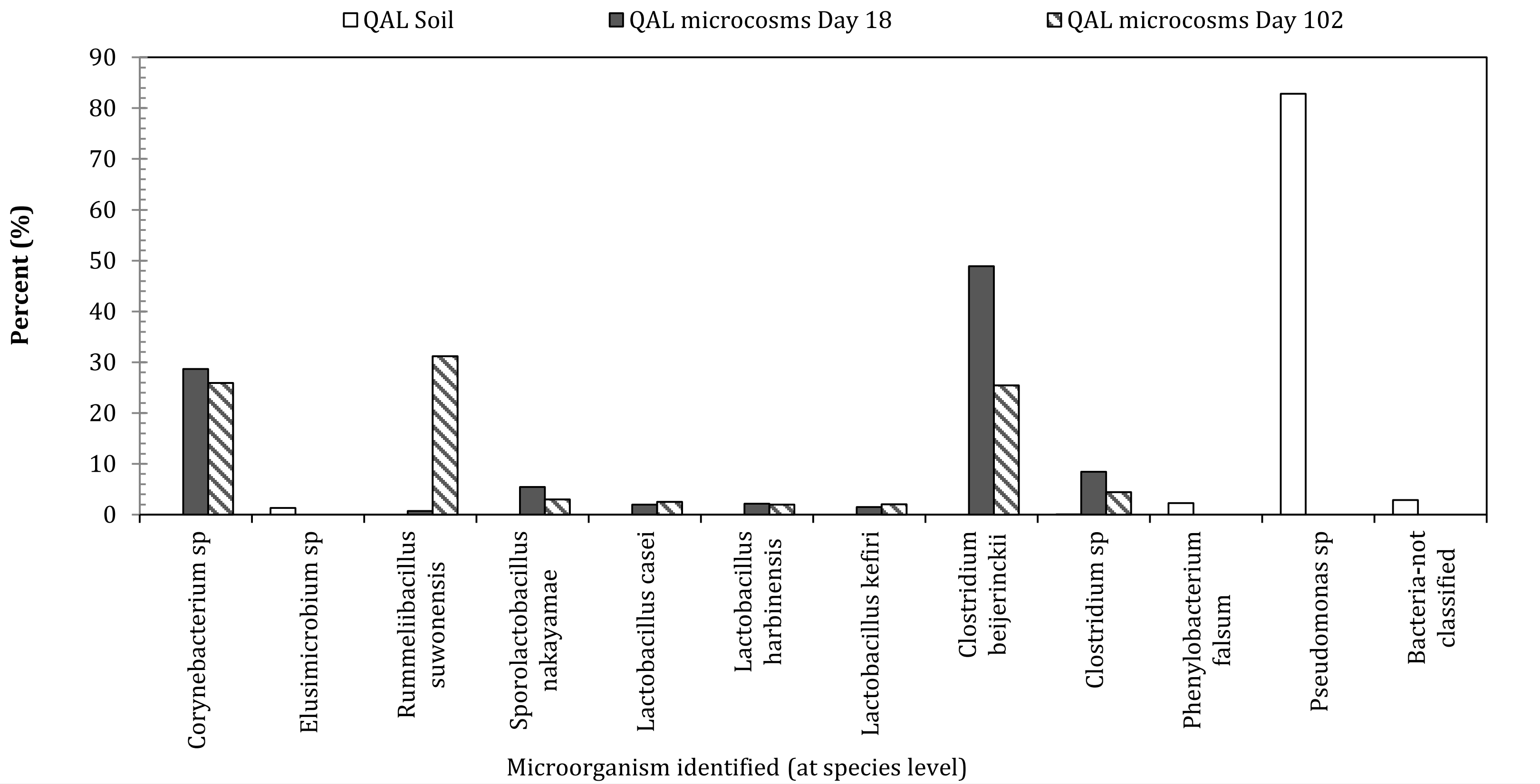
Table 5.3: Microbial Numbers and Diversity for the Phase II QAL Microcosms Using Universal Primer

			QAL microcosms			
	QAL Soil		Day 18		Day 102	
Organism/ g soil	**2.07E+06**		**4.82E+08**		**2.37E+08**	
Classification of bacterial species	Pseudomonas sp	82.84 %	Clostridium beijerinckii	48.92 %	Rummeliibacillus suwonensis	31.19 %
	Phenylobacterium falsum	2.27 %	Corynebacterium sp	28.69 %	Corynebacterium sp	25.95 %
	Elusimicrobium sp	1.30 %	Clostridium sp	8.47 %	Clostridium beijerinckii	25.44 %

Table 5.4: Microbial Numbers and Diversity for the Phase II QAL Microcosms using Primer Specific for Chromium Reducing Bacteria

			UMCf microcosms			
	UMCf Soil		Day 18		Day 102	
Organism/ g soil	**1.35E+04**		**2.55 E+07**		**1.31E+07**	
Classification of bacterial species	Pseudomonas sp	23.57 %	Corynebacterium sp	28.85 %	Rummeliibacillus suwonensis	42.24 %
	Phenylobacterium sp	19.27 %	Sporolactobacillus nakayamae	26.99 %	Clostridium beijerinckii	15.14 %
	Unclassified	18.00 %	Clostridium beijerinckii	24.39 %	Sporolactobacillus nakayamae	14.33 %

a. Microbial analysis for QAL microcosms with mixture of EOS-PRO and Industrial Sugar Wastewater (12 parts of Industrial Sugar Wastewater to 3 EOS-PRO) as Substrate and Di-ammonium Phosphate.



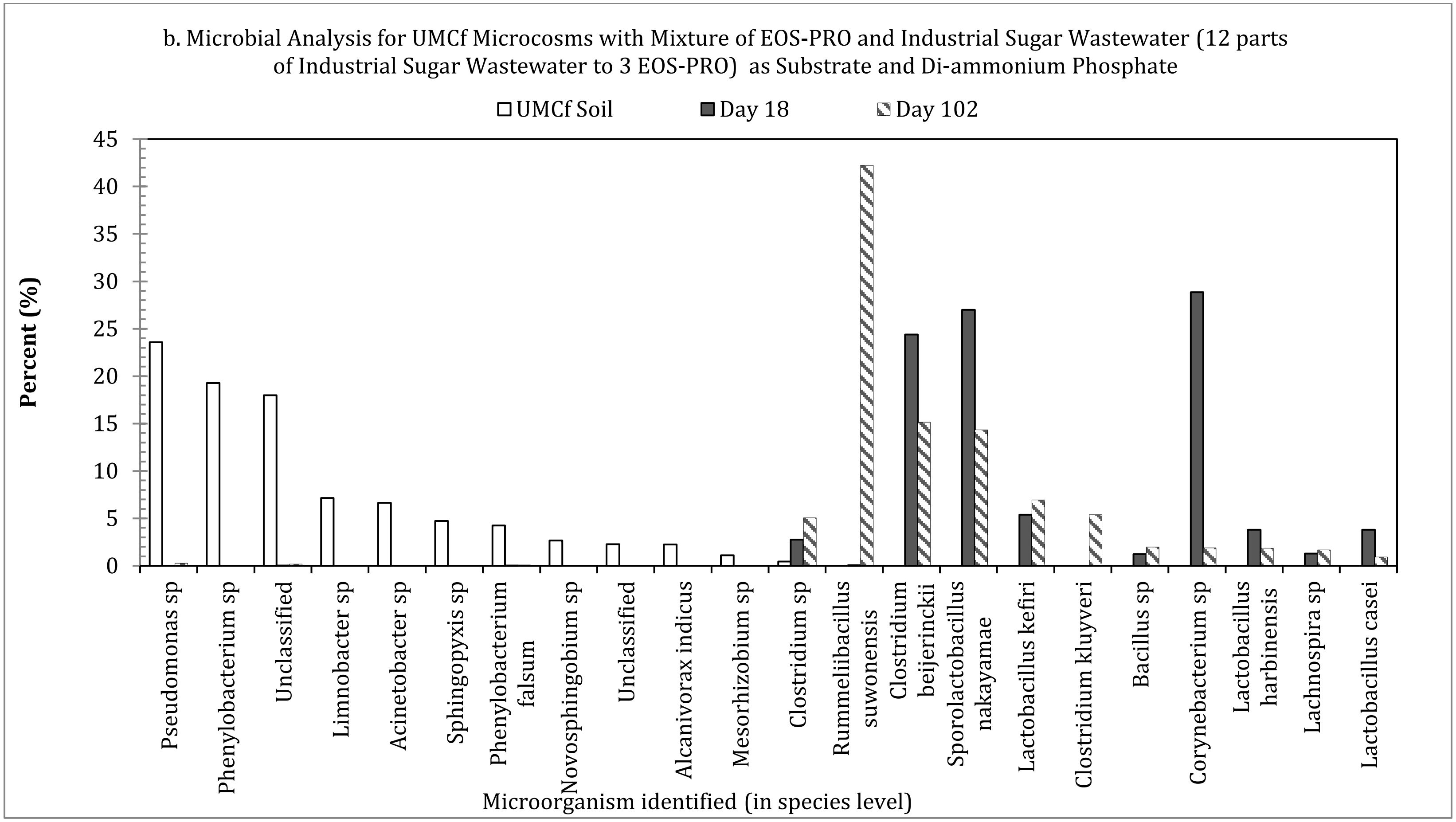


Figure 5.27: Microbial diversity for MIX microcosms for QAL (a) and UMCf (b) microcosms.

5.1.3 Microcosms with a Mixture of EOS-PRO and Sugar as Substrate to Substitute for Industrial Sugar Wastewater

This set of microcosms was an addition to the original plan with the goal of finding another suitable soluble substrate to mix with EOS-PRO. The reason is that the Industrial Sugar Wastewater may not be a reliable source of substrate in the future. Table E.7 in Appendix E depicts the experimental matrix used in these microcosm tests and the methodology is explained in section 2.6.3. Figure 5.28 shows the COD in the filtered samples from the microcosms for Day 4 and Day 10. The COD values are similar to those obtained with the mixture of Industrial Sugar Wastewater and EOS-PRO. The COD were almost the same on Day 4 as the initial concentrations, but were reduced by 33% in QAL and 16% in UMCf on Day 10 (Figure 5.28). No Cr (VI) degradation was observed on Day 4, but 50% of Cr was reduced by Day 10 (Figure 5.29) in both QAL and UMCf. This degredation rate is much slower compared to the other substrates presented in previous sections (5.1.1 and 5.1.2).

No nitrate, perchlorate, and chlorate degradation were observed, as shown in Table 5.5. Phosphate concentration was similar to the initial estimated phosphate on Day 10. The sugar and EOS-PRO microcosms were discontinued after 10 days because the Cr (VI) degradation was slower compared to Industrial Sugar Wastewater, Mix, EOS-PRO and Molasses microcosms. Therefore, sugar is not as effective a substrate as the Industrial Sugar Wastewater which contains—in addition to sugar—protein and carbohydrate.

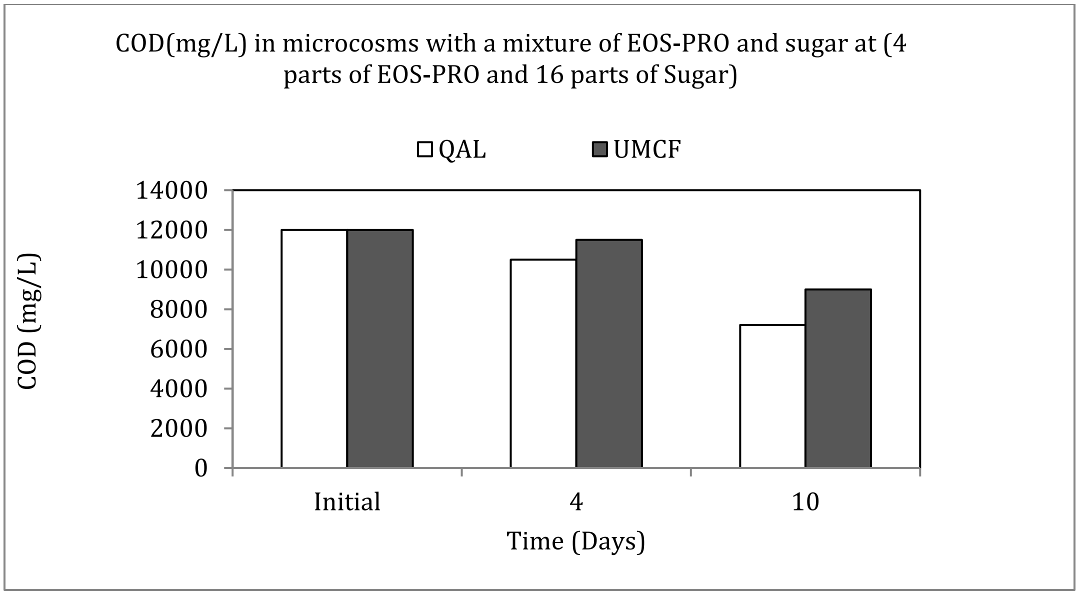


Figure 5.28: COD in QAL and UMCf microcosms with a mixture of EOS-PRO and sugar as substrate.

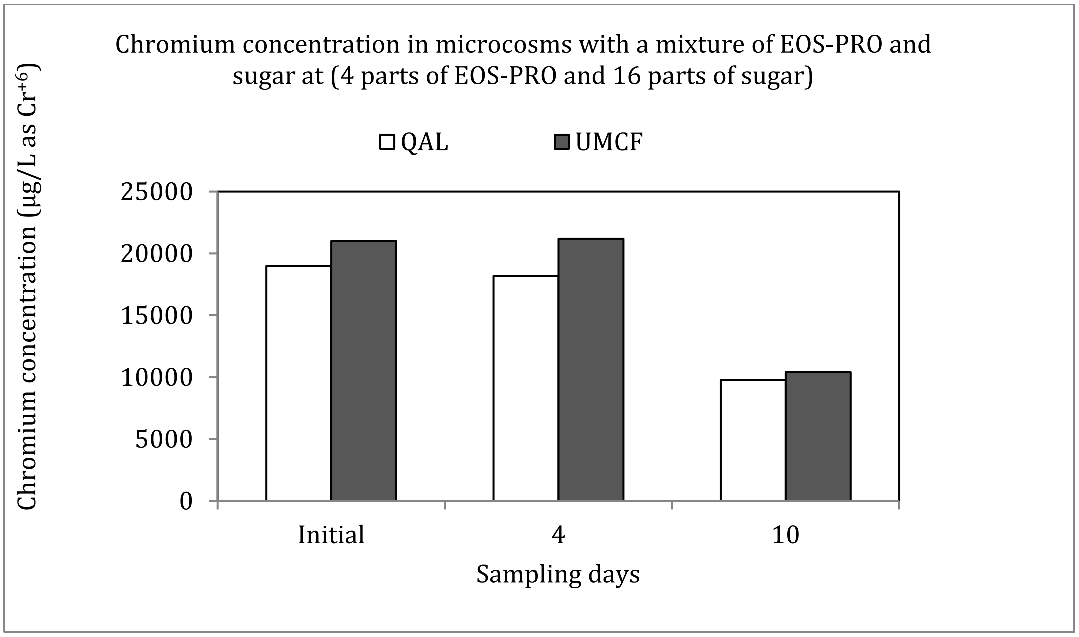


Figure 5.29: Cr (VI) in QAL and UMCf microcosms with a mixture of EOS-PRO and sugar as substrate.

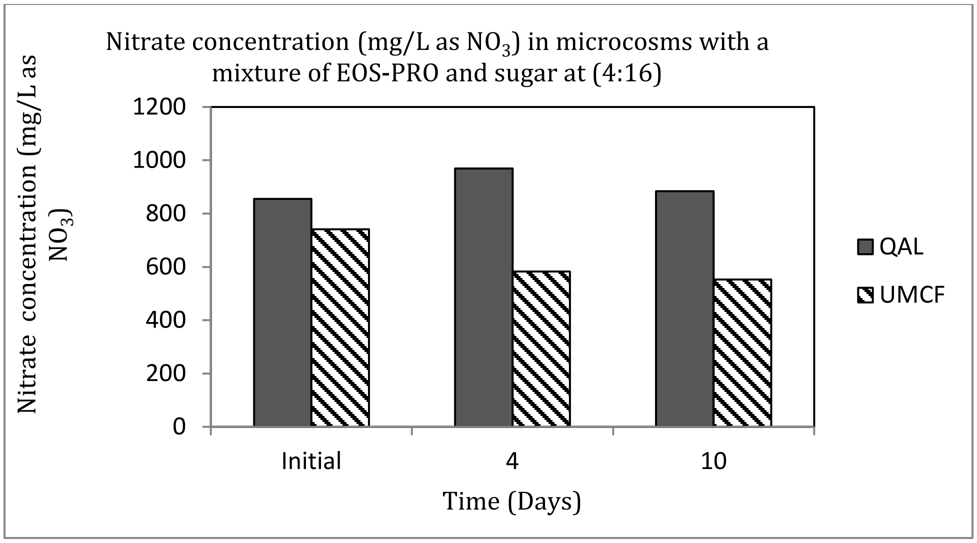


Figure 5.30: Nitrate in QAL and UMCf microcosms with a mixture of EOS-PRO and sugar as substrate.

Table 5.5: Concentrations of nitrate, perchlorate, chlorate and phosphate in the microcosms with EOS-PRO and sugar (4:16)

	Nitrate			Perchlorate		Chlorate		Phosphate	
Microcosm	Initial estimate	Day 4	Day 10	Initial estimate	Day 10	Initial estimate	Day 10	Initial estimate	Day 10
QAL	855	968.768	884.520	488	485.655	3138	2998.361	140	135
UMCF	740.9	582.940	552.614	642	551.3651	3136	3159.236	220	198

5.2 Column Biological Test

The biological reduction of chromium and co-contaminants was evaluated using four columns. Two of the columns were packed with soil from depths 25-30 ft (Quaternary Alluvial layer) termed QAL columns and two with soil from 35-40 ft (Muddy Creek Formation) termed UMCf columns. The operation details for the UMCf and QAL columns are shown in Table 2.7. The column feed solution composition was changed with time. Compositions included groundwater (GW) with EOS-PRO, a mixure of Industrial Sugar Wastewater and EOS-PRO, and GW alone. The full methodology for the column biological tests can be found in section 2.7.

The flow rates during the first four days of the run were 2.6 ± 1.2 mL/min and 1.5 ± 0.50 mL/min for columns QAL A and QAL B, respectively. From Day 5 onwards, the flowrates were **0.16 ± 0.17 mL/min on average in QAL A (ranging from 0.03 mL/min to 0.81 mL/min) and 0.14± 0.22 mL/min on average in QAL B (ranging from 0.01 mL/min to 1.51 mL/min)**. As mentioned earlier, this decrease in flowrate was caused by transport of the fine materials of QAL to the bottom of the column. **For the UMCf columns, the flowrates were steadier throughout the study period and ranged from 0.14 to 0.18 mL/min.** The flow rate and the contact time (CT) in the QAL and UMCf columns are shown in Table 5.6. **The contact times in the columns varied from 8.9-10.6 days for QAL and 5.2-7.2 days for UMCf**. Note that the UMCf column was run at 10 psi pressure while the QAL columns were run at 5 psi.

The data collected by Tetra Tech during the pilot field test show hydraulic conductivities in QAL (S wells) in the 10-3 to 10-4 cm/sec (2.5 -25 ft/day) range while the UMCf (D wells) had hydraulic conductivities one to two orders of magnitude lower, 10-5 and 10-6 cm/sec (0.25-0.02 ft/day). Therefore, for the approximately 46 inches of soil used in the columns—and assuming average field hydraulic conductivities—the contact time in the QAL and UMCf would vary from 1.5-15 days and from 15-190 days, respectively. Actual contact times measured in QAL during the laboratory tests varied from 8.9 to 10.6 days and are within the higher end of the range of QAL contact times in the field (1.5-15 days). However, the contact times observed in the laboratory for UMCf (5.2 to 7.2 days) are much shorter than those expected in the field (15-190 days). The reason is that the low hydraulic conductivity of the UMCf required higher pressure to facilitate flow within the time frame allocated for the project. As a consequence, field experiments will need much longer for UMCf bioremediation than the time reported here. However, contaminant removal is expected to be better because of the larger contact time in the aquifer. In summary, biodegradation results for QAL found in the laboratory are likely to follow very closely what will be observed in the field. However, UMCf bioremediation will take longer in the field and is limited by the slow groundwater velocity. Compared to the values found in the laboratory, final contaminant concentrations of UMCf—despite the longer time required—are likely to be much smaller than the ones found in the laboratory.

Table 5.6: Contact times (days) for the groundwater in the QAL and UMCf columns.

	Operational Period	QAL-Column A			QAL-Column B			UMCf-Column A			UMCf-Column B		
		Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max
Contact Times (days)	Overall period	8.92	0.87	28.07	10.6	0.47	23.66	7.16	2.45	13.62	5.22	1.75	12.76
	High amount of substrate (comparing the impact of Industrial Sugar Wastewater, no substrate and EOS-PRO alone)	8.36	0.31	20.53	10.6	0.47	23.66	3.78	2.21	5.63	2.85	1.52	4.29
	Low amount of substrate	8.95	2.06	28.07	13.19	1.54	80.7	9.15	4.02	13.62	6.62	3.14	12.76
Flow rate (mL/min)	Overall period	**0.16**	0.03	0.81	**0.14**	0.01	1.51	**0.13**	0.05	0.29	**0.17**	0.06	0.40
	High amount of substrate (comparing the impact of Industrial Sugar Wastewater, no substrate and EOS-PRO alone)	0.33	0.03	2.29	0.28	0.03	1.59	0.20	0.12	0.32	0.27	0.16	0.46
	Low amount of substrate	0.11	0.03	0.34	0.10	0.01	0.45	0.09	0.05	0.17	0.12	0.06	0.22

5.2.1 COD Measurements

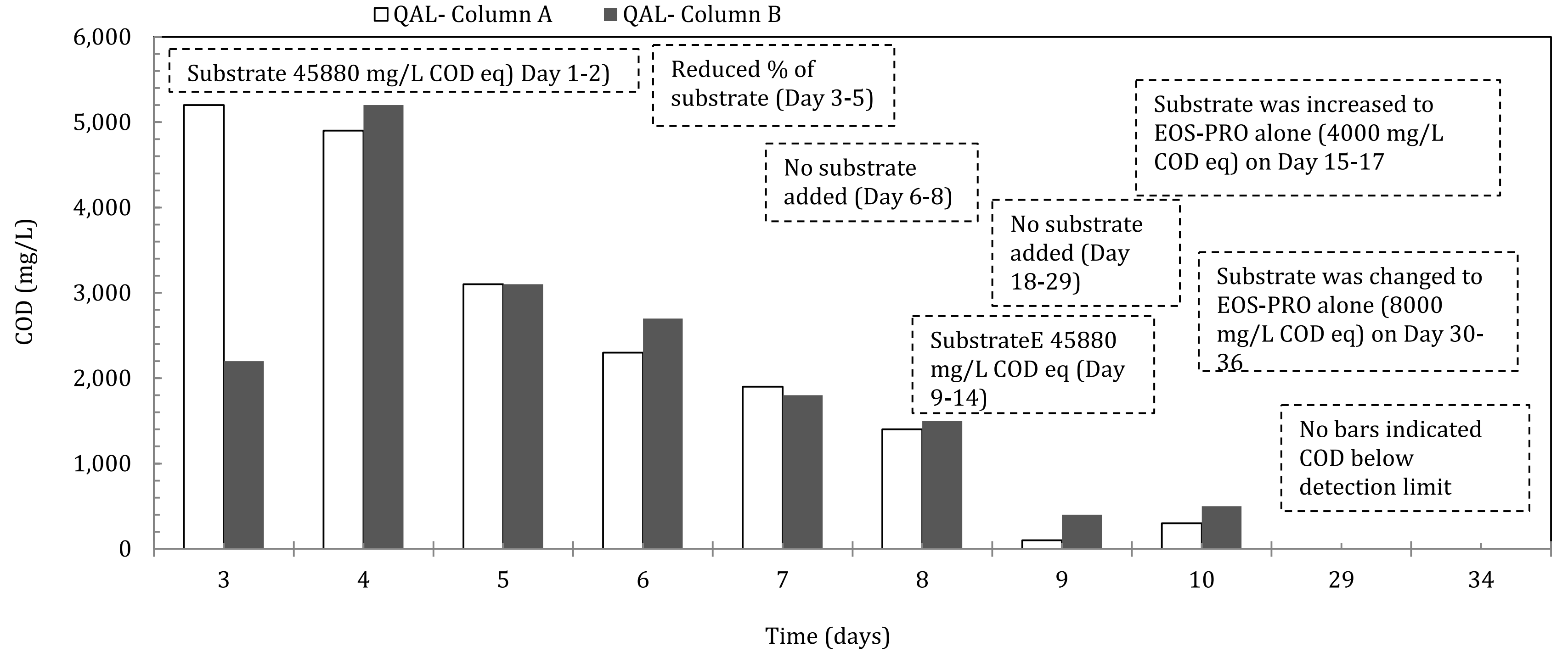
The effluent COD measurements from QAL columns when feeding high concentrations of substrate (45880 mg/L COD eq) are presented in Figure 5.31 (a). Notice that the effluent COD concentration is below 5,000 mg/L in Column A and below 2000 mg/L in Column B due to absorption of EOS-PRO in the soil. From Day 3 to Day 5, the feed was diluted with more groundwater and the COD in the effluent gradually decreased to below 500 mg/L. The addition of EOS-PRO only (at 4000 mg/L = 8000 mg/L COD eq) resulted in no COD in the effluent. This occurred because of the time it takes for the substrate to pass through the column. Note that during the period where COD was not observed, Cr (VI) and nitrate degradation were also not detected (Figure 5.33 (a) and 5.36 (a), respectively).

Figure 5.31 (b) shows the effluent COD for low substrate (9260 mg/L COD eq) in the QAL columns. The COD values were between 200 to 400mg/L, except Day 81, Day 101, and Day 108 in QAL Column A and Day 55, Day 77, Day 79, and Day 83 in QAL Column B. On Day 108, the COD nearly doubled in both columns which was expected considering power outage and crack formation in the columns. The high COD values, about 1300 mg/L, on Day 143 (in jut column QAL A) and Day 160 (in both columns) were not expected considering Cr (VI), nitrate, chlorate, and perchlorate degradation.

Figure 5.32 (a) shows the effluent COD in the UMCf columns at high substrate (45880 mg/L COD eq). In the beginning when the columns were fed at 45880 mg/L COD eq, the lower values of COD in the effluent (about 4000 to 5000 mg/L) might have been due to adsorption of EOS-PRO in the soil. After reducing the feed by diluting with more groundwater from Day 8 to Day 10, the COD in the effluent gradually decreased from Day 12. By Day 14, the COD was below 500 mg/L. After adding EOS-PRO at 45880 mg/L again, the effluent COD started to increase. Upon changing the feed to EOS-PRO only on Day 20 (4000 mg/L as COD eq), the COD decreased below 200 mg/L. Upon increasing the feed to 8000 mg/L as COD eq (EOS-PRO only) on Day 30, the effluent COD was below detection limit on Day 39 indicating COD was not sufficient for degradation.

For the UMCf columns, Cr (VI) and nitrate degradation were also not observed during this period with no COD detected (Figure 5.34 (a) and 5.38 (a), respectively). Figure 5.32 (b) shows the COD for low substrate (9260 mg/L COD eq) in the UMCf columns. In column A, the COD values were between 100 to 600 mg/L until Day 82 and remained below 400 mg/L throughout the study period. The COD values were between 100 to 600mg/L throughout the study in Column B, except for Day 137 when the COD was about 75 mg/L.

a. Effluent COD (mg/L) concentrations in QAL columns fed with high amount of substrate - mixture of Industrial Sugar Wastewater and EOS-PRO (45880 mg/L COD eq) or EOS-PRO alone (4000 mg/L to 8000 mg/L COD eq) as substrate or no substrate



Substrate 45880 mg/L COD eq) Day 1-2)

Reduced % of substrate (Day 3-5)

No substrate added (Day 6-8)

SubstrateE 45880 mg/L COD eq (Day 9-14)

No substrate added (Day 18-29)

Substrate was increased to EOS-PRO alone (4000 mg/L COD eq) on Day 15-17

Substrate was changed to EOS-PRO alone (8000 mg/L COD eq) on Day 30-36

No bars indicated COD below detection limit

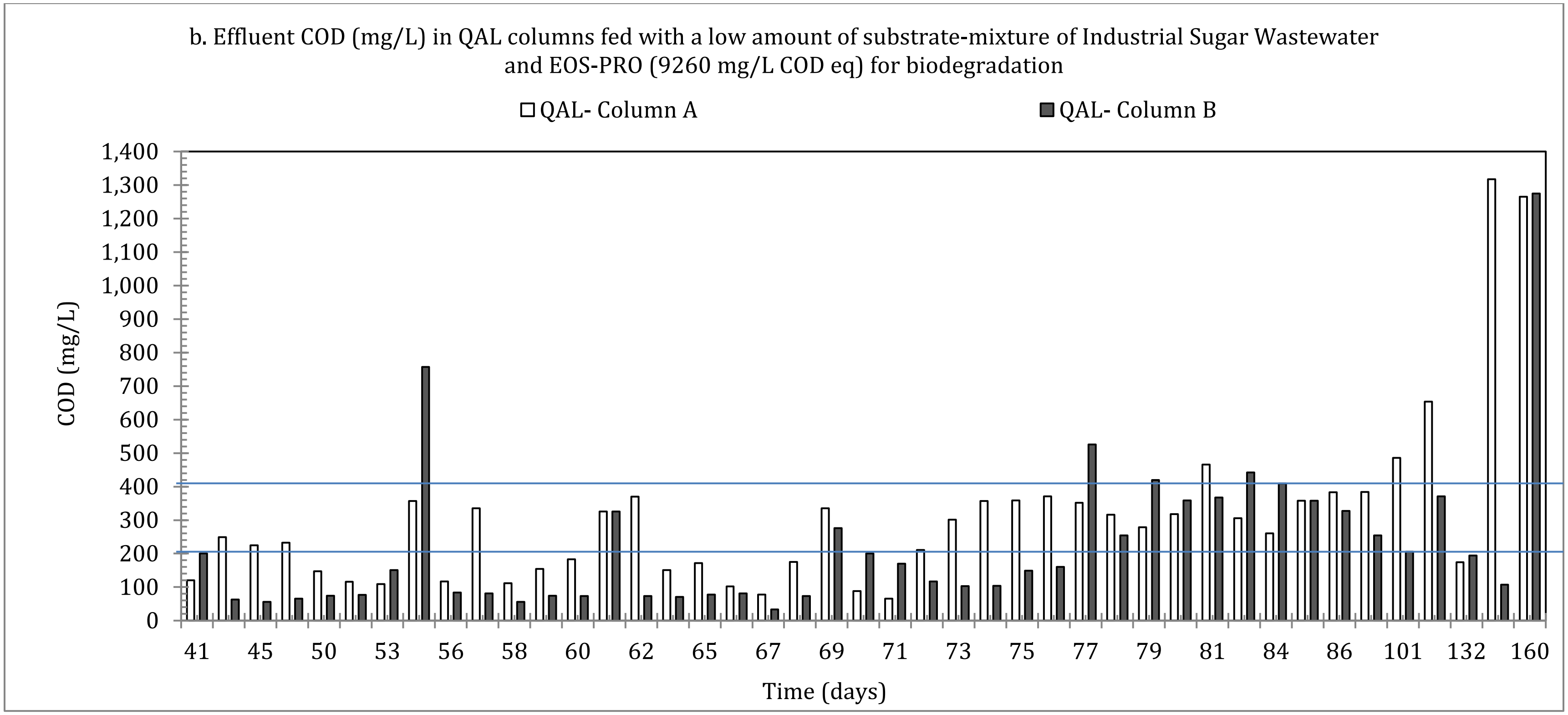
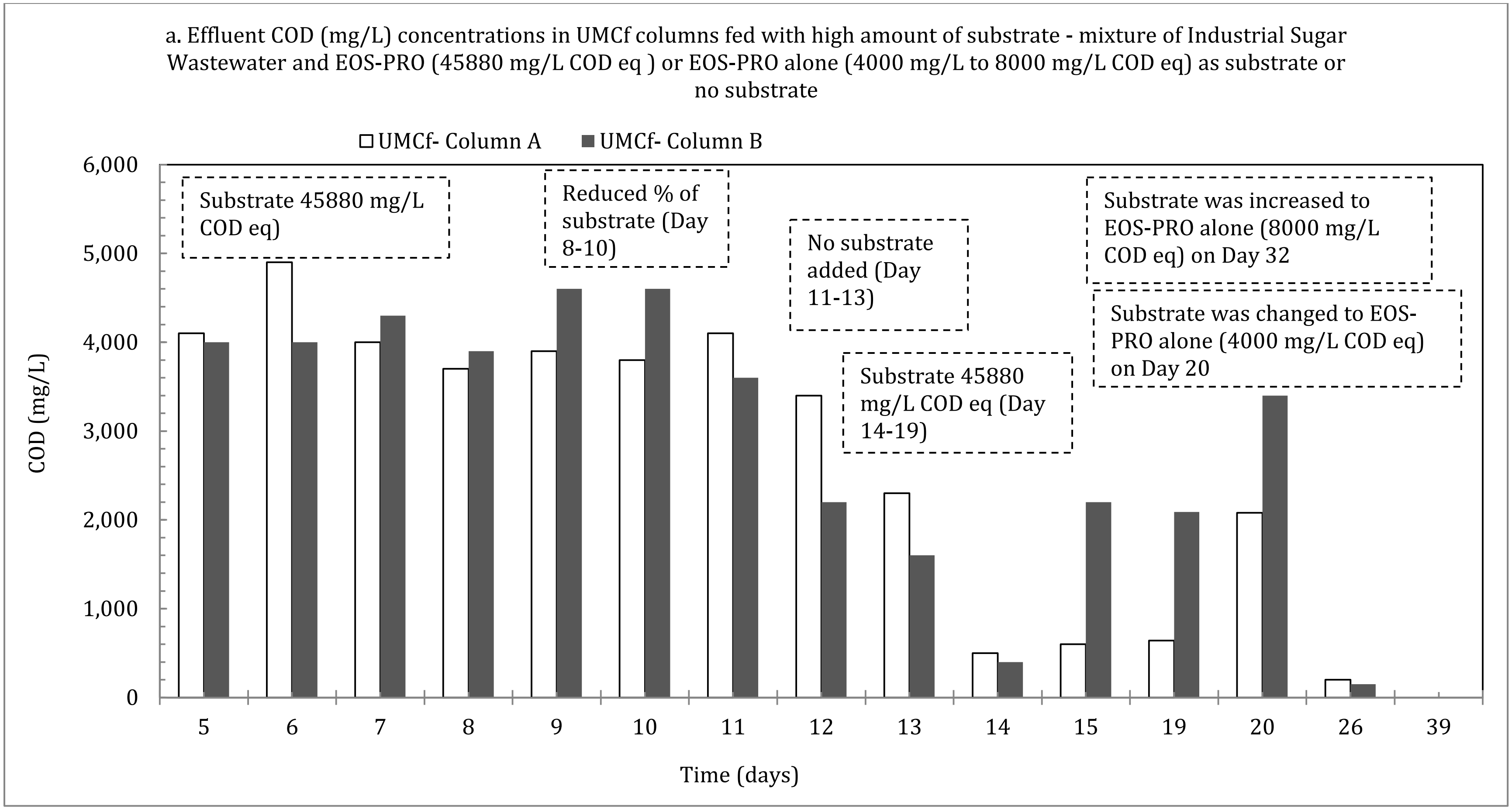


Figure 5.31: COD in the QAL columns- a high amount of substrate (mixture of Industrial Sugar Wastewater at 7% and EOS-PRO at 2% by volume) with 45880 mg/L COD eq, no substrate and EOS-PRO alone at 0.2% (4000 mg/L COD eq) and 0.4% (8000 mg/L COD eq) (a) and a low amount of substrate (mixture of Industrial Sugar Wastewater at 1.5% and EOS-PRO at 0.4%) with 9260 mg/L COD eq (b). The average influent hexavalent chromium concentration in the columns were 14261 ± 1987 µg/L (a) and 12377 ±997 µg/L (b) over the operation periods. (The horizontal lines are drawn to clarify the 200 mg/L and 400 mg/L COD levels).



a. Effluent COD (mg/L) concentrations in UMCf columns fed with high amount of substrate - mixture of Industrial Sugar Wastewater and EOS-PRO (45880 mg/L COD eq) or EOS-PRO alone (4000 mg/L to 8000 mg/L COD eq) as substrate or no substrate

Substrate 45880 mg/L COD eq)

Reduced % of substrate (Day 8-10)

No substrate added (Day 11-13)

Substrate 45880 mg/L COD eq (Day 14-19)

Substrate was increased to EOS-PRO alone (8000 mg/L COD eq) on Day 32

Substrate was changed to EOS-PRO alone (4000 mg/L COD eq) on Day 20

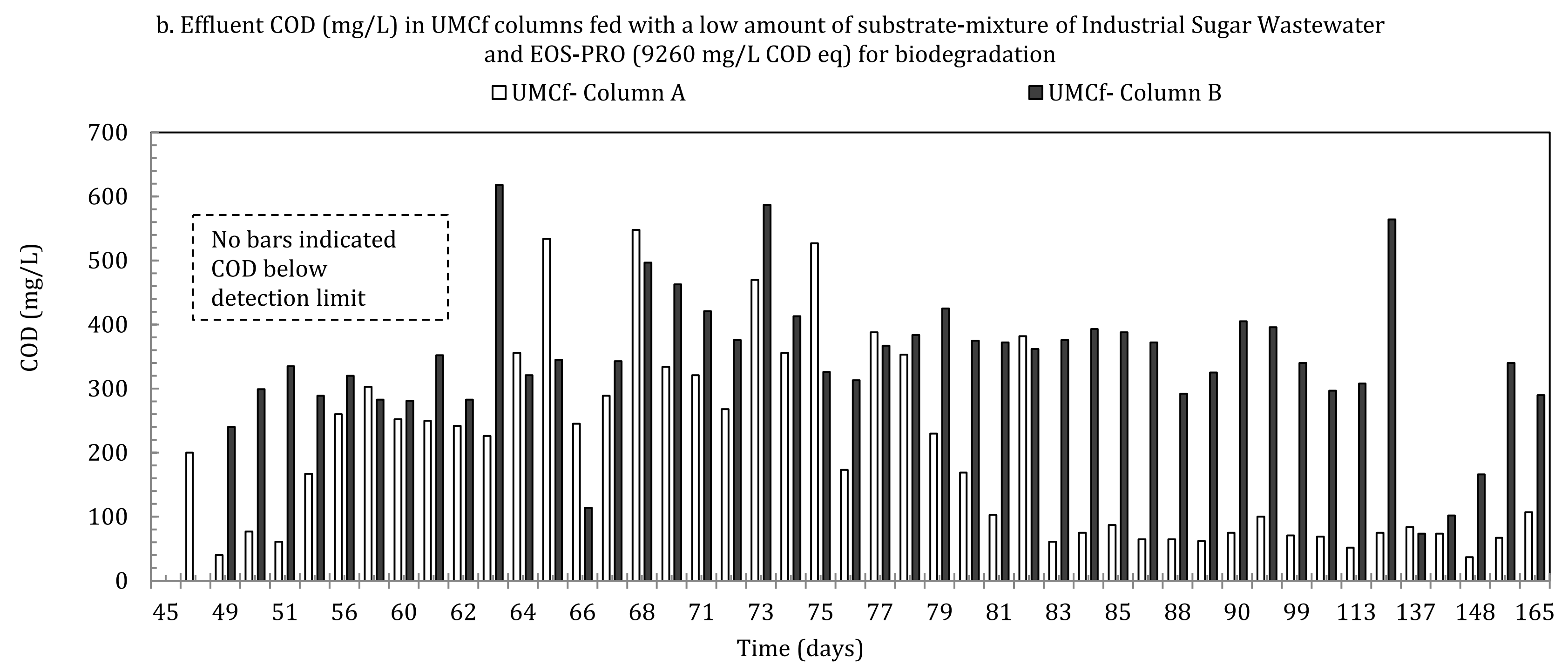


Figure 5.32: Effluent COD in the UMCf columns fed with a high amount of substrate (mixture of Industrial Sugar Wastewater at 7% and EOS-PRO at 2% by volume) with 45880 mg/L COD eq, no substrate and EOS-PRO alone at 0.2% (4000 mg/L COD eq) and 0.4% (8000 mg/L COD eq) (a) and a low amount of substrate (mixture of Industrial Sugar Wastewater at 1.5% and EOS-PRO at 0.4%) with 9260 mg/L COD eq (b). The average influent hexavalent chromium concentration was 17385± 1829 µg/L (a) and 15360 ±1325 µg/L (b) over the operation periods.

5.2.2 Cr (VI) Reduction

Figures 5.33 (a) and (b) show biological Cr (VI) reduction in the QAL columns in the presence of (a) high substrate then no substrate addition (45,880 mg/L COD equivalent and varying amounts of substrate) and (b) low (9260 mg/L COD equivalent) amounts of influent substrate concentration. The EOS-PRO oil and Industrial Sugar Wastewater added as substrates were absorbed into the soils (See COD section 5.1.1) generating COD values in the effluent of the column that were between 2,000-5,000 mg/L COD and < 300 mg/L COD under high and low substrate conditions, respectively. The COD provided by the EOS-PRO and the Industrial Sugar Wastewater were used as energy and carbon sources by bacteria to reduce Cr (VI) and other contaminants present in the groundwater.

The Cr (VI) in the effluent from the QAL columns decreased by half by Day 3, and continuously decreased with time (Figure 5.33 a). On Day 9, the chromium concentration increased slightly, but after adding a mixture of Industrial Sugar Wastewater and EOS-PRO (45880 mg/L COD eq) substrate on Days 9 to 14, the chromium concentration decreased steadily and was below detection limit in the effluent on Day 14. The reduction in substrate to 4000 mg/L COD eq (EOS-PRO) did not negatively impact the chromium reduction indicating the lower substrate concentration was sufficient to promote Cr (VI) reduction.

When no substrate was added for almost 11 days, the Cr (VI) concentration remained below detection limit in the effluent due to the residence time of the substrate within the QAL column. That is, substrate was still available within the column to promote degradation. As mentioned earlier, the average residence time in QAL columns varied from 8.9 and 10.6 days. Therefore, the breakthrough of Cr (VI) after 11 days of no substrate addition suggests the remaining sorbed substrate in the column was consumed after 11 days. After 11 days of addition of substrate to the column, the effluent Cr (VI) concentrations were 500 μg/L on Day 29 in Column A and 20 μg/L on Day 30 in Column B. The effluent chromium concentrations remained high (about 10000 μg/L in Column A and about 2000 μg/L in Column B) on Day 32 even after addition of substrate (8000 mg/L COD eq, EOS-PRO only). After Day 46, COD concentrations as low as 100 mg/L in the effluent (Figure 5.31) were sufficient to keep Cr (VI) levels undetected.

In summary, the results demonstrate the following:

(a) Cr (VI) reduction in NERT groundwater starts very quickly (in less than three days) when substrate is available—therefore naturally occurring chromate-reducing bacteria are present,

(b) both EOS-PRO and Industrial Sugar Wastewater are good substrate sources,

(c) when substrate addition is stopped, biological reduction was maintained possibly by the remaining substrate in the pore of space of the soil and is therefore dependent on the groundwater residence time,

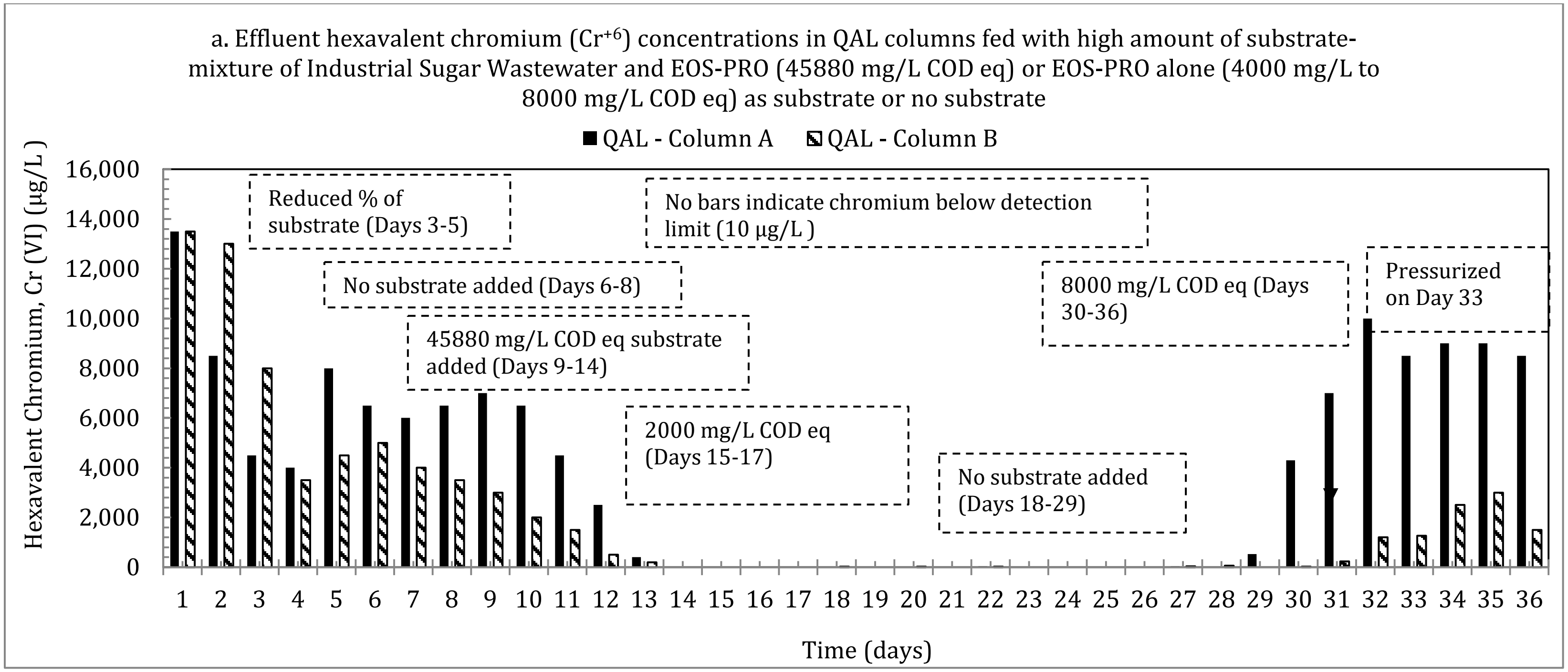
(d) effluent concentrations as low as 100 mg/L COD were sufficient to keep Cr (VI) levels undetected; therefore, depending on the other contaminants present, this COD value could be used as a tool in this location to indicate need for reinjection of substrates, and

(e) field application for in-situ Cr (VI) reduction at NERT will be controlled by the velocity of the groundwater (i.e., contact time), the porosity of the soil, and the substrate concentration available for degradation.

Microcosms testing results discussed in section 5.1 revealed that the addition of EOS-PRO alone as a substrate promotes slower Cr (VI) reduction than that fostered by a mixture of EOS-PRO and Industrial Sugar Wastewater. The results seem to indicate that the addition of readily biodegradable Industrial Sugar Wastewater promoted faster degradation of Cr (VI), either due to chemical or biological reduction. Therefore, in the column tests, a low amount of substrate (mixture of Industrial Sugar Wastewater and EOS-PRO at 9260 mg/L COD eq) was added on Day 37. The effluent chromium concentrations decreased gradually to below detection limit by Day 45 (Figure 5.33 b). The COD values in the effluent during this period (Days 37-45) were below 300 mg/L as compared to 2000-5000 mg/L observed within the first fifteen days of the column running; this indicates that much lower COD values are sufficient to promote Cr (VI) removal.

The effluent Cr (VI) concentration on Day 108 increased to 900 µg/L in QAL column A and 2600 µg/L in QAL Column B. On Day 113, the Cr (VI) concentrations were 3200 µg/L and 3300 µg/L in Columns A and B, respectively. It was suspected that the increase in the

Cr (VI) was because of the power outage that caused a crack in the media, causing micro-channeling. Once the columns were pressurized again, the microcracks were resolved. On Day 118, the Cr (VI) concentration was below 20 μg/L in both columns—suggesting the increase on Day 113 was because of the disruption. For rest of the period, the Cr (VI) fluctuated from below detection limit to 60 μg/L in both columns, demonstrating biological removal of Cr (VI) fron NERT groundwater is feasible and can be sustained for a long period of time. The biological process was not observed to cause any clogging in the columns. However, reduced flow rate was observed early in QAL columns due to displacement of the fine materials contained in QAL to the bottom of the columns.



a. Effluent hexavalent chromium (Cr^{+6}) concentrations in QAL columns fed with high amount of substrate-mixture of Industrial Sugar Wastewater and EOS-PRO (45880 mg/L COD eq) or EOS-PRO alone (4000 mg/L to 8000 mg/L COD eq) as substrate or no substrate

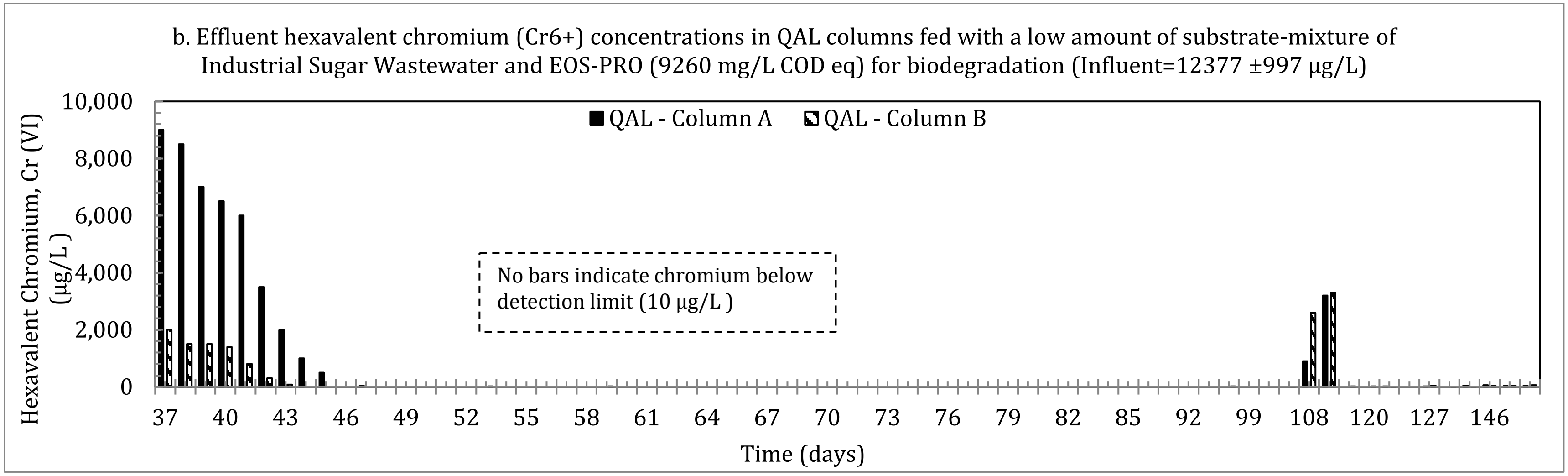


Figure 5.33: Effluent Cr (VI) concentrations in the QAL columns- a high amount of substrate (mixture of Industrial Sugar Wastewater at 7% and EOS-PRO at 2% by volume) with 45880 mg/L COD eq, no substrate and EOS-PRO alone at 0.2% (4000 mg/L COD eq) and 0.4% (8000 mg/L COD eq) (a) and a low amount of substrate (mixture of Industrial Sugar Wastewater at 1.5% and EOS-PRO at 0.4%) with 9260 mg/L COD eq (b). The average influent hexavalent chromium concentration in the columns were 14261 ± 1987 µg/L (a) and 12377 ±997 µg/L (b) over the operation periods.

Note: The influent Cr (VI) concentrations were lower than actual concentration in the groundwater which was suspected to be due to possible chemical or biodegradation in the feed tank due to Industrial Sugar Wastewater (Appendix E)—despite changing the feed bottle and groundwater every day. During the first two weeks of operation, the influent feed groudnwaters were wrapped with a few ice packs, but the ice packs were not enough to maintain the desired 4^0C temperature. This issue was corrected by using Velcro to attach more ice packs close to the influent bottle. In addition, in the influent that contained Industrial Sugar Wastewater potential abiotic reduction may have occurred—as explained earlier. Also, Appendix E shows that Industrial Sugar Wastewater has chemical abiotic reduction potential. Those influent readings are not considered for statistical analysis. From Day 15, the influent chromium was measured immediately after preparing the feed which improved the reading. Also, the feed groundwater bottles were surrounded with more ice packs, as mentioned earlier.

Figures 5.34 (a) and (b) show the Cr (VI) reduction in the UMCf columns fed with high and low amounts of substrate, respectively. Cr (VI) in the effluent from the UMCf columns decreased by 25% by Day 4, and continuously decreased even when the substrate addition was gradually reduced (Figure 5.34 a). After reinitiating feeding of substrate into the columns, it took some time for Cr (VI) reduction to start again. With a feed of 45880 mg/L COD equivalent (mixture of Industrial Sugar Wastewater and EOS-PRO) on Day 14, it took five days (Day 19) for the effluent Cr (VI) concentration to decrease below the detection limit. The reason is the slow velocity of water in the columns; recall that the estimated contact time for the UMCf columns ranges from 5.2 to 7.2 days. Therefore, the lag time between feeding time and chromium reduction relates to the time it takes for the substrate to pass through the column pores.

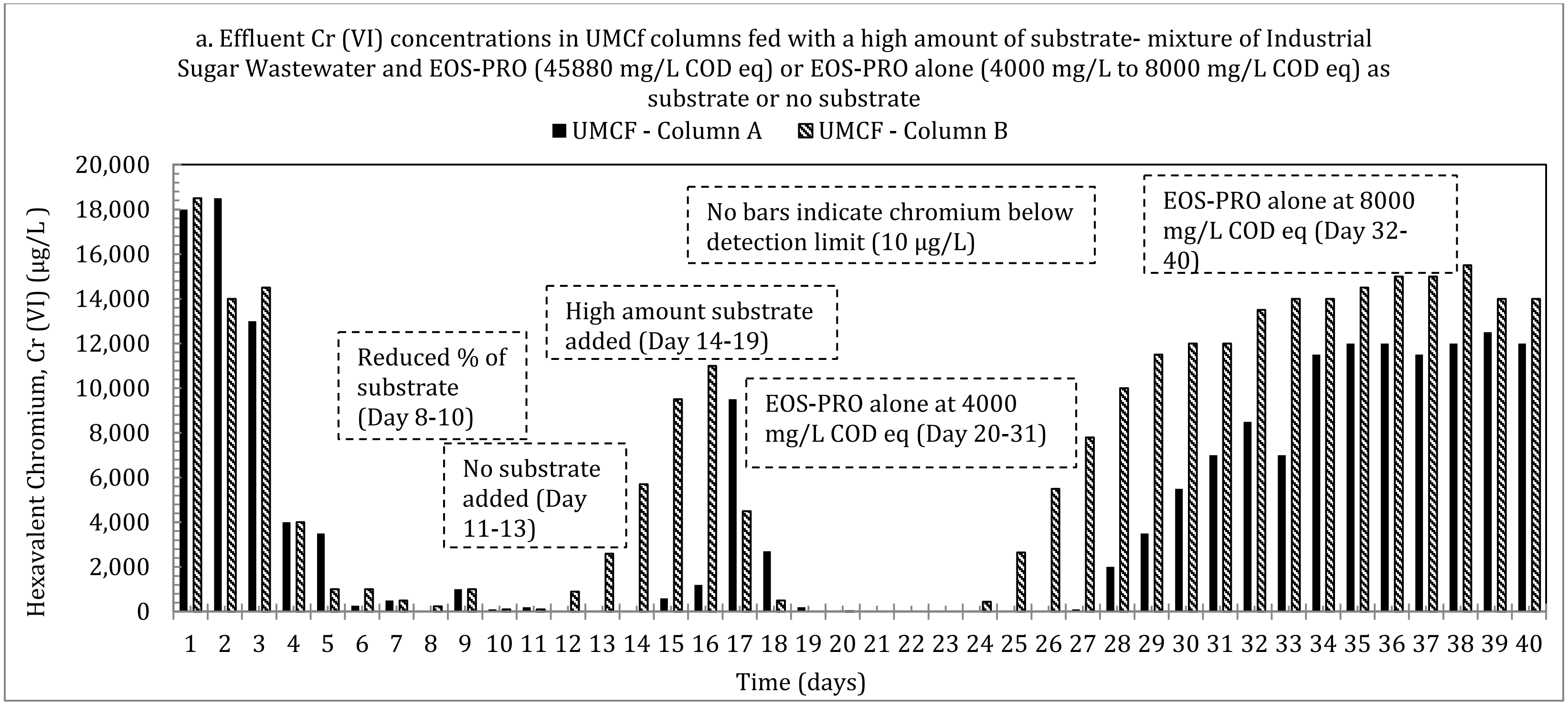
The feed substrate was reduced to 4000 mg/L COD eq (EOS-PRO only) on Day 20. As noted in the COD discussion, the effluent COD levels for the UMCf columns after Day 20 remained below detection limit until Day 45 (Figure 5.32). After Day 45, the levels started increasing and reached above 300 mg/L. For UMCf column A, COD values dropped below 100 mg/L after Day 83 (Figure 5.32).

The chromium concentration remained below detection limit in the effluent until Day 29 in Column A and Day 24 in Column B. The substrate was increased to 8000 mg/L COD eq (EOS-PRO only) on Day 32. Despite this increase, the effluent chromium concentrations remained around 14000 μg/L in Column A and about 16000 μg/L in Column B. As COD in the effluent increased, Cr (VI) was observed and it decreased with time until reaching non-detectable levels by Day 97.

The effect of adding a low amount of substrate (mixture of Industrial Sugar Wastewater and EOS-PRO at 9260 mg/L COD eq on Day 41) on effluent chromium concentrations is depicted in Figure 5.34 (b). The effluent chromium concentrations decreased gradually, were halved by Day 53, and were below detection limit by Day 95 (Figure 5.34 b). For UMCf A, cracks were not visible on Day 106 after the power cut, but a small crack was noticed on Day 116 in column UMCf B. On Day 120, the effluent chromium concentration in column B increased to 420 μg/L and on Day 125 was 3500 μg/L. This increase in concentration may be due to channeling caused by the cracking. Because the columns were operated under pressure—and given the clayey nature of the soil—small cracks slowly closed after repressurizing the columns. After Day 125, the effluent chromium concentration gradually decreased and was below detection limit after Day 148.

Although the influent chromium concentrations varied—because samples were taken at different times and different wells—Cr (VI) reduction was was observed in both QAL and UMCf soils every time sufficient substrate was available.

When comparing the performance of QAL and UMCf for Cr (VI) removal, the QAL columns performed better—reaching nondetectable levels (< 10 μg/L) after Day 45 of operation. The UMCf columns, fed the same COD equivalent of 8000 mg/L, reached stable non-detect by Day 90. This observation may reflect the fact that contact times in the UMCf columns were 5.2-7.2 days, as compared to 8.9 to 10.6 days in the QAL columns. Considering the QAL contact time was roughly twice as long, better degradation performance was expected. However, in the field, UMCf contact times will be longer and better performance is expected than for QAL under the same substrate feed conditions.



a. Effluent Cr (VI) concentrations in UMCf columns fed with a high amount of substrate- mixture of Industrial Sugar Wastewater and EOS-PRO (45880 mg/L COD eq) or EOS-PRO alone (4000 mg/L to 8000 mg/L COD eq) as substrate or no substrate

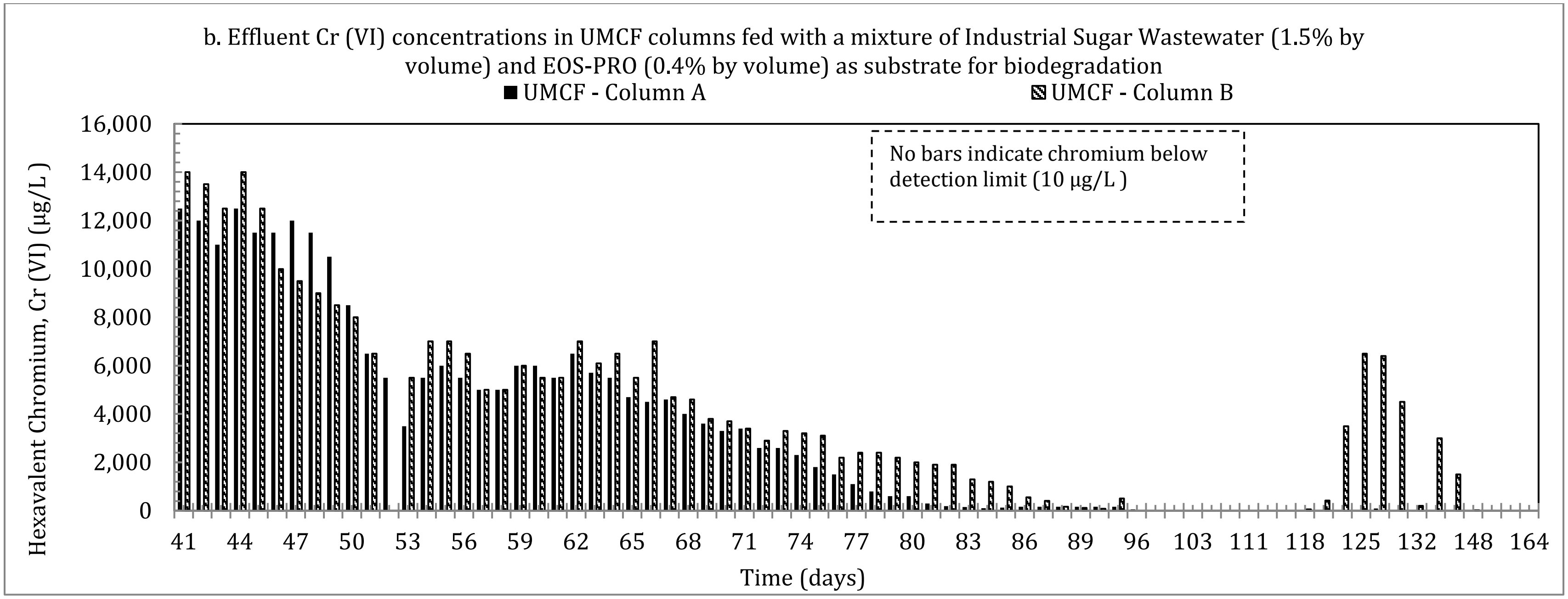


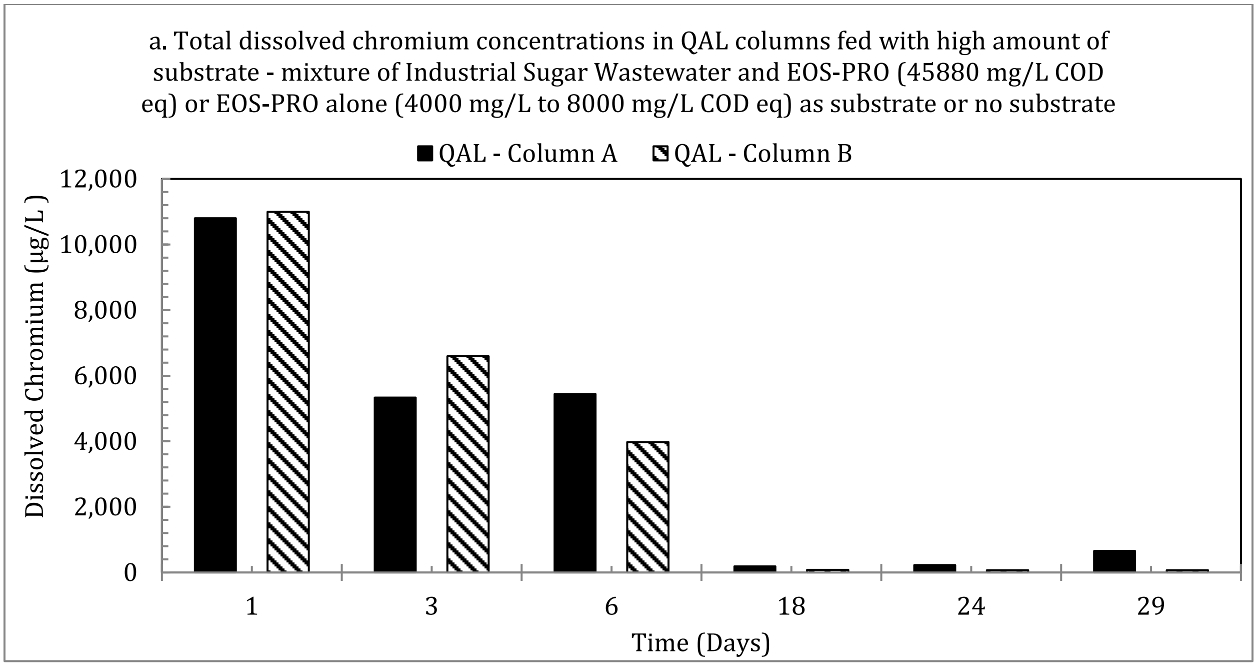
Figure 5.34: Effluent Cr (VI) concentrations in the UMCf columns fed with: a high amount of substrate (mixture of Industrial Sugar Wastewater at 7% and EOS-PRO at 2% by volume) with 45880 mg/L COD eq, no substrate and EOS-PRO alone at 0.2% (4000 mg/L COD eq) and 0.4% (8000 mg/L COD eq) (a) and a low amount of substrate (mixture of Industrial Sugar Wastewater at 1.5% and EOS-PRO at 0.4%) with 9260 mg/L COD eq (b). The average influent hexavalent chromium concentration was 17385± 1829 μg/L (a) and 15360 ±1325 μg/L (b) over the operation periods.

Note: The influent Cr (VI) concentrations were lower than actual concentration in the groundwater which was suspected to be caused by possible chemical or biodegradation in the feed tank due to Industrial Sugar Wastewater (Appendix E)—despite changing the feed bottle and groundwater every day. During the first two weeks of the operation, the influent feed groudnwaters were wrapped with a few ice packs, but the ice packs were not enough to maintain the desired 40C temperature. This issue was corrected by using Velcro to attach more ice packs close to the influent bottle. In addition, in the influent that contained Industrial Sugar Wastewater, potential abiotic reduction may have occurred, as explained earlier. Also, Appendix E shows that Industrial Sugar Wastewater has chemical abiotic reduction potential. Those affected influent readings are not considered for statistical analysis. From Day 15, the influent chromium was measured immediately after preparing the feed which improved the reading. Also, the feed groundwater bottles were surrounded with more ice packs, as mentioned earlier.

5.2.3 Dissolved Chromium Measurements

Figure 5.35 and Figure 5.36 show the dissolved chromium in QAL and UMCf columns, respectively. The dissolved chromium data followed the trend of Cr (VI) over the study period at high and low amounts of substrate. The dissolved chromium concentrations were measured in a 24-hour composite sample while the Cr (VI) was measured in grab samples—though the measurements were taken at the same time. Hexavalent chromium was measured in filtered samples using the HACH Method while total dissolved chromium was measured by ICP on settled (not filtered) samples taken from the effluent. Total dissolved chromium concentrations were measured for several days of testing, but not for all days.

Dissolved chromium in QAL columns fed high amount of substrate was reduced by half by Day 3. On Day 18, the dissolved chromium had fallen to about 200 μg/L in Column A and below 100 μg/L in Column B. In Column B, it remained below 100 μg/L until Day 29 (Figure 5.35 a). Dissolved chromium in QAL columns on Day 38 at a low amount of substrate (the mixture with Industrial Sugar Wastewater and EOS-PRO) was about 7000 μg/L in Column A and 1000 μg/L in Column B (Figure 5.35 b). The dissolved chromium in the QAL columns decreased below 2000 μg/L in Column A and 200 μg/L in Column B by Day 43 (five days after starting the low amount of substrate mixture). The total dissolved chromium concentrations show similar trends to those described for hexavalent chromium and show the impact of substrate level on Cr (VI) reduction.



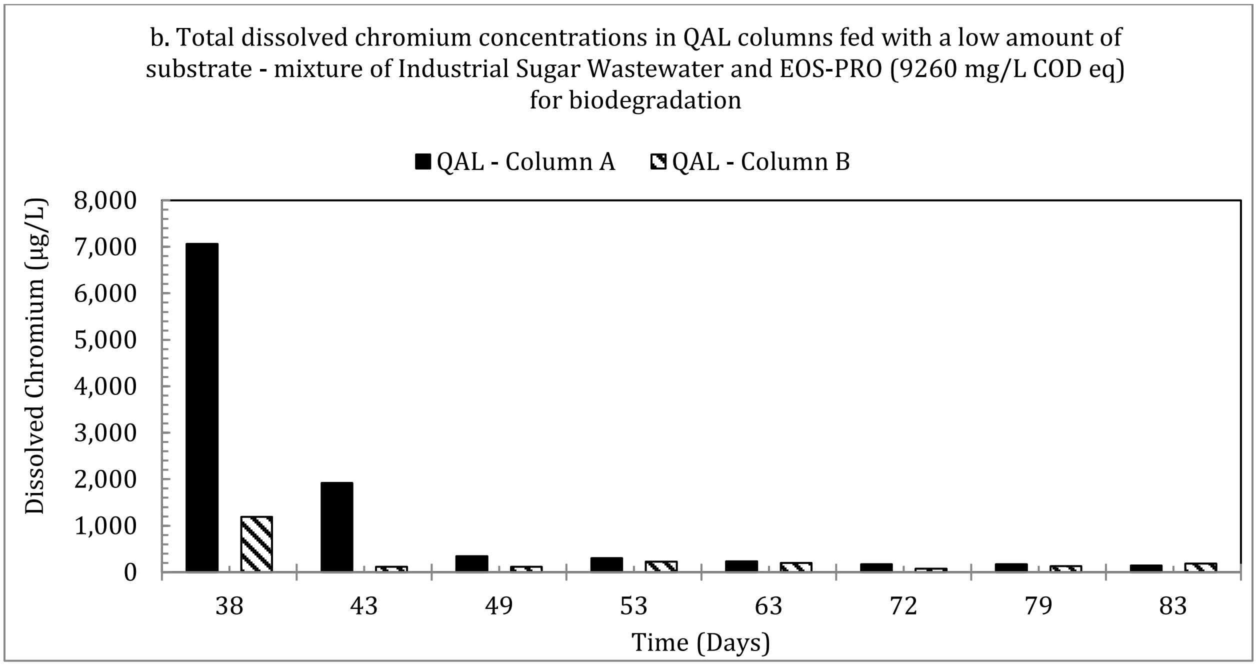
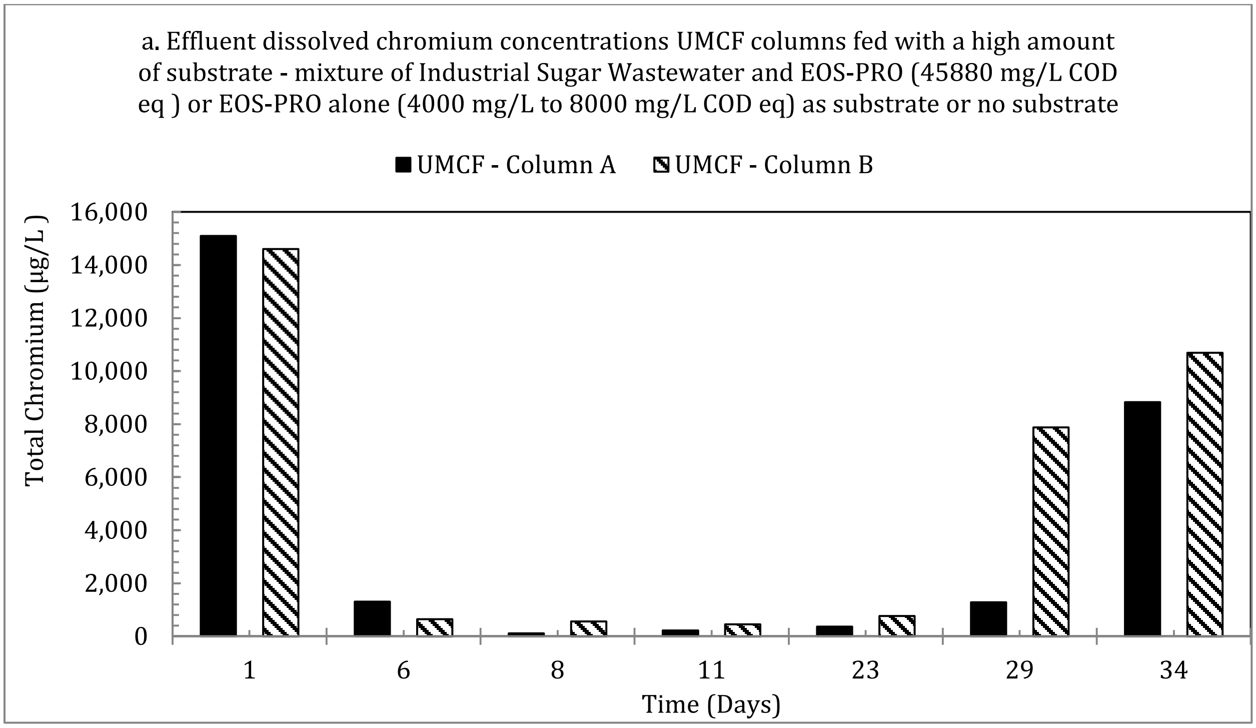


Figure 5.35: Total dissolved Chromium in the QAL columns fed with - a high amount of substrate (mixture of Industrial Sugar Wastewater at 7% and EOS-PRO at 2%), no substrate and EOS-PRO alone at 0.2% and 0.4% (a) and a low amount of substrate (mixture of Industrial Sugar Wastewater at 1.5% and EOS-PRO at 0.4%) (b).

Total dissolved chromium concentrations in the UMCf columns show the same trend as the Cr (VI) data described previously for the UMCf columns. The dissolved chromium in

UMCf columns at high amount of substrate was reduced to a seventh by Day 6—about 2000 µg/L in Column A and 1000 µg/L in Column B—and remained below 1000 µg/L in both UMCf columns until Day 29 (Figure 4.36 a). As expected, the dissolved chromium increased to 10000 µg/L while the columns were fed with 0.4% EOS-PRO. Dissolved chromium in both UMCf columns on Day 48 (at low amount of substrate, the mixture with Industrial Sugar Wastewater and EOS-PRO) was about 8000 µg/L (Figure 4.36 b). On Day 54, the dissoved chromium was about 7000 µg/L in Column A and 6000 µg/L in Column B. The dissolved chromium in the UMCf columns gradually decreased below 200 µg/L in Column A and 500 µg/L in Column B by Day 88.



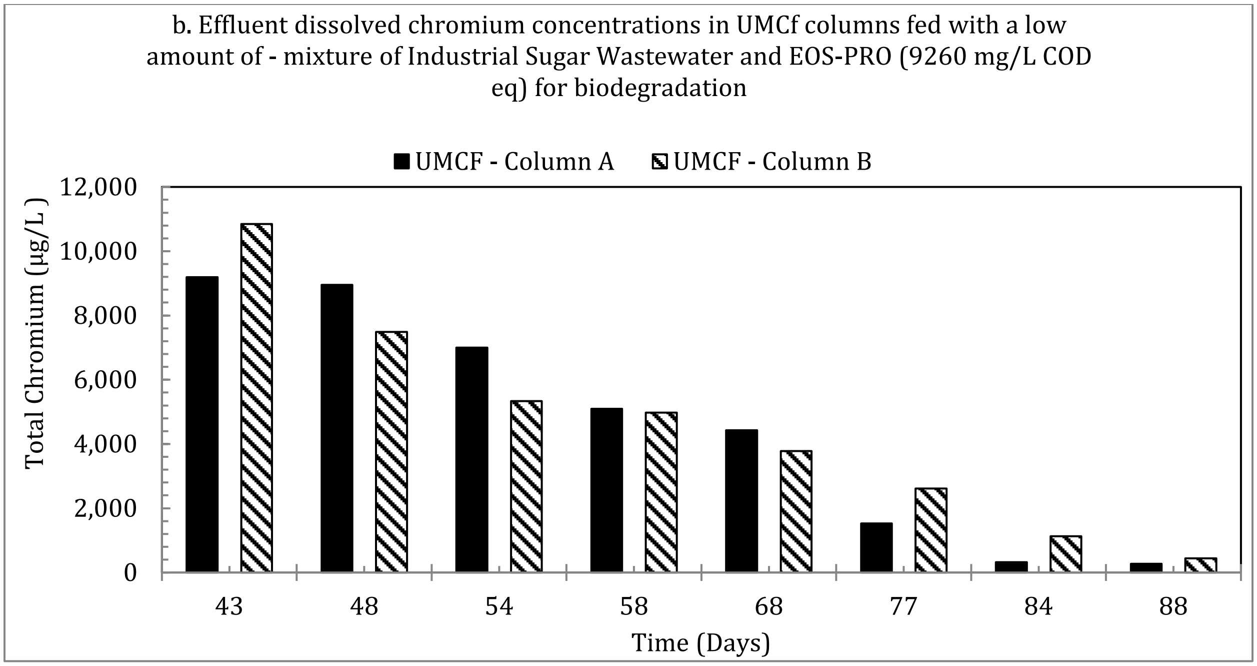


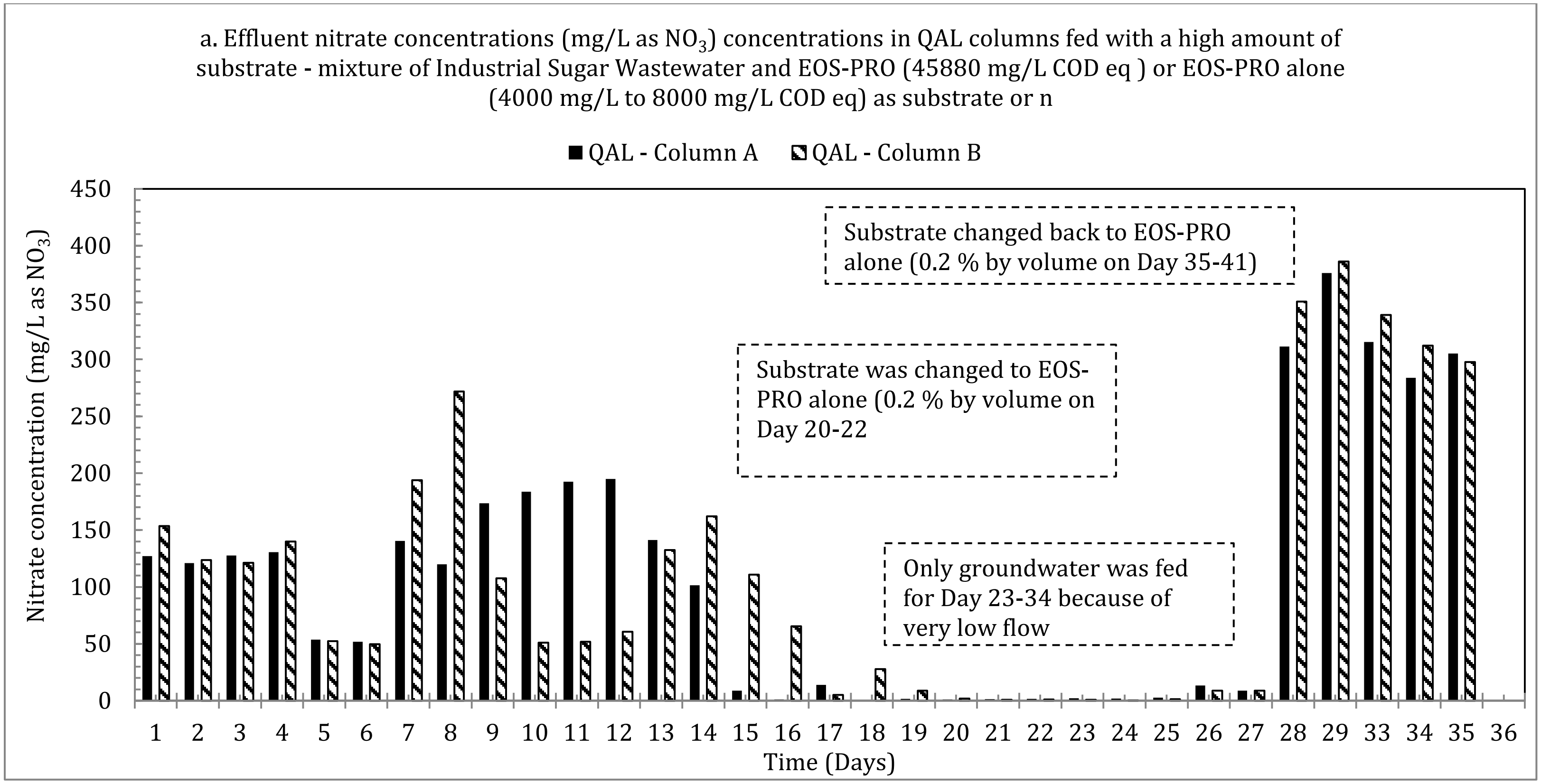
Figure 5.36: Dissolved chromium concentrations in the UMCf columns fed with- a high amount of substrate (mixture of Industrial Sugar Wastewater at 7% and EOS-PRO at 2%), no substrate and EOS-PRO alone at 0.2% and 0.4% (a) and a low amount of substrate (mixture of Industrial Sugar Wastewater at 1.5% and EOS-PRO at 0.4%) (b).

5.2.4 Nitrate Concentrations

Figure 5.37 and Figure 5.38 show the nitrate concentration in QAL columns and UMCf columns, respectively. The results show the impact of Cr (VI) on nitrate reduction. Figure 5.37 (a) shows the nitrate concentration in QAL columns for high amounts of substrate (mixture of Industrial Sugar Wastewater and EOS-PRO). As mentioned earlier, the initial nitrate influent and effluent concentrations (150 mg/L as NO_3) were lower than the groundwater (400 mg/L as NO_3). The lower nitrate values observed during the first days were likely the impact of degradation in the feed bottle (used by the chromium reducing bacteria for growth or/and nitrate biodegradation). Nitrate biodegradation started on Days 5 and 6—the nitrate effluent concentration was about 50 mg/L as NO_3 in both columns (note that Cr (VI) reduced below 1000 µg/L on Day 5). On Day 7, as new feed was added, the effluent nitrate concentration was observed to be about 200 mg/L as NO_3. During the period of no substrate addition, the nitrate concentrations fluctuated between

50 and 200 mg/L. On Day 14, a high amount of substrate mixture was added. Nitrate degradation was observed on Day 15, with concentrations below 5 mg/L as NO_3 by Day 20. Nitrate concentration increased to about 350 mg/L as NO_3 on Day 28, after 9 days of no substrate addition. During the same period, Cr (VI) also increased to about 500 µg/L on Day 29 and continued to increase up to about 16000 µg/L. **The results reveal that nitrate degradation is impacted by the presence of Cr (VI). Chromium degradation is observed to occur first; however, when chromium decreases to lower levels, nitrate and chromium are reduced concomitantly. For the QAL columns, complete nitrate degradation lagged about 5 days behind chromium reduction (Day 14 for Cr (VI) and Day 19 for nitrate). Similar to that observed for Cr (VI), nitrate levels increase when substrate levels decrease.**

Figure 5.37 (b) shows the nitrate concentrations in QAL columns fed with low amount of substrate (mixture of Industrial Sugar Wastewater and EOS-PRO). The effluent nitrate concentration was about 300 mg/L as NO_3 until Day 40. On Day 41, the concentration decreased slightly (about 200 mg/L as NO_3), and concentration was below 20 mg/L as NO_3 on Day 148. Note that the Cr (VI) concentration was below 1000 µg/L by Day 44. **These data indicate that nitrate and Cr (VI) reduction occur at the same time.**


a. Effluent nitrate concentrations (mg/L as NO_3) concentrations in QAL columns fed with a high amount of substrate - mixture of Industrial Sugar Wastewater and EOS-PRO (45880 mg/L COD eq) or EOS-PRO alone (4000 mg/L to 8000 mg/L COD eq) as substrate or n
■ QAL - Column A
▨ QAL - Column B
Nitrate concentration (mg/L as NO_3)
450
400
350
300
250
200
150
100
50
0
Substrate changed back to EOS-PRO alone (0.2 % by volume on Day 35-41)
Substrate was changed to EOS-PRO alone (0.2 % by volume on Day 20-22
Only groundwater was fed for Day 23-34 because of very low flow
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 29 33 34 35 36
Time (Days)

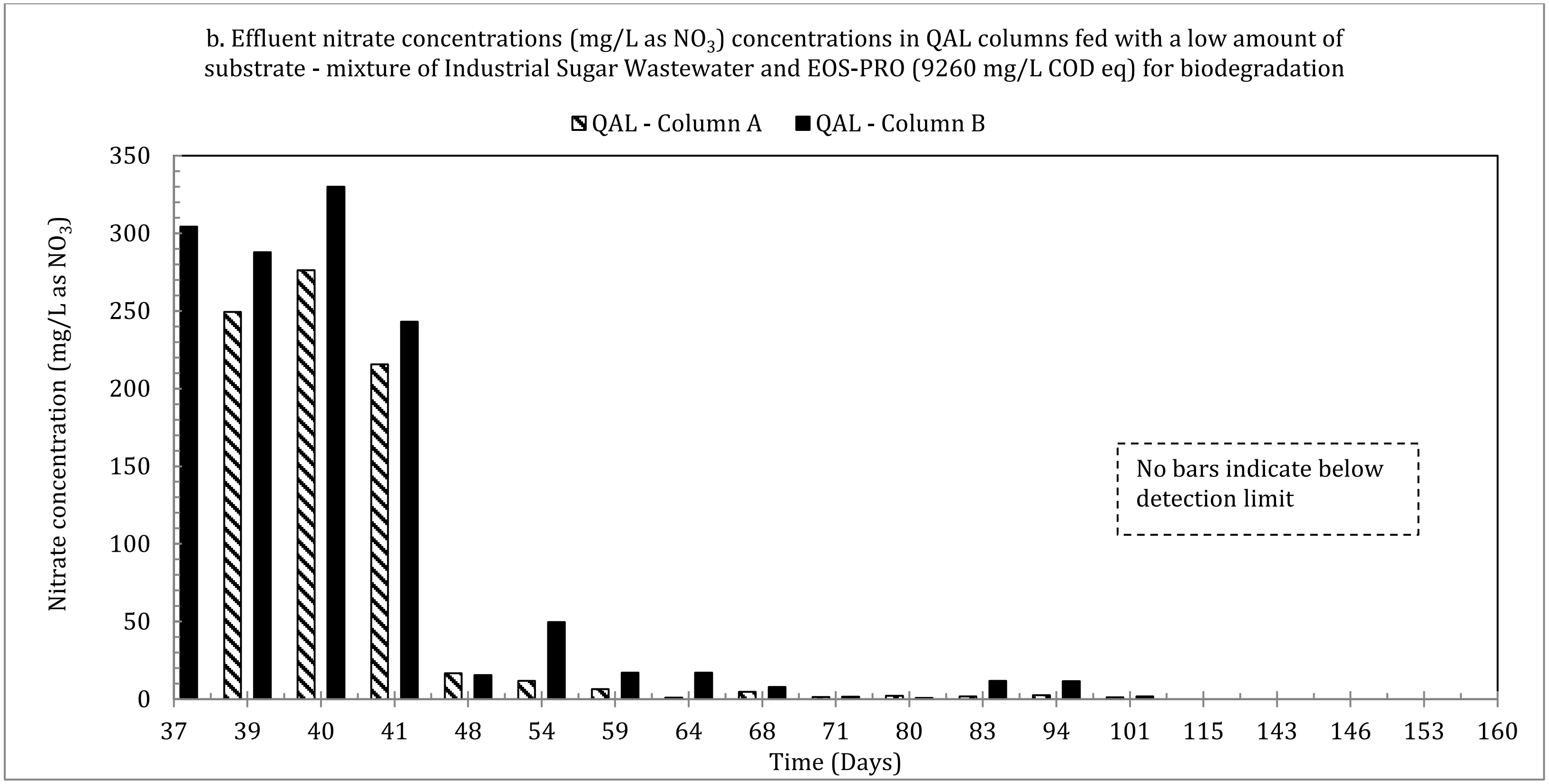
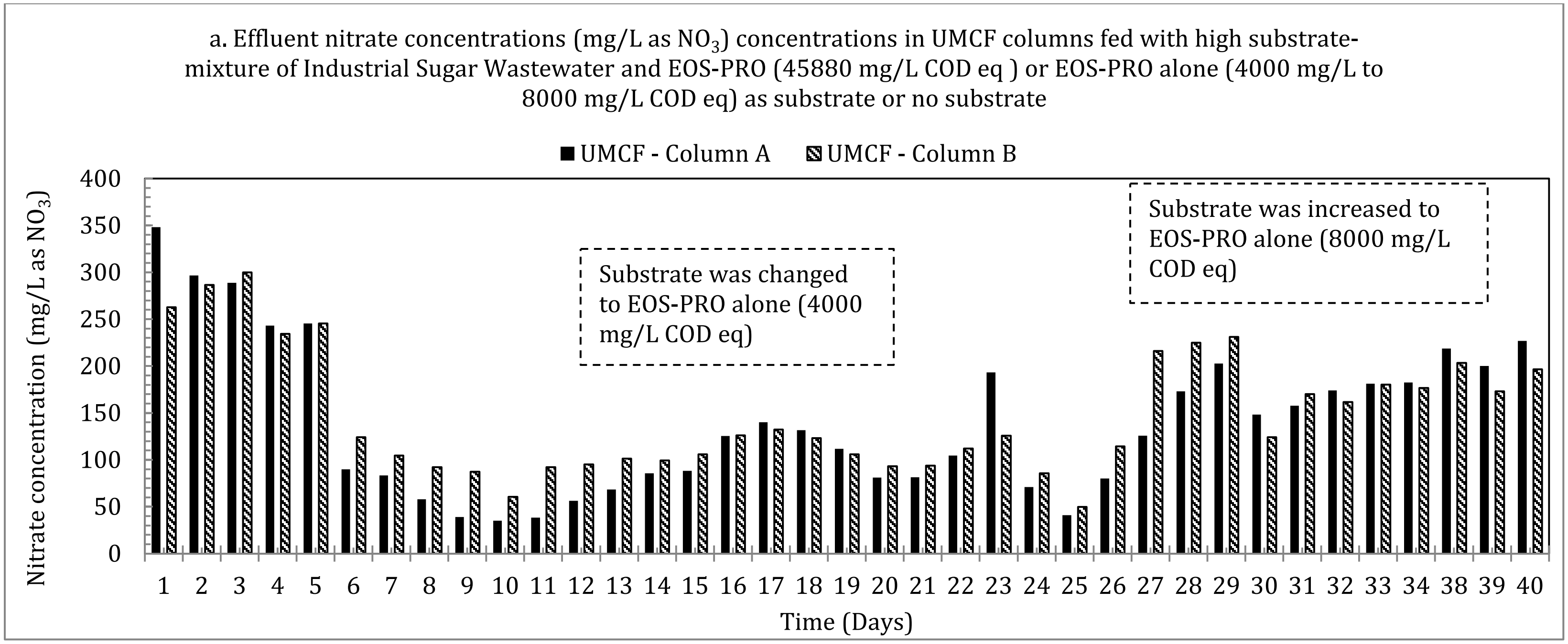


Figure 5.37: Effluent nitrate concentrations in the QAL.

Figure 5.38 (a) shows the effluent nitrate concentrations in UMCf columns fed with high amount of substrate (mixture of Industrial Sugar Wastewater and EOS-PRO). Biodegradation was observed on Day 5; the nitrate effluent concentration was about 100 mg/L as NO_3 in both columns (note that Cr (VI) reduced below 1000µg/L on Day 5). The effluent concentration gradually increased after Day 11, but remained below 150 mg/L as NO_3 until Day 27. On Day 28, nitrate concentrations increased to about 250 mg/L as NO_3 (note that the Cr (VI) increased to about 500 µg/L on Day 29 and continued to increase up to about 16000 µg/L). Therefore, Cr (VI) impacts nitrate reduction, as seen earlier for the QAL columns. However, the level of nitrate reduction for the UMCf columns was less than that observed for QAL.

Figure 5.38 (b) shows the nitrate concentrations in UMCf columns with low amount of substrate (mixture of Industrial Sugar Wastewater and EOS-PRO). The effluent nitrate concentration was about 300 mg/L as NO_3 until Day 43. On Day 44, the concentrations increased for an unknown reason. On Day 45, nitrate decreased slightly (about 150 mg/L as NO_3), continuing to below 100 mg/L as NO_3 on Day 98. Therefore, for both chromium and nitrate biological reduction was poorer in the UMCf columns than in the QAL columns. **Note that the Cr (VI) degradation was slow in UMCf columns. Only after Day 79 was the Cr (VI) below 1000 µg/L in Column A and after Day 85 in Column B. The nitrate remained below 150 mg/L as NO_3 throughout the study period, except for Day 147 in UMCf Column B. As mentioned earlier, in the field UMCf contact times are greater than the ones simulated in the UMCf columns and reduction is expected to be more effective.**

In the QAL columns, nitrate reduction to < 1 mg/L was observed when chromium concentrations were below detection; for the UMCf columns, the lowest nitrate obtained was 50 mg/L. Again, this difference is due to the shorter contact time (5.2 to 7.2 days) in the UMCf columns as compared to that in the QAL columns (8.9 to 10.6 days). In the field, UMCf contact times will be much greater than the ones that were feasible to simulate in the laboratory.


a. Effluent nitrate concentrations (mg/L as NO_3) concentrations in UMCF columns fed with high substrate-mixture of Industrial Sugar Wastewater and EOS-PRO (45880 mg/L COD eq) or EOS-PRO alone (4000 mg/L to 8000 mg/L COD eq) as substrate or no substrate
■ UMCF - Column A
▧ UMCF - Column B
Substrate was changed to EOS-PRO alone (4000 mg/L COD eq)
Substrate was increased to EOS-PRO alone (8000 mg/L COD eq)
Nitrate concentration (mg/L as NO_3)
400
350
300
250
200
150
100
50
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 29 30 31 32 33 34 38 39 40
Time (Days)

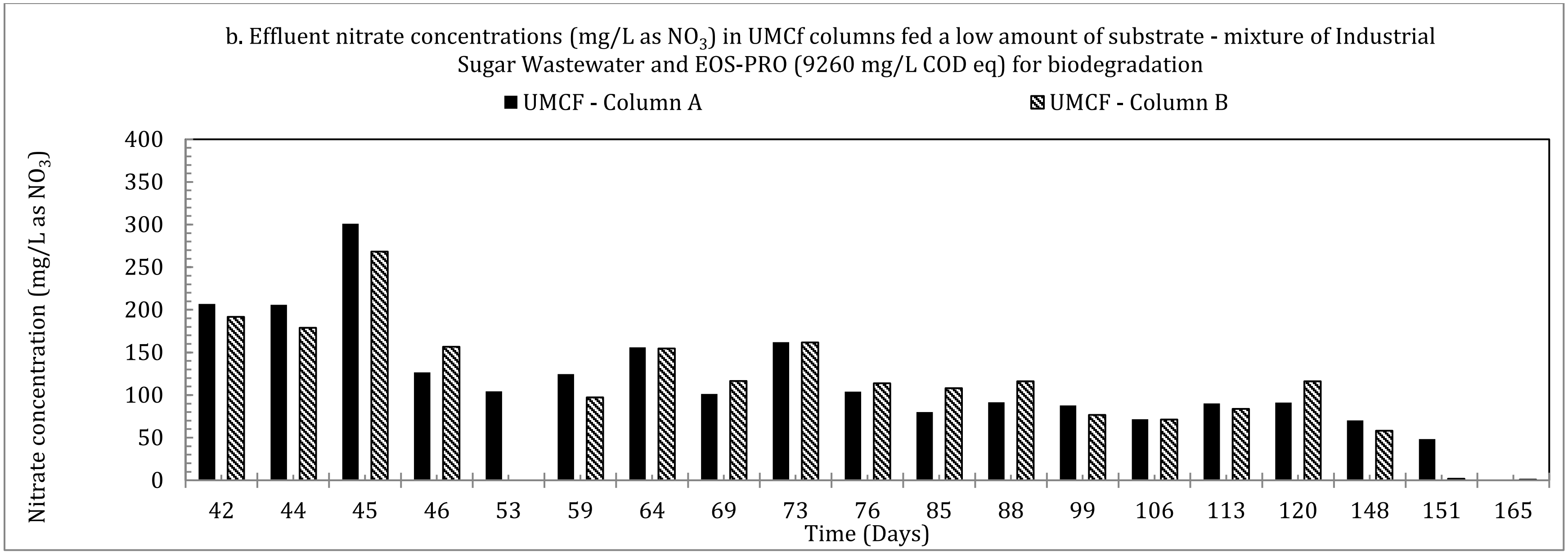


Figure 5.38: Effluent nitrate concentrations in the UMCf.

5.2.5 Chlorate Concentrations

Figure 5.39 shows the effluent concentrations of chlorate over the study period in QAL columns. Chlorate was not measured in all samples because it was not biodegrading initially. The lag in biodegradation is due to the negative impact of Cr (VI) and nitrate on chlorate and perchlorate degradation. Chlorate degradation was observed by Day 24, after Cr (VI) was below non-detect and nitrate levels were about 2 mg/L as NO_3 in both columns. Therefore, the QAL columns results show that chlorate will degrade after nitrate and Cr (VI) have been utilized. The impact of nitrate on chlorate degradation was observed on Day 64 when the nitrate was less than 2 mg/L as NO_3 in Column A and Column B had about 17 mg/L as NO_3. The effluent chlorate in Column A was half (about 250 mg/L) of the chlorate in Column B (about 500 mg/L). On Day 108, chlorate was observed at half of its influent concentration, thw significant increase is suspected to be related to the cracks formed during the power outage on Day 105. After Day 127, no chlorate was observed in the QAL columns—correlating to the period where both Cr (VI) and nitrate had also reduced.

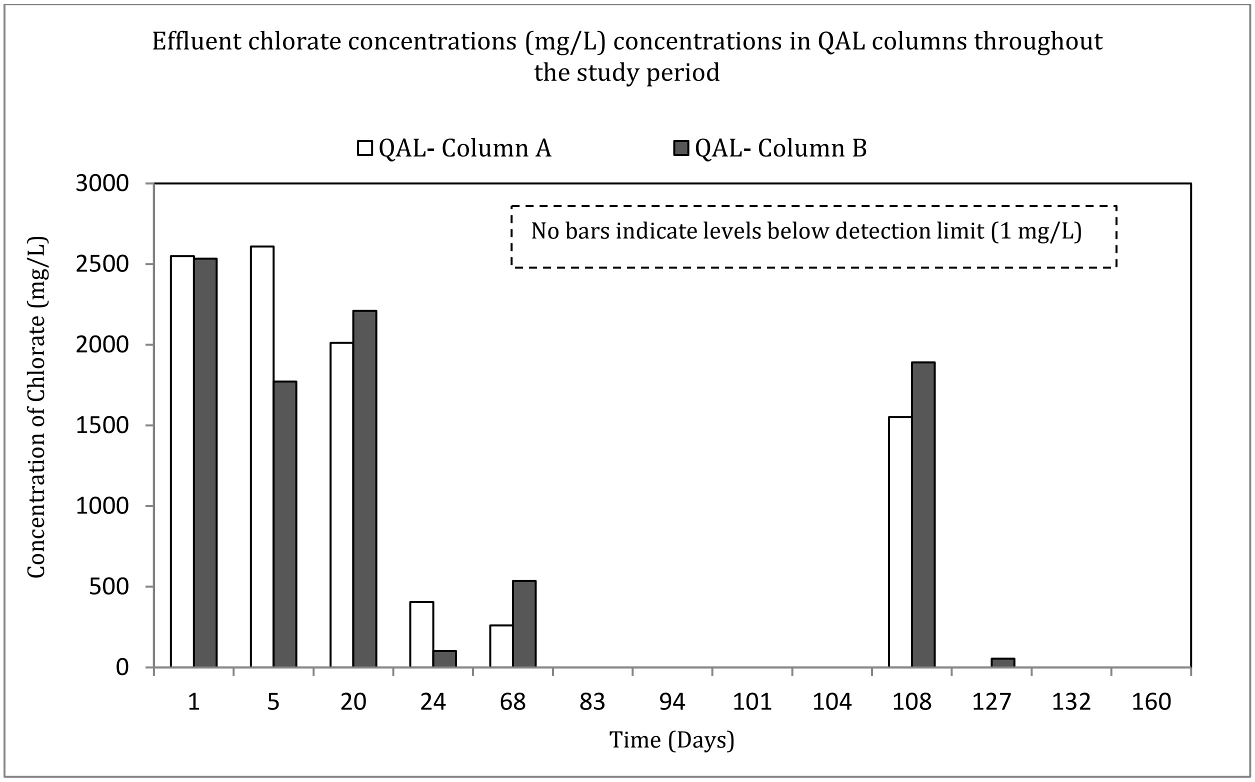


Figure 5.39: Effluent chlorate concentrations in the QAL.

Figure 5.40 shows the effluent concentrations of chlorate in UMCf columns A and B. On Day 113, chlorate was observed at half of its initial influent concentration (i.e 3000 mg/L). In UMCf column A, no chlorate was observed on Day 137 as on Day 151 in UMCf column B. For the UMCf columns, chlorate was biodegraded to non-detectable levels after Day 151 and after Cr (VI) and nitrate had been reduced.

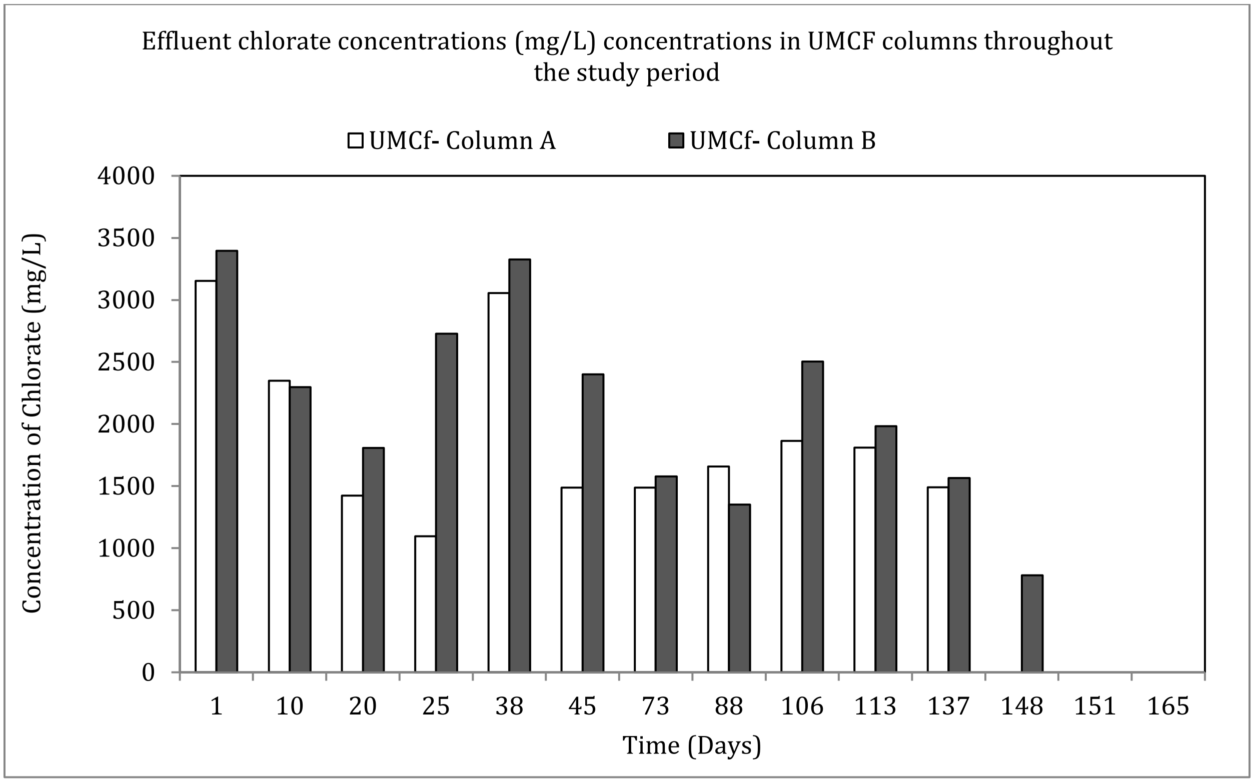


Figure 5.40: Effluent chlorate concentrations in the UMCf.

5.2.6 Perchlorate Reduction

Figure 5.41 shows the effluent perchlorate concentration in QAL columns. No perchlorate degradation was observed until Day 101 in QAL columns. The lower value of perchlorate on Day 17 (not shown on graph) relates to the lower influent perchlorate concentration (about 300 mg/L) fed to the column prior to this date. On Day 115, the perchlorate concentration was half the initial concentration in both columns. Recall that chlorate had degraded about 50% by Day 68 and was completely degraded on Day 127.

Therefore, the degradation of perchlorate—observed in Day 132 of QAL—follows chlorate degradation.

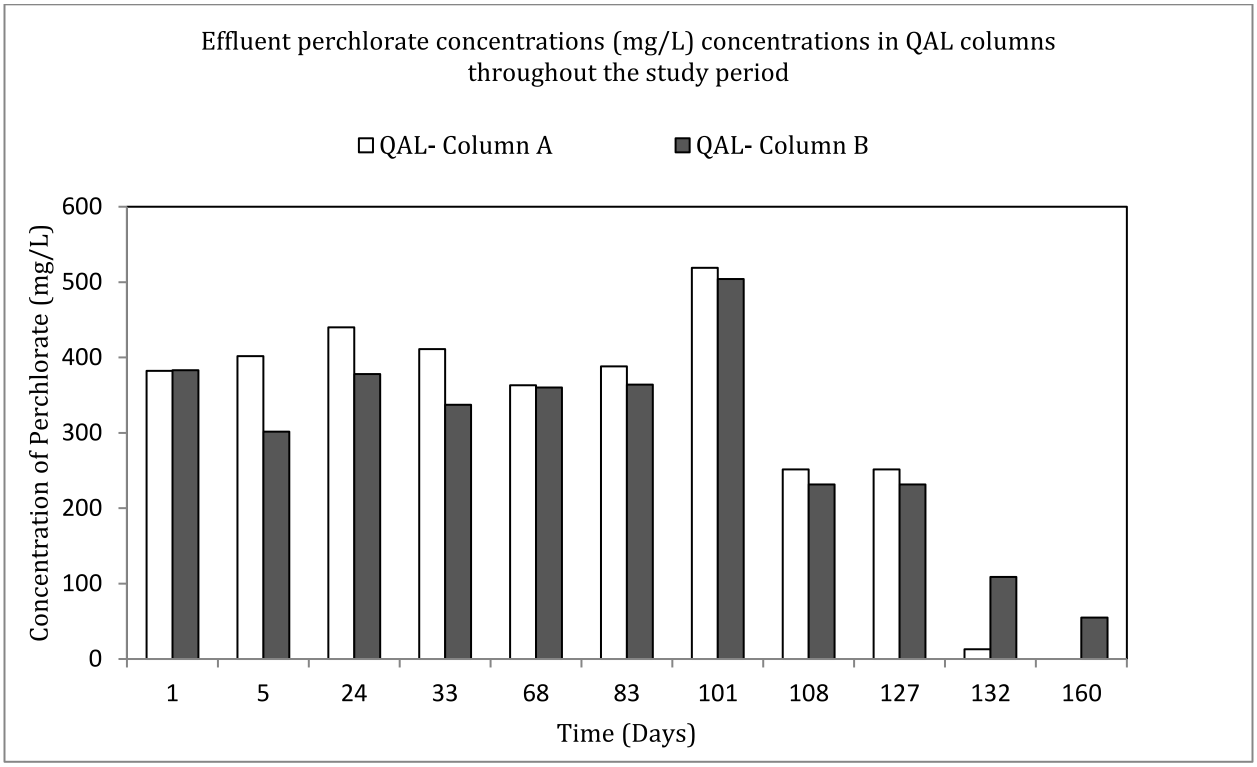


Figure 5.41: Effluent perchlorate concentrations in the QAL.

Figure 5.42 shows the effluent perchlorate concentration in UMCf columns. No perchlorate degradation was observed until Day 165 in UMCf columns. On Day 1, the influent perchlorate concentration was 337 mg/L, but the groundwater obtained on Day 20 and onwards had a perchlorate concentration above 500 mg/L. Therefore, the lower effluent perchlorate concentrations observed in the beginning of the run relates to the lower concentrations in the feed groundwater.

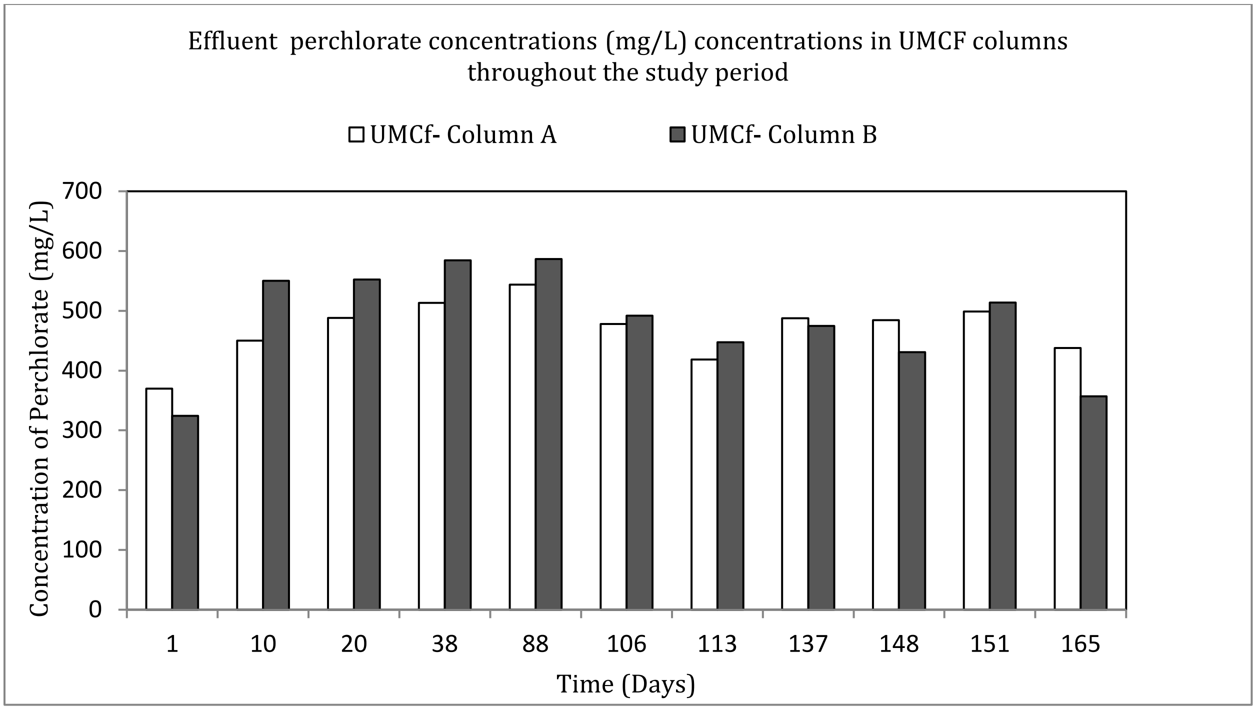


Figure 5.42: Effluent perchlorate concentrations in the UMCf.

5.2.7 Overall Degredation Timelines

The timeline and sequence of degradation for the contaminants of concern in the QAL and UMCf columns is illustrated in Figure 5.43. **Notice that for QAL, chromium is reduced in about a week and nitrate degrades in about a month. However, three times more time is needed to degrade chlorate, and perchlorate degradation follows after chlorate degrades. For UMCf, it took longer to degrade each of the contaminants, especially nitrate which took 123 days to biodegrade.**

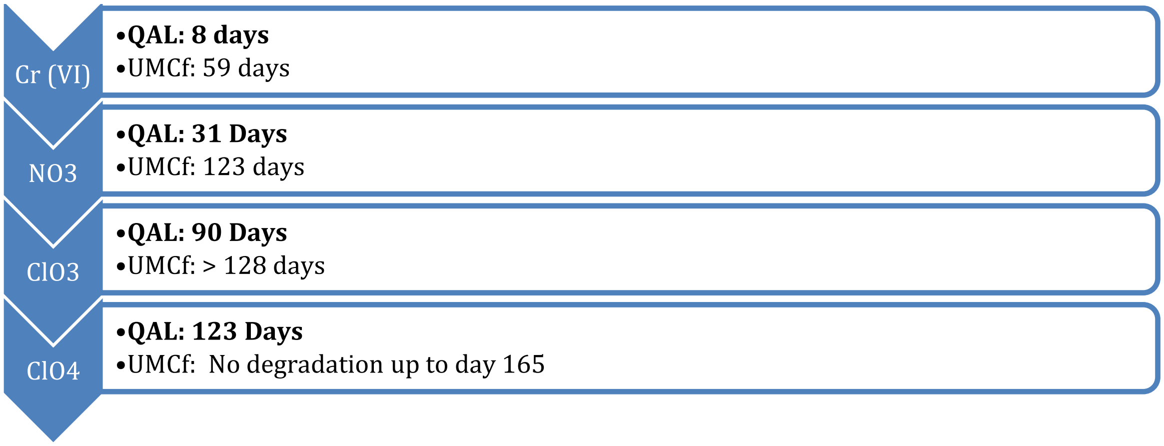
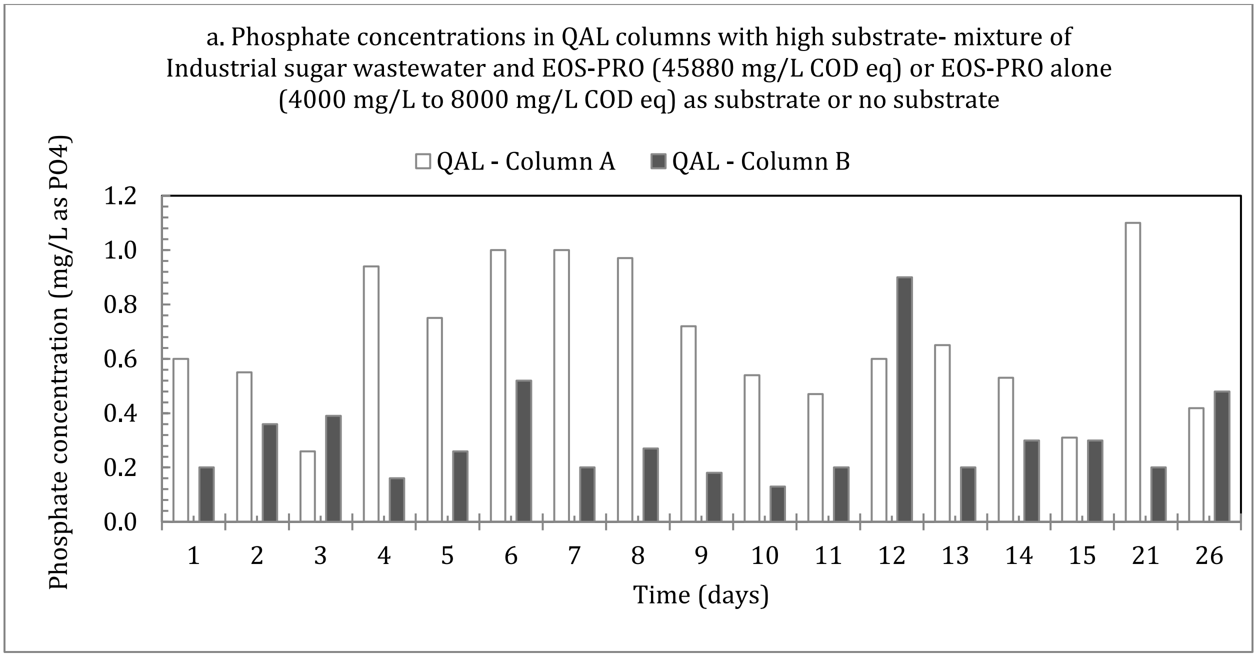


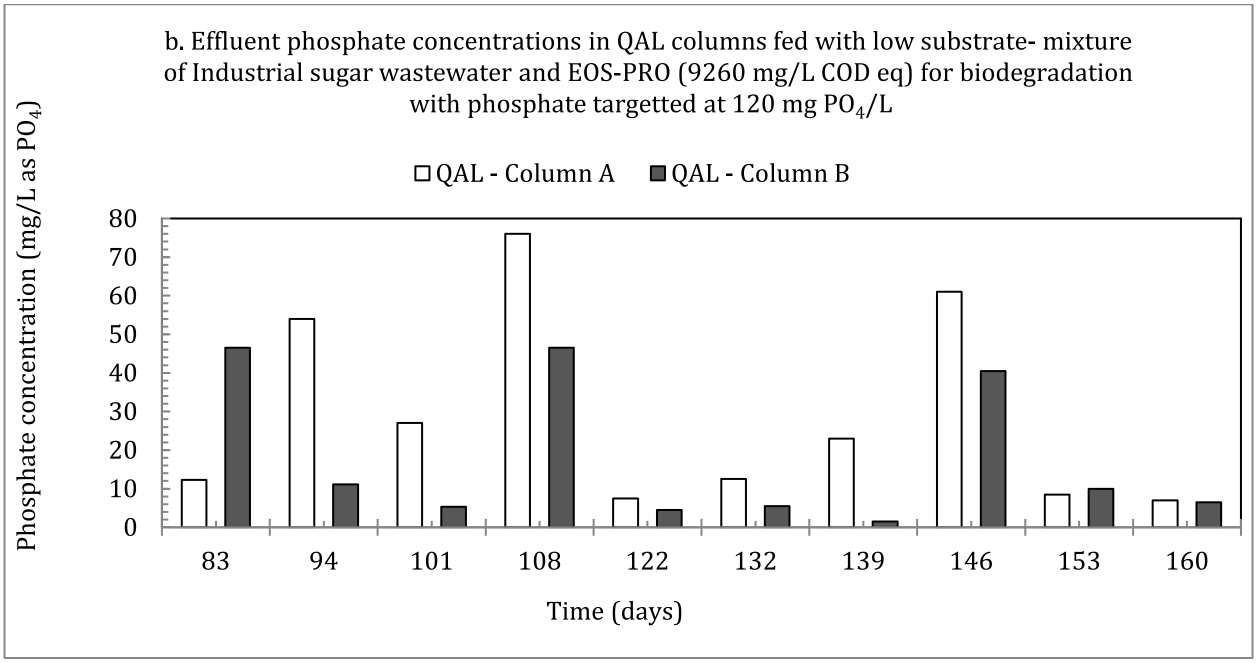
Figure 5.43: Timeline for degradation of contaminant in the columns

5.2.8 Phosphate Concentrations

Figures 5.44 (a) and (b) present the phosphate concentrations in QAL columns, and Figure 5.45 (a) and Figure 5.45 (b) depict the phosphate concentrations in UMCf Columns. No additional phosphate was added during the high substrate feeding period. Therefore, the readings were below 1.2 mg/L as PO_4 for all the QAL and UMCf columns. During the low strength substrate feeding, phosphate was added at about 120 mg/L as PO_4 along with the substrate. For the QAL columns, the effluent PO_4 concentrations were between 10- 30 mg/L as PO_4 for most of the days during low strength substrate column feeding. In the UMC columns, the effluent PO_4 concentrations were even higher. These results indicate that the phosphate levels in the feed were too high and should be reduced in future testing or in the field pilot test.

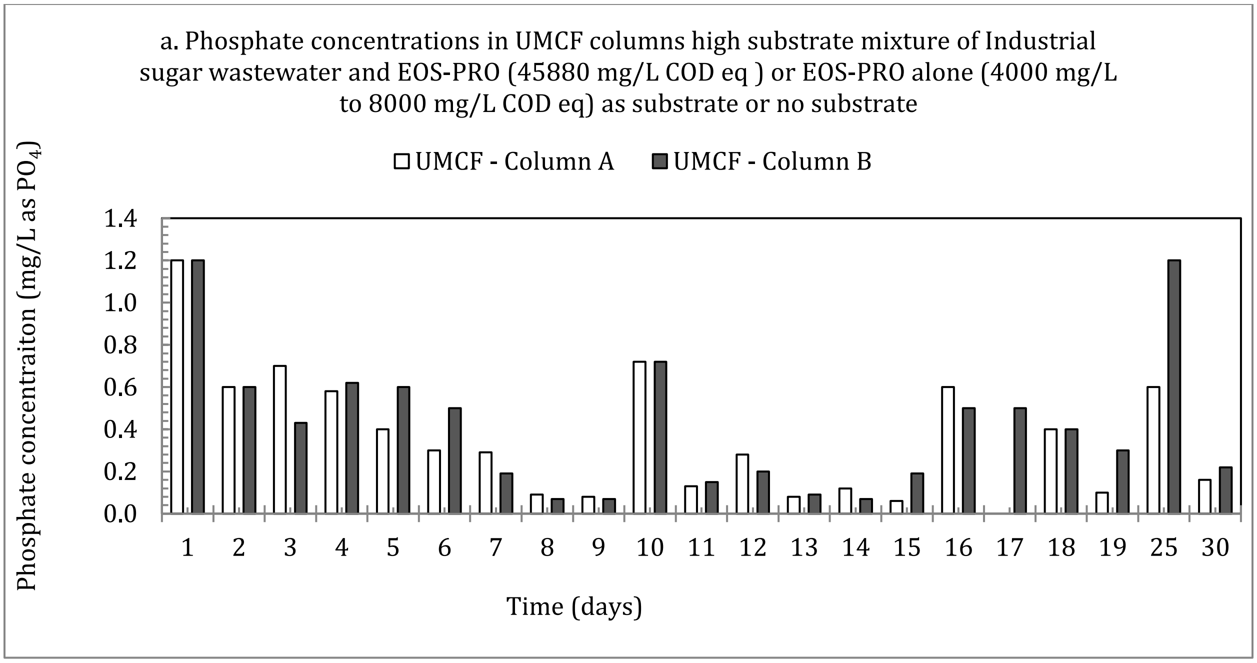


a. Phosphate concentrations in QAL columns with high substrate- mixture of Industrial sugar wastewater and EOS-PRO (45880 mg/L COD eq) or EOS-PRO alone (4000 mg/L to 8000 mg/L COD eq) as substrate or no substrate



b. Effluent phosphate concentrations in QAL columns fed with low substrate- mixture of Industrial sugar wastewater and EOS-PRO (9260 mg/L COD eq) for biodegradation with phosphate targetted at 120 mg PO_4/L

Figure 5.44: Effluent phosphate concentrations in the QAL.



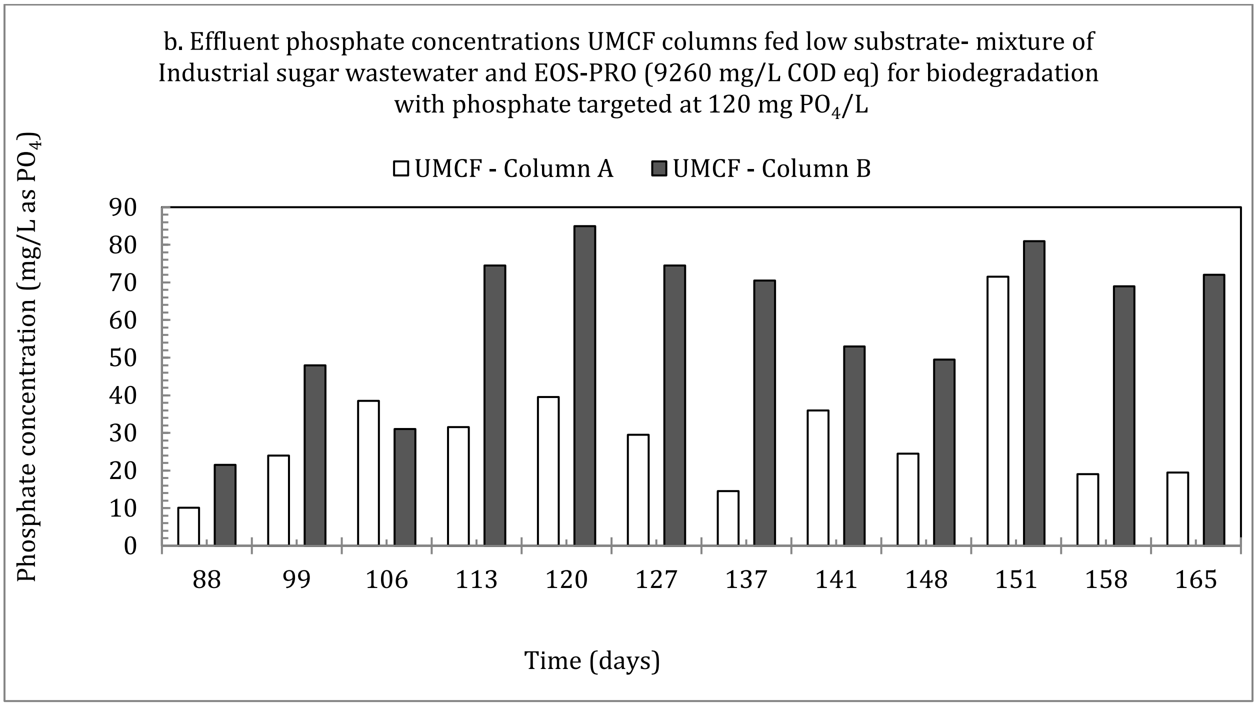


Figure 5.45: Effluent phosphate concentrations in the UMCf.

6. References

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APPENDICES

Appendix A: Investigation of analytical interference with Cr (VI) in QAL groundwater

A.1 Issues with Measuring Low Cr (VI) Concentration QAL Groundwater

Problems measuring low chromium concentrations were first encountered in chemical batch testing (section 2.4). The groundwater spiked with high concentration of Cr (VI) measured 10,500 μg Cr^{+6}/L and 9800 μg Cr^{+6}/L for QAL and UMCf, respectively. The groundwater spiked with low concentration of Cr (VI) measured 520 μg Cr^{+6}/L in groundwater from UMCf. There were analytical interferences detected with measuring Cr (VI) in the spiked 'low concentration' QAL groundwater.

The Hach analytical method used to measure Cr (VI) had low accuracy when measuring QAL groundwater (25-30 ft bgs) spiked with 500 μg Cr^{+6}/L. The possible constituent interferrences listed in the Hach method were Iron (> 1mg/L), mercurous/mercuric ions, highly buffered or extreme pH, turbidity, and vanadium (1 mg/L). The analytical results showed that the groundwater does not contain iron, pH, or turbidity exceeding the limits of interference. Mercurous/mercuric ions and vanadium were not analyzed. Therefore, a method sensitivity test was performed by spiking QAL and UMCf groundwater and a deionized water blank with chromium concentrations of 500, 1000, 2000, 3000, 4000, 5000, and 10000 μg Cr^{+6}/L. The Cr (VI) concentrations were measured immediately after mixing and a percentage error was calculated for each test. Table A.1 shows that the percentage error in QAL samples increased as the concentration of the chromium decreased.

Table A.1: Chromium Standarization Test Results using Groundwater from 25-30 ft spiked to 500, 1000, 2000, 3000, 4000, 5000, and 10000 µg Cr^{+6}/L

	QAL groundwater		UMCf groundwater		Blank (DI water)	
Expected (µg Cr^{+6}/L)	Measured (µg Cr^{+6})	Error (%)	Measured (µg Cr^{+6})	Error (%)	Measured (µg Cr^{+6})	Error (%)
10000	8600	14	NA		NA	
5000	4600	8	NA		NA	
4000	2500	37.5	4020	-0.5	4000	0
3000	2000	33.3	NA		NA	
2000	240	88	2080	-4	2040	-6
1000	120	88	1040	-4	1060	-6
500	70	86	520	-4	520	-4

In the QAL samples, Cr (VI) analysis of concentration ≥ 5000 µg/L had analytical error < 15%, which is the QA/QC threshold typically followed in our laboratory. Therefore, QAL measurement of concentrations < 5,000 µg/L (0.5 mg/L) will incur significant error margins. To eliminate this issue, total chromium concentrations were measured using inductively coupled plasma (ICP) for the QAL samples. The results of the sensitivity tests performed in UMCf groundwater (35-40 ft bgs) and a spiked blank (with nanopure water) exhibited no analytical issue with Cr (VI).

The QAL groundwater was analyzed for COD and phosphate (Table A.2) to detect other potential interferences with the Hach method (not listed in the Hach document, but potential interferences for other methods). The COD of the QAL groundwater, 58 mg/L, is relatively high for groundwater and reflects the potential presence of organic compounds. After spiking with Cr (VI), duplicate analyses of QAL with the elevated COD showed an error of 14% in the chromium analysis. This difference is within the expected 15% error for the laboratory QA/QC. Palmer and Puls (1994) suggested that hexavalent chromium can be immobilized within soils in the presence of natural organic matter. The nature of the organic compounds present in the QAL groundwater was not known at the time of these analyses. It was suspected that organics may be interfering or immobilizing hexavalent chromium in the QAL groundwater.

Table A.2: Other Contaminants in Groundwater from 25-30 ft spiked with 2000 µg Cr^{+6}/L

	Concentration in QAL groundwater	Concentration in QAL groundwater after spiking with 500 µg Cr^{+6}/L	Error (%)
Ferrous Iron (mg/L)	0.07	0.06	14.28
COD (mg/L)	58	50	13.80
Phosphate (mg/L)	0.52	0.50	3.84
Chromium(µg/L)	40	70	42.85

To test the hypothesis that the Cr (VI) analysis is affected by the presence of organics in the QAL groundwater, the groundwater was first diluted (1, 5, 10, and 100 times) and then spiked with 500 µg Cr^{+6}/L. Further, the 10X diluted groundwater spiked with with 500 µg Cr^{+6}/L, was further diluted by 2 and 10 times (final dilutions of the groundwater were 20 and 100) such that the expected chromium concentrations were 250 µg Cr^{+6}/L and 50 µg Cr^{+6}/L, respectively. The expected and measured Cr (VI) concentrations in the diluted QAL groundwater, and the percent error are presented in Table A.3.

Table A.3: Chromium Test in Diluted Groundwater from 25-30 ft spiked with 500 µg Cr^{+6}/L

GW Diluted by Factor	Expected value µg/L Cr^{+6}	Readings µg/L Cr^{+6}	Error (%)
No dilution	500	70	86.0
5	500	70	86.0
10†	500	140	97.2
10	500	160	68.0
20*	250	210	16.0
100	500	470	6.0
100	500	490	2.0
100*	500	520	4.0

*The samples were diluted from the diluted GW at the dilution factor of 10†.

The data in Table A.3 show that the accuracy of chromium measurement in the QAL groundwater improved with increased dilution. Therefore, it was concluded that organic compounds were possibly interfering with Cr (VI) analysis. Independent analyses of QAL groundwater (Tetra Tech communication from 2016) for typical simple organics (i.e., short chain fatty acids) were performed and the results indicated that acetic acid, formic acid, lactic acid, n-butyric acid, propionic acid, and pyruvic acids were not detected. Tetra-tech performed these field tests to detect organics in the groundwater.

Following, the QAL groundwater was pretreated with granular activated carbon (GAC, Calgon Carbon-F400), as an attempt to remove potential organic compound interfering the Cr (VI) analysis. Some GACs also remove chromium, but the groundwater was spiked with Cr (VI) after processing through the GAC (Satapaty et al., 2005). The QAL groundwater was filtered through 50 mL GAC at the rate of 25 mL/min or 1 mL/min. Further, the GAC-treated groundwater was diluted by 5, 10 and 100 times. Finally, the groundwater was spiked with 500 µg Cr^{+6}/L. Table A.4 shows the results for the GAC treated and diluted groundwater sample. COD remained similar to that of the groundwater.

Table A.4: Chromium Test in Diluted QAL Groundwater spiked with 500 µg Cr^{+6}/L

QAL groundwater with initial COD 43.6 mg/L							
Flow rate of 25 mL/min COD after GAC treatment: 48.6 mg/L				Flow rate of 1 mL/min COD after GAC treatment: 50 mg/L			
GW Diluted by Factor	Expected value µg/L Cr^{+6}	Readings mg/L Cr^{+6}	Error (%)	GW Diluted by Factor	Expected value µg/L Cr^{+6}	Readings µg/L Cr^{+6}	Error (%)
No dilution	500	0	100	1	500	10	98
No dilution	500	20	96	1	500	20	96
5	500	110	78	5	500	50	90
10	500	180	64	5	500	90	82
20	500	360	28	20	500	420	16
100	500	470	6	100	500	470	6
100	500	480	4	100	500	480	4

The results show that the potential interfering compounds present in the groundwater are not removed by granular activated carbon. It is not know at this time what compound in the groundwater is interfering with the Cr (VI) analysis. However, dilution with deionized water (100X) eliminated the interference with chromium (VI) analysis. This dilution was then used for the Cr (VI) analysis for QAL. In addition, total chromium analyses were performed using ICP.

Appendix B: Preliminary Batch Testing

The experimental methodology used for the preliminary batch testing can be found in section 2.4. Calcium polysulfide was used in the batch tests to reduce Cr (VI) to Cr (III) and precipitate Cr (III) as Cr $(OH)_3$. Calcium polysulfide (CaSx) (Calmet ®) was obtained from Best Sulfur products (Fresno, CA). It contains lime sulfur (calcium sulfide) at 24-29% by weight. The pH of CaSx ranges between 11.5 to 11.7 and the relative density is 1.27.

The ferrous sulfate solution was obtained from the product provided by Brenntag (Las Vegas, NV) to Envirogen at the NERT site. It contains 6% Fe by weight and the relative density is 1.203.

B.1 Preliminary Batch Testing Matrix for Cr (VI) Removal from QAL and UMCf Groundwater

Preliminary batch tests were conducted to determine the coagulant dose range required to remove low and high levels of chromium from the groundwater. The test was conducted with groundwater spiked with 10000 µg Cr^{+6}/L and 500 µg Cr^{+6}/L. For the preliminary tests, two (2X) and three times (3X) the stoichiometric requirement for CaSx, and ten (10X) and thirty times (30X) the stoichiometric requirement for ferrous sulfate were selected. Table B1 shows the matrix for the tests.

Table B.1: Matrix for the Preliminary Testing with High and Low Concentrations of Cr (VI)

		High concentration of Cr (VI)		Low concentration of Cr (VI)	
		mL of CaSx/ 1000 L groundwater	mL of FeSO4/ 1000 L groundwater	mL of CaSx/ 1000 L groundwater	mL of FeSO4/ 1000 L groundwater
Selected ratio times the stoichio. ratio (1.5 moles CaSx/mole Cr^{+6})	2X	336		34	
	3X	505		50	
Selected ratio times the stoichio. Ratio (3 moles of Fe/ mole of Cr^{+6})	10X		4472		224
	30X		8945		671

Raw CaSx = undiluted, as it comes from manufacturer.

B.2 Preliminary Batch Test Result for High Concentration of Chromium

The preliminary result for the high chromium concentration indicated that for QAL groundwater, calcium polysulfide at 2X the stoichiometric requirement and ferrous sulfate at 10X the stoichiometric requirement produced better removal (Table B2). The post-treatment concentrations of chromium for the QAL groundwater were both 20 µg Cr^{+6}/L (99.8% removal). However, results for the UMCf groundwater were poor and removal was only 8-11% with CaSx. For FeSO4, the removal in UMCf varied widely from 8-92%. It was suspected that the poor removal of Cr was associated with the very low turbidity of the UMCf groundwater (UMCf turbidity ~ 6NTU). Therefore, further batch testing was peformed with UMCf groundwater in which one gram of dry UMCf soil per liter of UMCf groundwater was added.

Table B.2: Preliminary Batch Precipitation Test Results Groundwater with High Chromium Concentration (10200 µg/L)

Selected ratio times the stoichio. ratio (1.5 moles CaSx/mole Cr+6)	Groundwater with initial concentration of 10200 µg/L Cr^{+6}				Selected ratio times the stoichio. Ratio (3 moles of Fe/ mole of Cr+6)	Groundwater with initial concentration 10200 µg/L Cr^{+6}			
	QAL		UMCf			QAL		UMCf	
	Final µg/L Cr^{+6}	% removal	Final µg/L Cr^{+6}	% removal		Final µg/L Cr^{+6}	% removal	Final µg/L Cr^{+6}	% removal
2X	20	**99.8**	**9400**	**7.84**	10X	20	**99.8**	**9400**	**7.84**
3X	0	**100**	**9000**	**11.7**	30X	50	**99.5**	**800**	**92.1**

The results of the batch tests with addition of soil to the UMCf groundwater exhibited final Cr concentrations of 10 µg Cr^{+6}/L (99.9% removal) for 2X CaSx and 30 µg Cr^{+6}/L (99.7% removal) with 30X $FeSO_4$. It is well established that coagulation in low tubidty water, such as the groundwater from the UMCf, is not effective (Muyibi et al., 1995).

Table B.3: Batch Test for UMCf Groundwater with addition of 1g dry UMCf soil/L groundwater

Groundwater with initial concentration 10200 µg/L Cr $^{+6}$ with 1g dry UMCf soil/L					
Calcium Polysulfide			Ferrous Sulfate		
Selected ratio times the stoichio. ratio (1.5 moles CaSx/mole Cr^{+6})	Final µg/L Cr^{+6}	% removal	Selected ratio times the Stoichio. Ratio (3 moles of Fe/ mole of Cr^{+6})	Final µg/L Cr^{+6}	% removal
2X	10	**99.9**	10X	**45**	**99.6**
3X	30	**99.7**	30X	**30**	**99.7**

B.3 Preliminary Batch Coagulation Test Using Low Cr Concentration

Preliminary batch coagulation tests were conducted without adding chromium to the groundwater because it already contained relatively low concentrations of chromium. The results of the batch testing for the selected ratios of 2X and 3X of the stoichiometry for CaSx, and 10X and 30X of the stoichiometry for ferrous sulfate are shown in Table B.4. The final concentration of chromium after precipitation was below the method detection limit (10 µg Cr^{+6}/L) for the QAL groundwater using 3X calcium polysulfide. For the UMCf groundwater, the final concentration was 10 µg Cr^{+6}/L using 10X ferrous sulfate. Note that the initial concentrations for QAL and UMCf groundwater were 50 µg Cr^{+6}/L and 70 µg Cr^{+6}/L, respectively.

In summary, preliminary testing indicated that for high chromium concentration in the QAL, calcium polysulfide at three times (3X) and ferrous sulfate at ten times (10X) the stoichiometric requirement lowered the Cr (VI) concentration to desired levels. For low chromium batch tests, calcium polysulfide at three times (3X) and the ferrous sulfate at 30 times (30X) stoichiometric ratios performed best. CaSx batches had Cr (VI) below 10 µg Cr^{+6}/L, but in batches with ferrous sulfate the 10 µg Cr^{+6}/L goal could not be met.

For the UMCf groundwater with high or low concentrations of Cr (VI), neither the use of CaSx nor ferrous sulfate met the 10 µg Cr^{+6}/L goal. The UMCF groundwater was free of any suspended solids—the clays that constitute the UMCf act as a filter and result in very clear groundwater—while the QAL groundwater contained a significant amount of suspended solids (turbidity in QAL was 1471 NTU). It was suspected that the poor coagulation of UMCf groundwater as compared to QAL groundwater was related to lack of suspended solids (turbidity in UMCf was 6 NTU). It is well known in water treatment, that the absence of suspended solids results in poor coagulation (Crittenden et al. 2012).

To evaluate this hypothesis, further testing was performed by adding a gram of dry UMCf soil per liter of UMCf groundwater. The results showed improved removal with addition of soil; achieving similar removals to QAL when using CaSx at 2X the stoichiometric requirement and ferrous sulfate at 10X the stoichiometric requirement. However, the test with ferrous sulfate and groundwater mixed with soil still did not meet the desired 10 μg Cr^{+6}/L permit requirement.

Table B.4: Preliminary Batch Precipitation Test Results using Groundwater at Low Chromium Concentration with CaSx and FeSO4

CaSx					FeSO4				
Selected ratio times the stoichio. ratio (1.5 moles CaSx/mole Cr^{+6})	QAL groundwater a with **initial concentration 50 µg/L Cr^{+6}**		UMCf groundwater with **initial concentration 70 µg/L Cr^{+6}**		Selected ratio times the Stoichio. mass ratio (3moles Fe/ mole Cr^{+6})	QAL groundwater a with **initial concentration 50 µg/L Cr^{+6}**		UMCf groundwater with **initial concentration 70 µg/L Cr^{+6}**	
	Final µg Cr^{+6}/L	% removal	Final µg Cr^{+6}/L	% removal		Final µg Cr^{+6}/L	% removal	Final µg Cr^{+6}/L	% removal
2X	20	**60**	**20**	**71.4**	10X	10	**80**	**40**	**42.8**
3X	0	**100**	**30**	**57.1**	30X	30	**40**	**20**	**71.4**

Appendix C: Final Test Matrix for CaSx and Ferrous Sulfate Coagulation

The matrices in this appendix are for the secondary chemical batch testing discussed in section 2.4.3 and section 4.1.

C.1 Matrices for Final Batch Testing with QAL and UMCf Groundwater

Table C.1: Matrix for QAL and UMCf for High and Low Concentrations of Cr (VI)

Calcium Polysulfide with QAL and UMCF			Ferrous sulfate with QAL andUMCf		
Selected ratio times the stoichiometric ratio (1.5 moles CaSx/mole Cr^{+6})	mL of CaSx / 1000 L groundwater		**Selected ratio times the Stoichiometric ratio (3moles Fe/ mole Cr^{+6})**	mL of $FeSO_4$ / 1000 L groundwater	
	High Concentration	Low Concentration		High Concentration	Low Concentration
1.5	252		5	2236	
1.5	252		5	2236	
2	336	34	10	4472	224
2	336	34	10	4472	224
3	505	50	20	8945	447
3	505	50	20	8945	447
4	673	67	30	13417	671
5	841	84	50	22361	1118
5	841	84	50	22361	1118

Table C.2: Matrix for QAL and UMCf with filtered groundwater and addition of soil

Sample type	**Selected ratio times the stoichiometric ratio**	Volume of CaSx Raw CaSx mL/ 1000 L groundwater	Volume of $FeSO_4$ mL/ 1000 L groundwater
Filtered through coffee filter	5	842	2236
	5	842	2236
	10	1682	4472
1 g soil added to the filtered groundwater	5	842	2236
	5	842	2236
	10	1682	4472

C.2 Data for Final Batch Testing with QAL and UMCf Groundwater

Table C3: pH in Batch Tests with High Cr (VI) concentrations in QAL and UMCf Groundwater (Initial Concentration= 10500 µg Cr^{+6}/L) Using Calcium Polysulfide (CaSx, 27%) and Ferrous Sulfate (6%)

Selected ratio times the stoichiometric ratio (1.5 moles CaSx/mole Cr^{+6})	**Calcium Polysulfide**		**Selected ratio times the Stoichiometric ratio (3moles Fe/ mole Cr^{+6})**	**Ferrous Sulfate**	
	QAL	**UMCf**		**QAL**	**UMCf**
1.5X	8.01	7.78	5X	6.3	5.9
1.5X	8.12	7.85	5X	6.15	6.1
2X	8.04	7.81	10X	5.98	6.84
2X	8.06	7.97	10X	6.28	6.25
3X	8.18	7.92	20X	5.99	5.42
3X	8.2	7.93	20X	6.01	5.5
4X	8.26	7.88	30X	5.16	5.18
5X	7.85	7.99	50X	8.08	8.1
5X	8.21	8.03	50X	7.45	8.09

Table C.4: pH in Batch Tests with High Cr (VI) in QAL and UMCf Groundwater to Evaluate the Effect of Solids addition on Chromium Removal

Groundwater treatment for Jar test	**Selected ratio times the stoichiometric ratio for CaSx and Ferrous Sulfate**	**CaSx**	**Ferrous Sulfate**
		QAL	**UMCf**
filtered through coffee filter	5X	8.29	6.98
	5X	8.3	6.28
	10X	8.22	6.42
1 g soil added to the filtered groundwater	5X	8.12	6.81
	5X	8.1	5.98
	10X	8.06	6.62

Table C.5: pH in Batch Test with Low Cr (VI) Concentration in QAL Groundwater (Initial Concentration= 500 µg Cr^{+6}/L) Using Calcium Polysulfide (CaSx, 27%) and Ferrous Sulfate (6%)

Selected ratio times the stoichiometric ratio (1.5 moles CaSx/mole Cr^{+6})	**Calcium Polysulfide**		**Selected ratio times the Stoichiometric ratio (3 moles Fe/ mole Cr^{+6})**	**Ferrous Sulfate**	
	QAL	**UMCf**		**QAL**	**UMCf**
1.5X	7.60	7.52	5X	7.40	7.22
1.5X	7.62	7.48	5X	7.44	7.32
2X	7.60	7.37	10X	7.29	6.98
2X	7.56	7.48	10X	7.32	7.08
5X	7.59	7.41	50X	7.10	6.74
5X	7.57	7.47	50X	7.14	6.75

Table C.6: Turbidity (NTUs) in Samples with Low Cr (VI) concentrations in QAL Groundwater (Initial Concentration= 500 µg Cr^{+6}/L) Using Calcium Polysulfide (CaSx, 27%) and Ferrous Sulfate (6%)

Selected ratio times the stoichiometric ratio (1.5 moles CaSx/mole Cr^{+6})	**Calcium Polysulfide**		**Selected ratio times the stoichiometric ratio (3moles Fe/ mole Cr^{+6})**	**Ferrous Sulfate**	
	QAL	**UMCf**		**QAL**	**UMCf**
1.5X	174	54	5X	201	28
1.5X	181	48	5X	216	31
2X	153	66	10X	178	87
2X	170	70	10X	217	79
5X	146	103	50X	284	139
5X	159	93	50X	200	169

Table C.7: Nitrate (mg NO_3/L) in the Batch Tests with High Cr (VI) Concentrations in QAL and UMCf Groundwater (Initial Concentration= 10500 µg Cr^{+6}/L) Using Calcium Polysulfide (CaSx, 27%) and Ferrous Sulfate (6%)

Calcium Polysulfide			**Ferrous Sulfate**		
Selected ratio times the stoichiometric ratio (1.5 moles CaSx/moles Cr^{+6})	**Nitrate (mg NO_3/L)**		**Selected ratio times the Stoichiometric ratio (3.2 moles Fe/ mole Cr^{+6})**	**Nitrate (mg NO_3/L)**	
	QAL	**UMCf**		**QAL**	**UMCf**
2X	1089.43	628.86	10X	1089.43	602.28
5X	1116.00	611.14	50X	1116.00	389.71

Table C.8: Perchlorate (mg/L) in the Samples for High Cr (VI) in QAL and UMCf Groundwater (Initial Concentration= 10500 µg Cr^{+6}/L) Using Calcium Polysulfide (CaSx, 27%) and Ferrous Sulfate (6%)

Calcium Polysulfide			**Ferrous Sulfate**		
Selected ratio times the stoichiometric ratio (1.5 moles CaSx/moles Cr^{+6})	**Perchlorate (mg/L)**		**Selected ratio times the Stoichiometric ratio (3.2 mg Fe/mg Cr^{+6})**	**Perchlorate (mg/L)**	
	QAL	**UMCf**		**QAL**	**UMCf**
2X	1266.12	1399.27	10X	1194.35	1342.04
5X	1212.15	1384.61	50X	1153.11	1326.04

Appendix D: Preliminary Testing of Chromium Removal Using Columns

A preliminary coagulation test was operated in two columns with soil from the QAL and UMCf horizons of well UFIW-02. Approximately 2.5 kg of sun-dried (at about 107^{o}C) soil was packed into the 2.5 inch diameter columns to mimic water flowrates encountered at the site. The approximate bulk densities of the soils were 1700 kg/m^3 for the QAL column and 1550 kg/m^3 for the UMCf. The groundwater used for this preliminary test was from well BMW1 spiked with 1000 μg Cr^{+6}/L in the feed water. CaSx was the coagulant used.

The QAL column was gravity fed and the UMCf column was operated in downflow mode at 30 psi using a peristaltic pump and a pressure valve built at the UNLV Engineering Shop. Figure D.1 shows the schematic diagram of the columns and their dimensions. In this experiment, the total contact depth of aquifer material was 13.5 inches. The injection port was filled with glassbeads to facilitate chemical injection. Three inches of aquifer material and gravel (cover) were placed above the injection port to prevent calcium polysulfide from diffusing upward. The cover was not considered as contact soil depth for this study since CaSx was injected below the cover. Table D.1 also shows the hydraulic properties of the columns. The empty bed contact times for the QAL and UMCf columns were 12 and 25 hours, respectively. The flowrate in the UMCf column was 0.5 mL/min and the flowrate in the QAL column was 1.0 mL/min at the start of the run.

The calcium polysulfide was injected once a day into the soil in the UMCf column. For the QAL column, a combination of Intravenous (IV) dial valve and flow reducer was used to maintain calcium polysulfide injection at a rate of 170 to 200 μL/min contiuously.

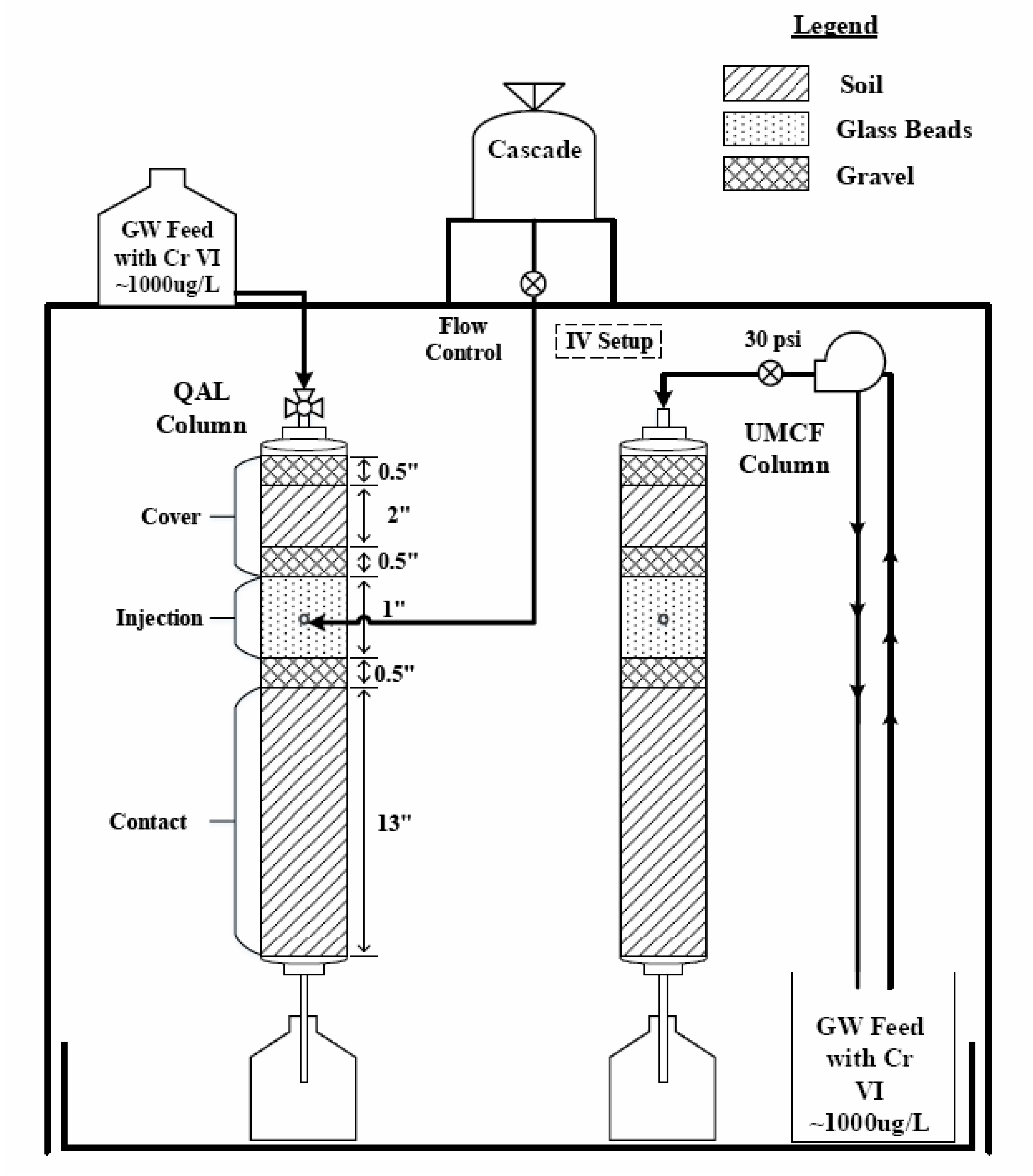


Figure D.1: Schematic diagram of the preliminary columns to remove chromium with CaSx

Table D.1: Hydraulic properties of the columns

QAL column (Gravity fed)			UMCf column (Pressurized at 30 psi)		
Flow (mL/min)	EBCT (hrs)	Hydraulic Conductivity (cm/s)	Flow (mL/min)	EBCT (hrs)	Hydraulic Conductivity (cm/s)
1±0.5	12	8.56 E-04	0.5±0.09	25	8.60 E-06

The preliminary columns were operated for 36 days. Figure D.2 and D.3 show the Cr (VI) effluent concentration measured with the Hach Method and the total dissolved chromium concentration measured by inductively coupled plasma (ICP) in acidified effluent samples. The effluent chromium concentration remained above 10 μg Cr^{+6}/L (target effluent concentration) for the first three days in the UMCf column and the first four days in the QAL column (Figure D.2 indent). The concentrations of Cr (VI) after Day 4 in UMCf and Day 5 in QAL columns were below 10 μg Cr^{+6}/L, except for a few instances. The dissolved total chromium results measured by ICP (Figure D.3) for those days with effluent Cr (VI) concentrations exceeding 10 μg Cr^{+6}/L (except for UMCf sample on Day 7) were lower than the measured Cr (VI) concentrations using the Hach method. The ICP measurements are made in settled and filtered samples that have been acified while the Cr (VI) measurements are not. In addition, ICP is more accurate. Nonetheless, the results showed excellent chromium removals to levels below the permit requirements for NERT. **The QAL column required 5 days and UMCf required 4 days after injecting calcium polysulfide to achieve an initial effluent Cr (VI) concentration below the target level of 10 μg/L.**

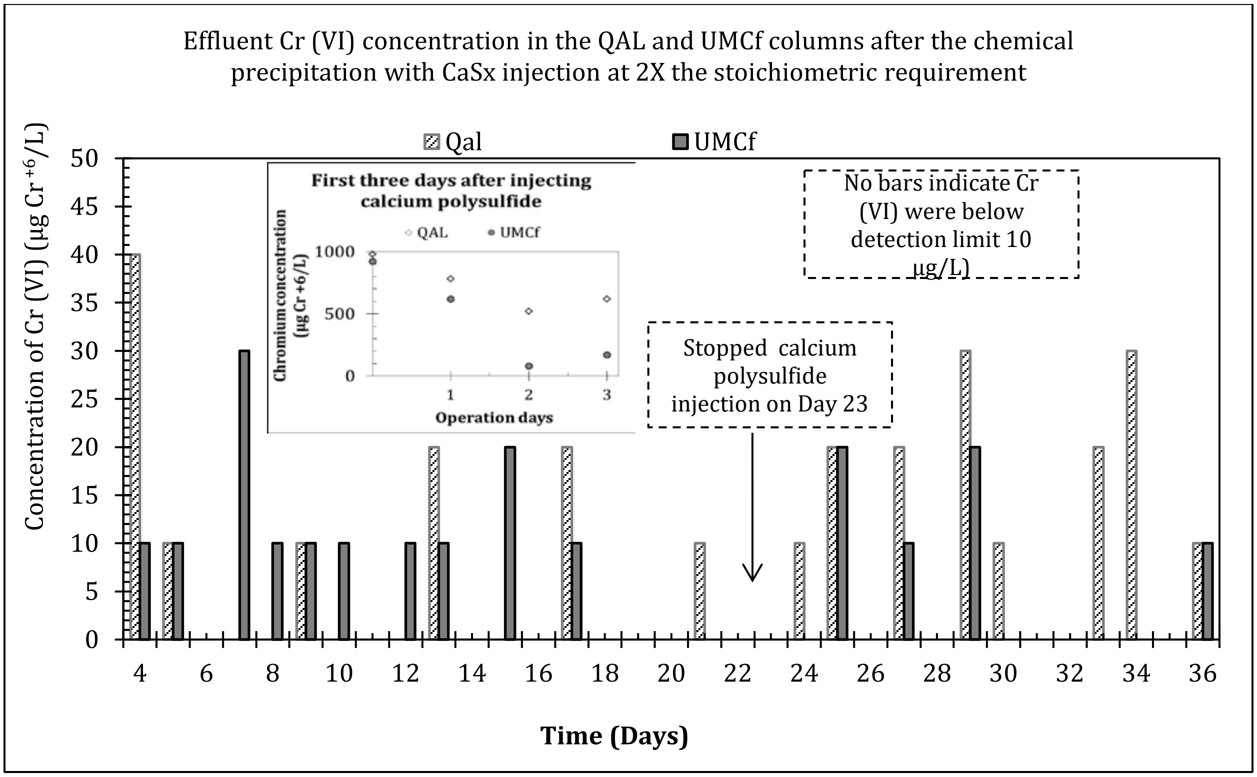


Figure D.2: Effluent Cr (VI) concentrations in the QAL and the UMCf column after chemical precipitation of chromium with calcium polysulfide. The indent in the picture shows chromium concentration in composite samples in days 1 to 3. (Calcium polysulfide was stopped on Day 23 represented by an arrow). The average influent hexavalent chromium concentration was 980±0.01 mg/L and 960 ±0.5 μg/L in QAL and UMCf, respectively. CaSx was fed continuously in QAL column, and was injected each day in UMCf column.

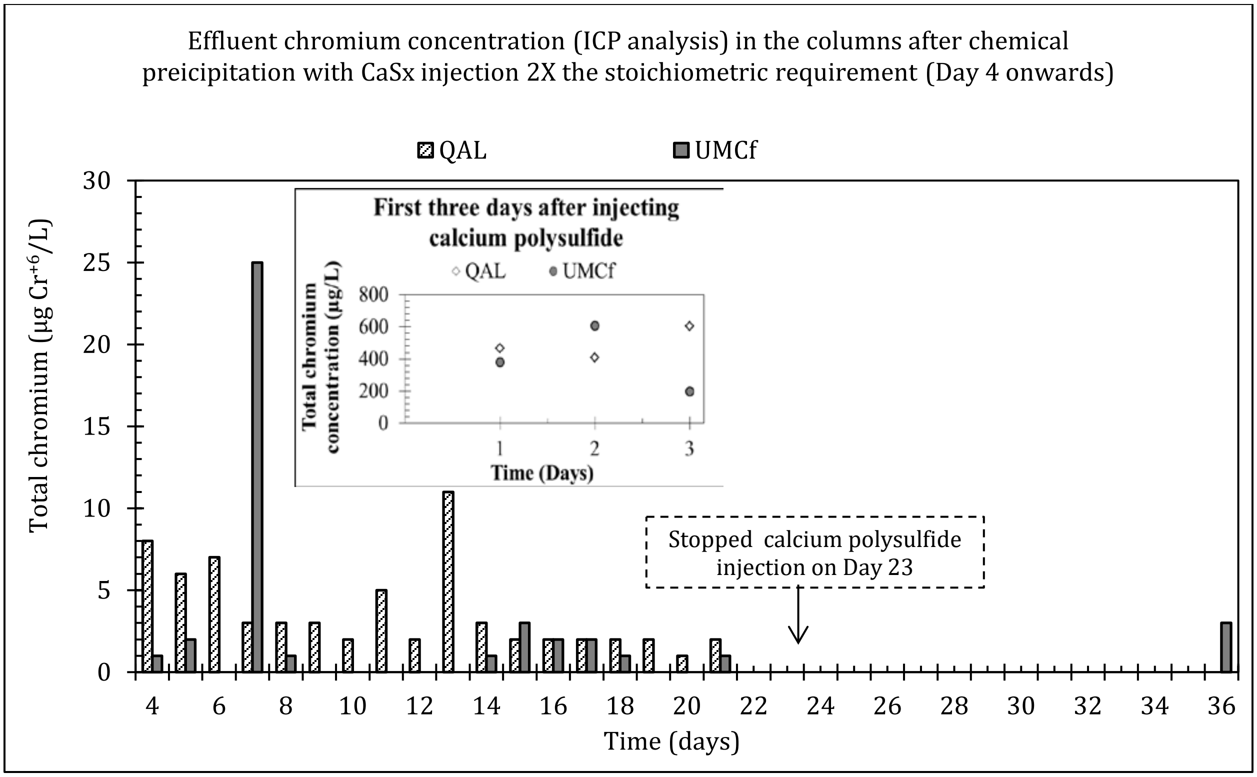


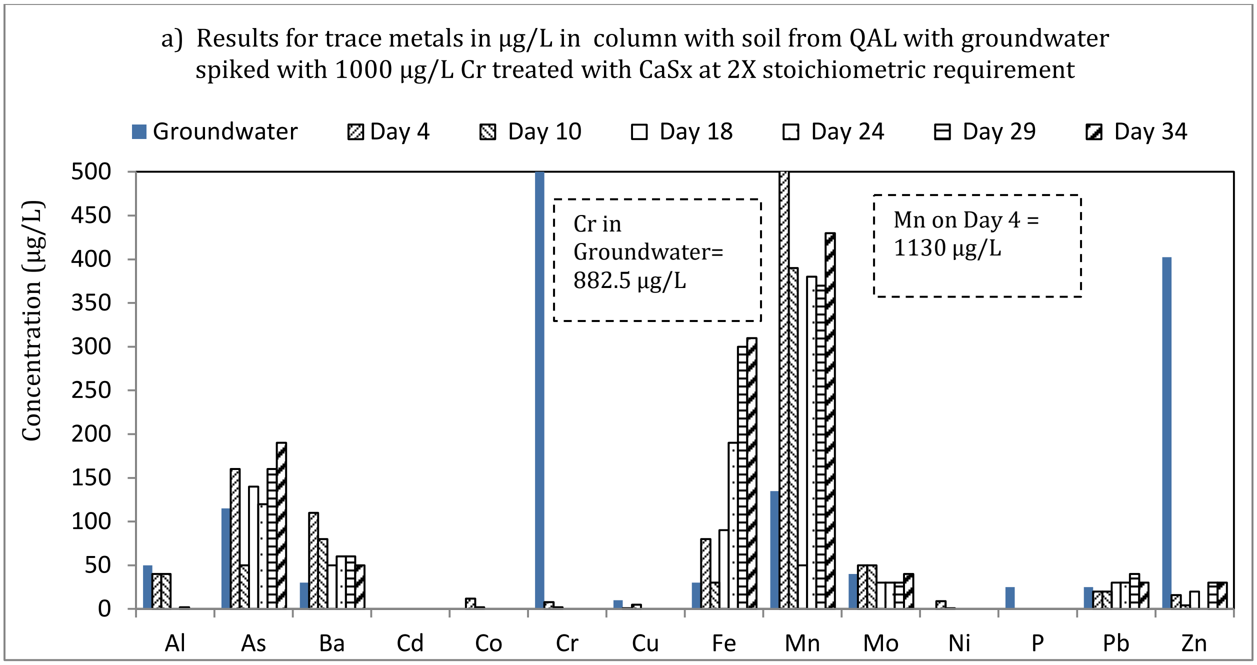
Figure D.3: Effluent dissolved chromium concentrations in the QAL and the UMCf column after chemical precipitation of chromium with calcium polysulfide from Day 4. The indent in the picture shows chromium concentration in composite samples in days 1 to 3. (Calcium polysulfide was stopped on Day 23 represented by the vertical arrow). Note that in columns, most of the precipitate was trapped by the soil media resulting in lower value of total chromium after sample filtration.

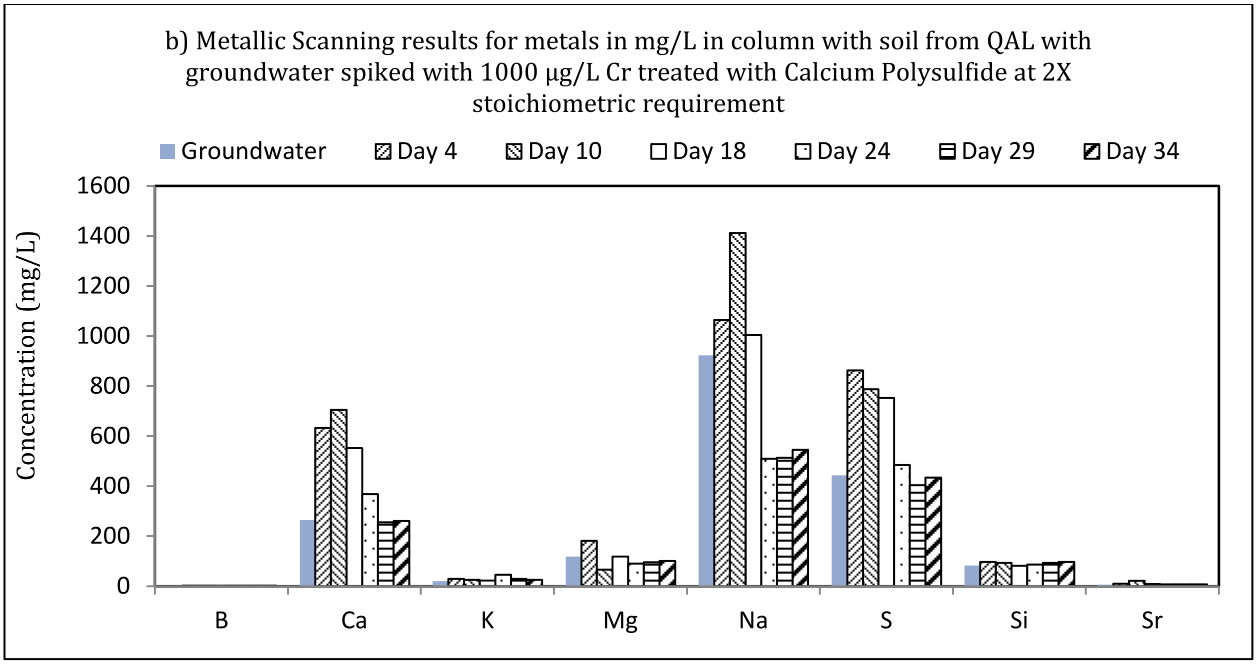
Table D.2 shows the statistical analysis of percent removal of hexavalent chromium in composite and grab samples for Days 3 to 23 in the columns (21 days). The minimum percent removal values were for Day 3 for the UMCf column and Day 4 for the QAL column.

Table D.2: Statistical analysis of percent removal in the columns for composite and grab samples.

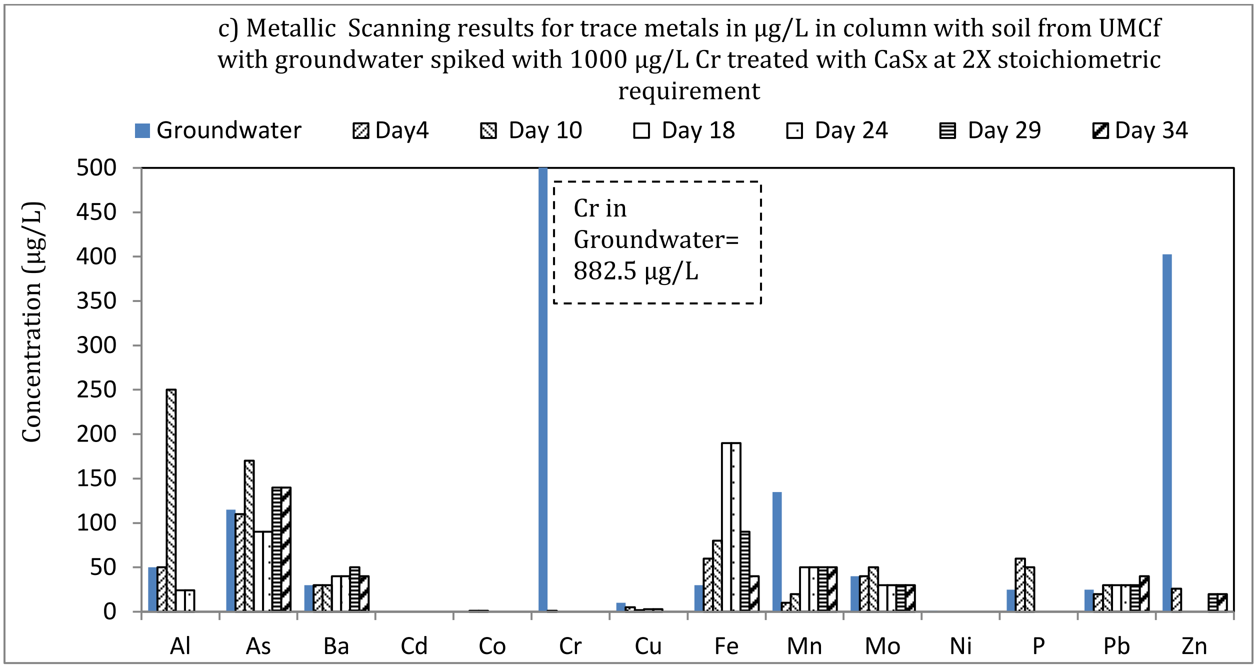
	Removal (%)			
	UMCf column		QAL column	
	Composite sample	Grab sample	Composite sample	Grab sample
Average	98 ± 3.5	99± 0.70	99 ± 0	99 ± 0.74
Minimum	83	98	38	28
Maximum	100	99	99	100

Figure D.4 shows the metallic scanning of effluent over the operation period. Figure D.4 (a) and Figure D.4 (b) present metal concentrations for QAL column samples measured in µg/L and mg/L, respectively. Figure D.4 (c) and Figure D.4 (d) present metal concentrations for the UMCf column, again measured in µg/L and mg/L, respectively. **Arsenic, barium, iron and manganese concentrations in the effluent samples gradually increased** with time compared to the groundwater concentrations in both columns. Calcium, Sodium and Sulfur increased initially, but their concentrations were comparable to the groundwater concentrations on Day 34.


a) Results for trace metals in µg/L in column with soil from QAL with groundwater spiked with 1000 µg/L Cr treated with CaSx at 2X stoichiometric requirement



b) Metallic Scanning results for metals in mg/L in column with soil from QAL with groundwater spiked with 1000 µg/L Cr treated with Calcium Polysulfide at 2X stoichiometric requirement



c) Metallic Scanning results for trace metals in µg/L in column with soil from UMCf with groundwater spiked with 1000 µg/L Cr treated with CaSx at 2X stoichiometric requirement

Cr in Groundwater= 882.5 µg/L

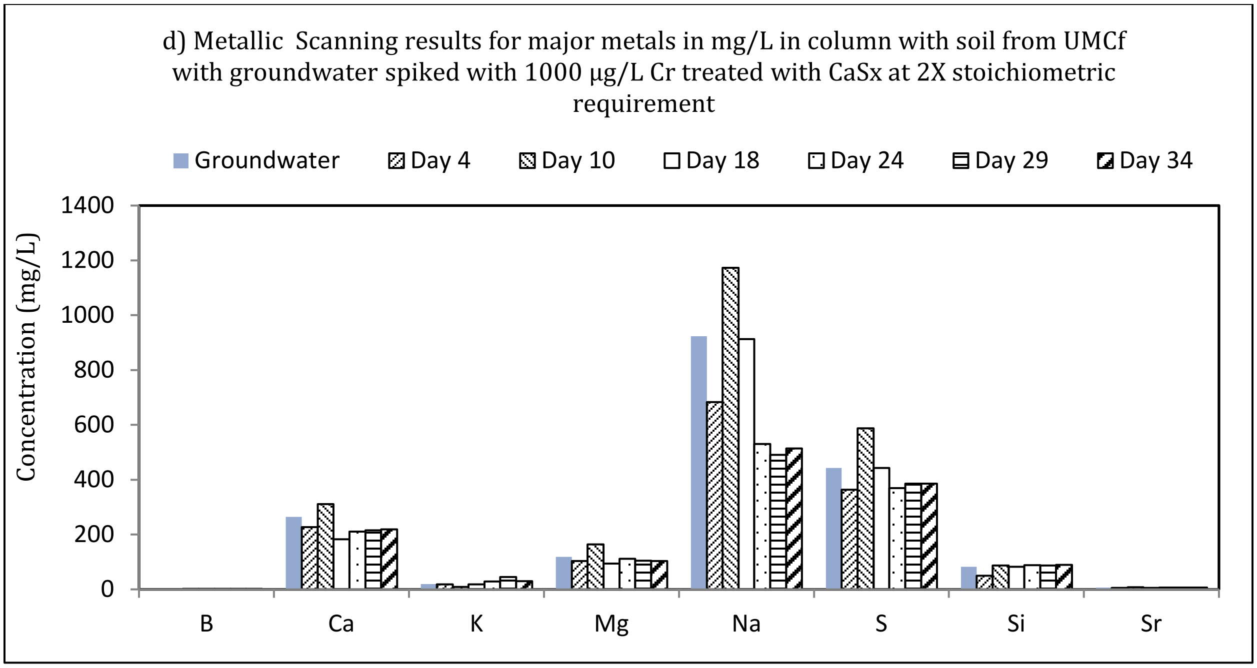


Figure D.4: Scanning of trace and major results in effluent in the QAL (a and b) and the UMCf (c and d) columns at different days.

Appendix E: Substrate Calculation

E.1: Calculation of Substrate Requirement

The substrate calculations in this appendix support the experiementation introduced in sections 2.6 and 2.7, then discussed further in chapter 5.

Table E.1: Amount of contaminants in groundwater

Contaminants amounts in the groundwater			Contaminant amounts in the groundwater for EOS-PRO calculation	
	mg/L	Molar ratios from the redox equation	mg in 100 mL groundwater	lb in 100 mL groundwater
ClO4	300	1	30	6.60E-05
NO_3	600	0.75	45	9.98E-05
Cr	5	2.463	1.2315	2.71E-06
O2	4	0.5	0.2	4.40E-07
ClO3	3000	0.75	225	4.95E-04
			Total	5.84E-04

Table E.2: COD of the substrate

Substrate	Molasses	Industrial Sugar Wastewater	EOS-PRO	Sugar (100 g sugar/L)
COD (mg/L)	1,053,000	99,440	2,000,000	100,000

Table E.3: Substrate requirement calculation for Molasses, Industrial Sugar Wastewater, and Sugar

	Molasses	Industrial Sugar Wastewater	Sugar
Concentration of contaminants eq (ClO_4 NO_3 ClO_3 and Cr (mg/L))	3014	2654	2654
Stoichiometric requirement for reducing contaminant (mol C/mol COD)	2.35	2.35	2.35
Required COD of electron donor (mg/L)	7083.64	7083.64	7083.64
X stoichiometric requirement	10	10	10
Total volume of groundwater to be treated (L)	1	1	1
Volume of electron donor REQUIRED (L) for 1 L GW	0.07	0.71	0.71

Table E.4: EOS-PRO requirement calculation

1 lb EOS PRO provides H2 for	0.25	lb contaminant	Source: EOS ®
Total volume of groundwater to be treated (L)	1		
contaminants in lb	0.0066		
lb EOS-PRO needed to remove the contaminant	0.0265		
EOS-PRO needed to remove the contaminant, Kg	0.012	kg EOS-PRO	
Density of EOS-PRO, Kg/L	0.98		
L of EOS-PRO needed for 1 L of GW	0.012		

E.2: Matrices Used for the Study

Table E.5: Matrix for preliminary microcosms (the amount added as mL per L GW is shown in parenthesis)

Substrate (mL/L GW)	1	2	3	4	5	6	7	8
EOS (60 mL)	EOS 1	EOS 2	EOS 3	EOS 4	EOS 5	EOS 6	EOS 7	EOS 8
	EOS 1 R	EOS 2 R	EOS 3 R	EOS 4 R	EOS 5 R	EOS 6 R	EOS 7 R	EOS 8 R
Mix (50 mL Industrial Sugar Wastewater + 40 mL EOS-PRO)	MIX 1	MIX 2	MIX 3	MIX 4	MIX 5	MIX 6	MIX 7	MIX 8
	MIX 1 R	MIX 2 R	MIX 3 R	MIX 4 R	MIX 5 R	MIX 6 R	MIX 7 R	MIX 8 R
Industrial Sugar Wastewater (60 mL)	OS 1	OS 2	OS 3	OS 4	OS 5	OS 6	OS 7	OS 8
	OS 1 R	OS 2 R	OS 3 R	OS 4 R	OS 5 R	OS 6 R	OS 7 R	OS 8 R
Molasses (40 mL) + Phosphate		P + M 1		P + M 2		P + M 3		P + M 4
		P + M 1 R		P + M 2 R		P + M 3 R		P + M 4 R
Blank	BLK 1							BLK 2
	BLK 1 R							BLK 2 R
Molasses without Phosphate	M w/o P 1							M w/o P 2
	M w/o P 1 R							M w/o P 2 R
Industrial Sugar Wastewater without phosphate	O w/o 1 P							O w/o 2 P
	O w/o P 1 R							O w/o P 2 R

Table E.6: Matrix for microcosms with mixture of EOS-PRO and Industrial Sugar Wastewater (the amount added as mL per L GW is shown in parenthesis)

Substrate (mL/ L GW)	1	2	3	4	5	6
Mix-1 (12mL Industrial Sugar Wastewater and 3 mL EOS-PRO)	MIX 1	MIX 2	MIX 3	MIX 4	MIX 5	MIX 6
	MIX 1 R	MIX 2 R	MIX 3 R	MIX 4 R	MIX 6 R	MIX 5 R
Blank						BLK 1
						BLK 2 R
Industrial Sugar Wastewater without phosphate (Control)						O w/o P 1
						O w/o P 1 R

Table E.7: Matrix for microcosms with mixture of EOS-PRO and Sugar (the amount added as mL per L GW is shown in parenthesis)

Substrate (mL/ L GW)	1	2	3	4
Mix-1 (12mL Sugar with COD equivalent to Industrial Sugar Wastewater and 3 mL EOS-PRO)	Sugar 1	Sugar 2	Sugar 3	Sugar 4
	Sugar 1 R	Sugar 2 R	Sugar 3 R	Sugar 4 R
Blank				BLK 1
				BLK 1 R
Sugar without phosphate (Control)				S w/o P 1
				S w/o P 1 R

E.3: Testing Impact of Chemical Reduction of Cr (VI) by Industrial Sugar Wastewater

This test was conducted to estimate the abiotic reduction contribution of Industrial Sugar Wastewater to hexavalent chromium removal. Chen et al. (2015) suggested that hexavalent chromium readily accepts electrons from the phenolic hydroxyl group and reduces to Cr $^{+3}$. The study showed that using molasses, Cr (VI) was reduced over wide range of pH (2-6).

To ensure no microbes were present for this test, Industrial Sugar Wastewater as well as groundwaters (QAL and UMCf) were filtered through 0.2 μm filters separately. Eight bottles were filled with sterilized groundwater and Industrial Sugar Wastewater was added at 6% and 16% by volume. After adding Industrial Sugar Wastewater, hexavalent chromium was measured after 4 hours and 4 days.

Table E1 shows that Cr (VI) concentration was reduced by about 35% in both QAL and UMCf groundwater when 6% (by volume) Industrial Sugar Wastewater was added to the groundwater. On Day 4, the Cr (VI) concentration had reduced further—by 47% in QAL and 40% in UMCf groundwater. Upon increasing the Industrial Sugar Wastewater content to 16%, the Cr (VI) remained at 47% in QAL and increased to 42% in UMCf groundwater within 4 hours. After 4 days, the Cr (VI) concentration had been reduced by 59% in QAL and 52% in UMCf groundwater. Therefore, it is possible that the Cr (VI) reduction observed in the microcosms is the result of both abiotic and biotic reduction. However, the microcosms were not set up to fully answer this question. It is clear biological reduction occurs in the microcosms where EOS-PRO alone was used. In the Mix and Industrial Sugar Wastewater microcosms, there is the potential that some reduction was abiotic.

Table E.8: Impact of Industrial Sugar Wastewater on Cr (VI)

		Cr (VI) in the groundwater	Cr (VI) in GW mixed with Industrial Sugar Wastewater		Cr (VI) % removal in GW mixed with Industrial Sugar Wastewater	
			4 hr	4 days	4 hr	4 days
6% Industrial Sugar Wastewater	QAL	17	11	9	35.3	47.1
	UMCf	21	13.5	12.5	35.7	40.5
16% Industrial Sugar Wastewater	QAL	17	9	7	47.1	58.8
	UMCf	21	12	10	42.9	52.4

Appendix F: Pictures of the Chemical Coagulation Tests for Cr Removal with CaSx and Ferrous Sulfate

F.1: Batch Coagulation Tests

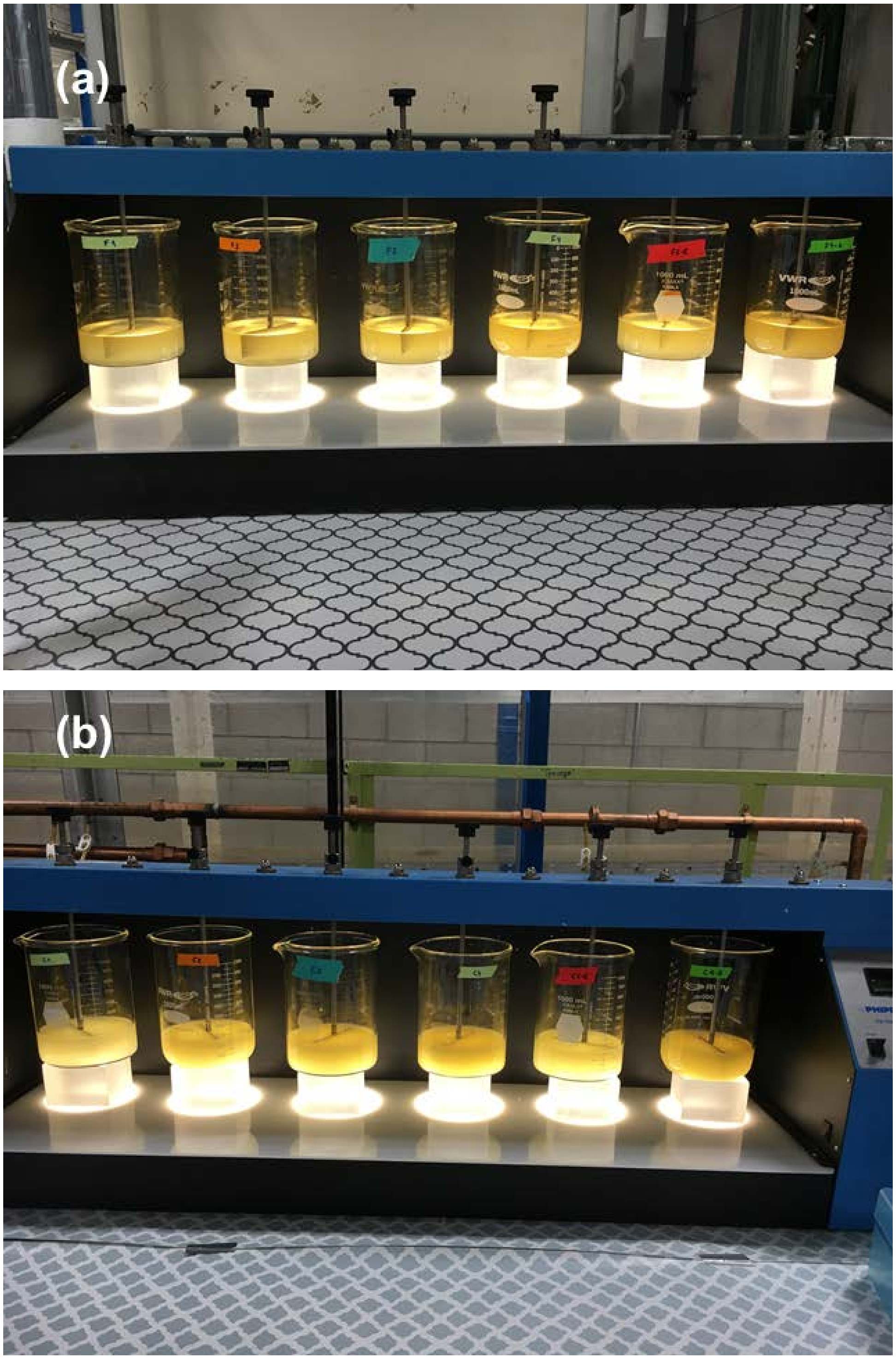


Figure F.1**:** High-range concentration batch experimental set-up: (a) groundwater with ferrous sulfate and (b) with calcium polysulfide.

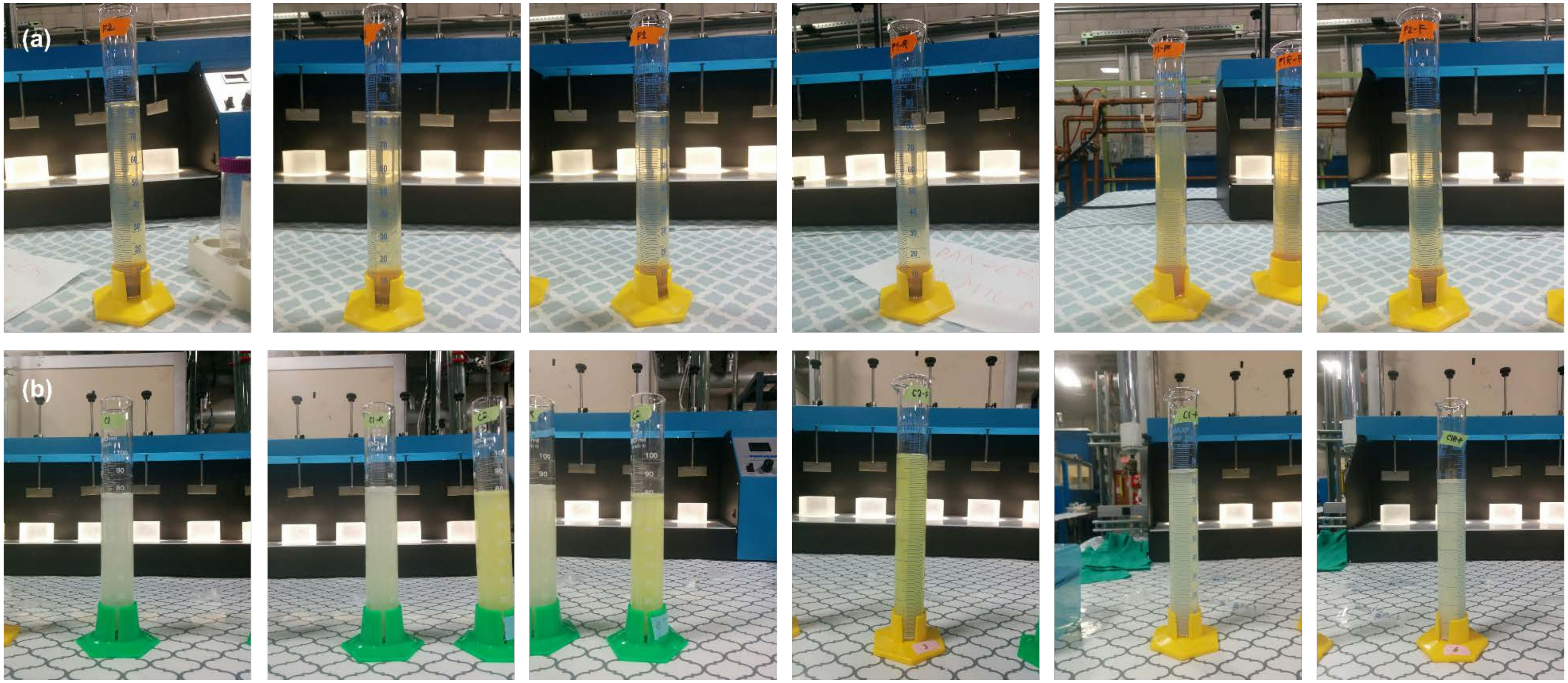


Figure F.2: High-range concentration settling: (a) groundwater with ferrous sulfate and (b) with calcium polysulfide.

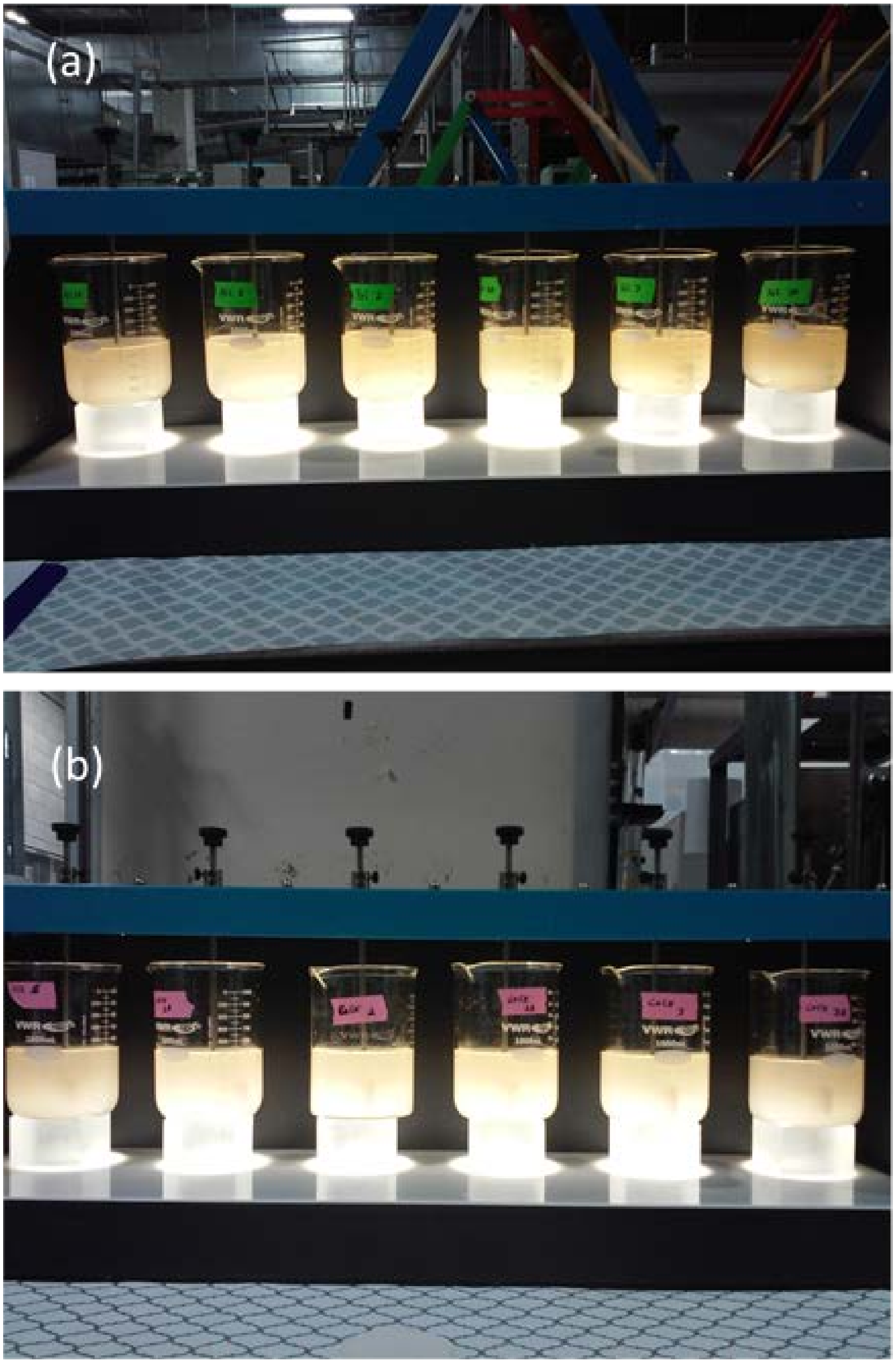


Figure F.3: Low-range concentration batch experimental set-up for QAL groundwater (25 -30 feet bgs) (a) groundwater with ferrous sulfate and (b) with calcium polysulfide.

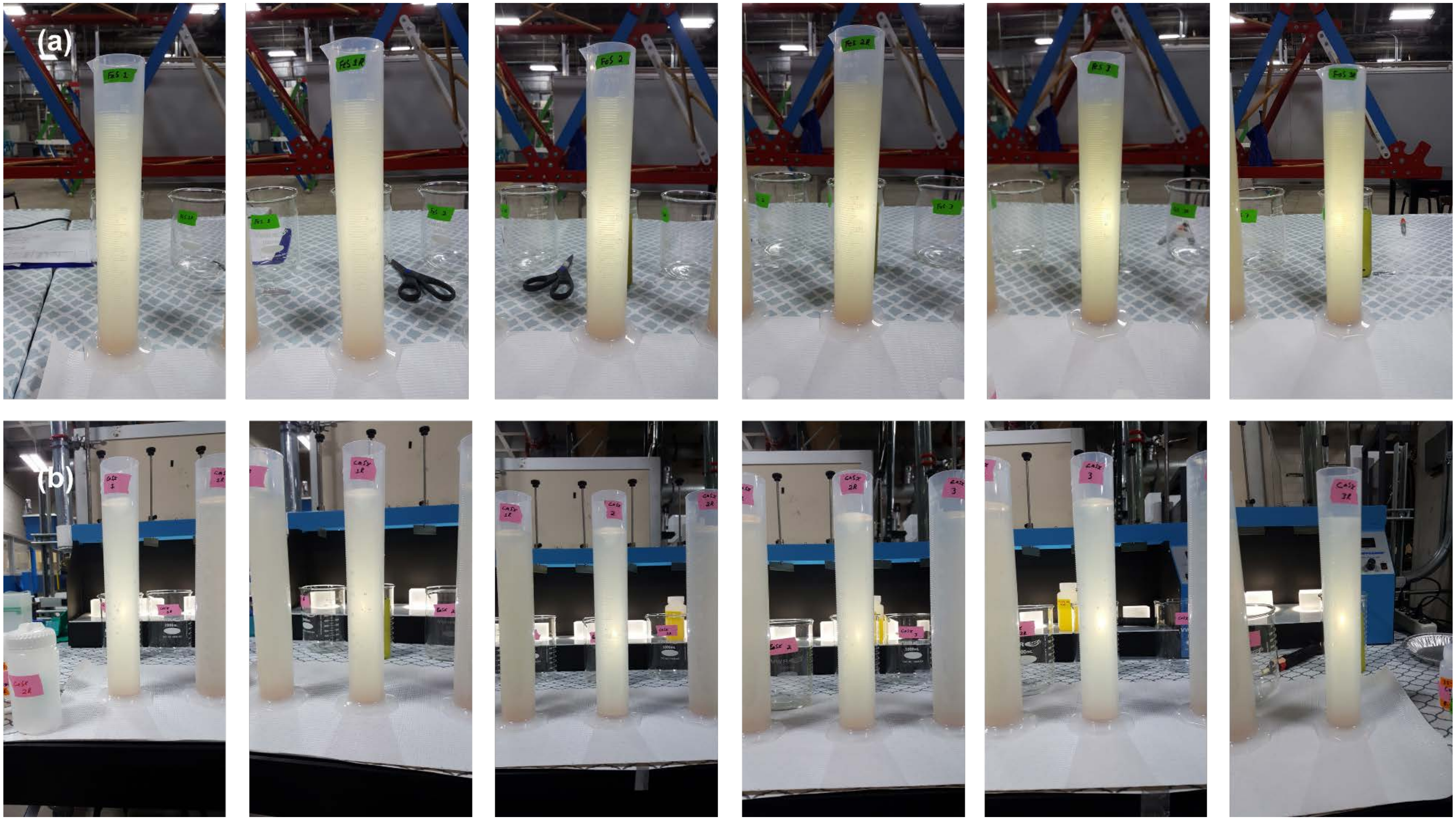


Figure F.4: Low-range concentration settling for QAL groundwater (25-30 feet bgs): (a) groundwater with ferrous sulfate and (b) with calcium polysulfide. Each set shows the sludge of individual tests.

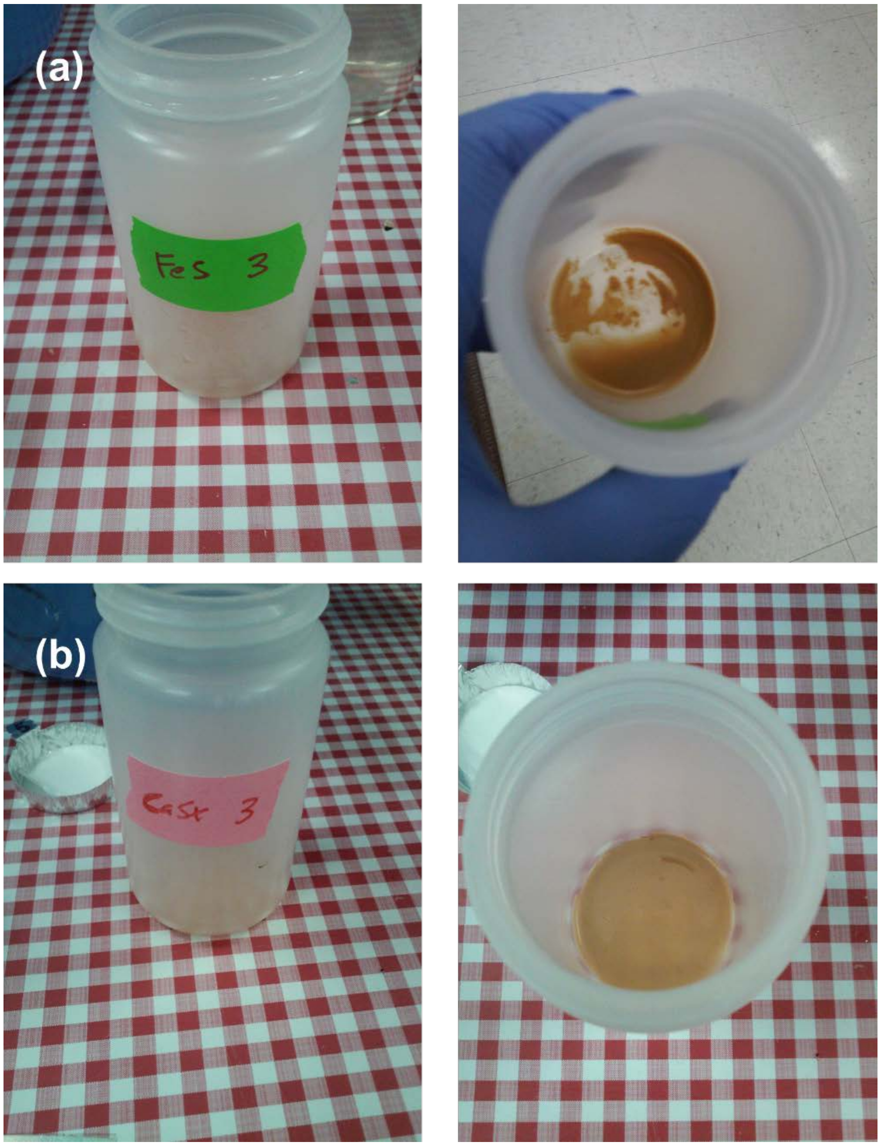


Figure F.5: Sludge content for low-range concentration for QAL groundwater 25 to 30 feet bgs) with 0.50 mg/L Cr (VI): (a) groundwater with ferrous sulfate and (b) with calcium polysulfide.

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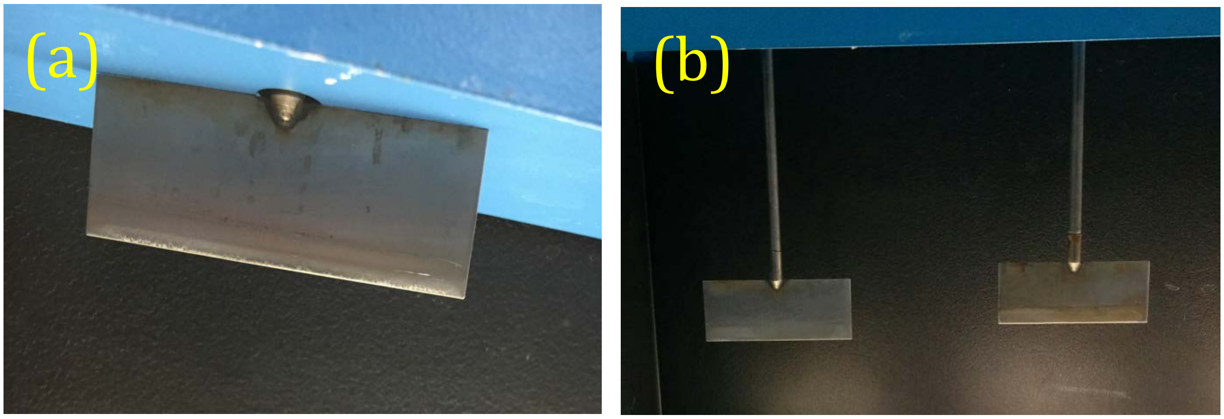


Figure F.6: Stirrers after operating batch precipitation test with groundwater from 25-30 ft containing high-range chromium concentration: (a) ferrous sulfate or (b) with calcium polysulfide showing that no inorganic scales were formed on the stirrer.

F.2 Column Coagulation Tests

Figure F.7: Injection port on UMCf column Day 1

Figure F.8: Injection port on UMCf column Day 16

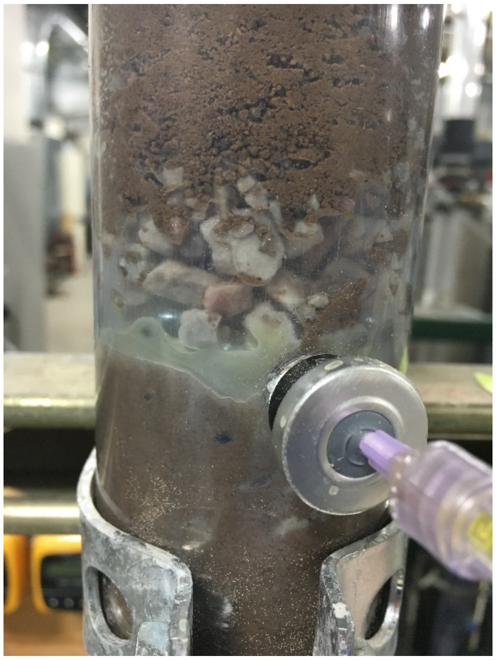


Figure F.9: Injection port on QAL column Day 5 shows the white scale formation at the injection port

Figure F.10: Injection port on QAL column Day 16 shows the white scale formation at the injection port

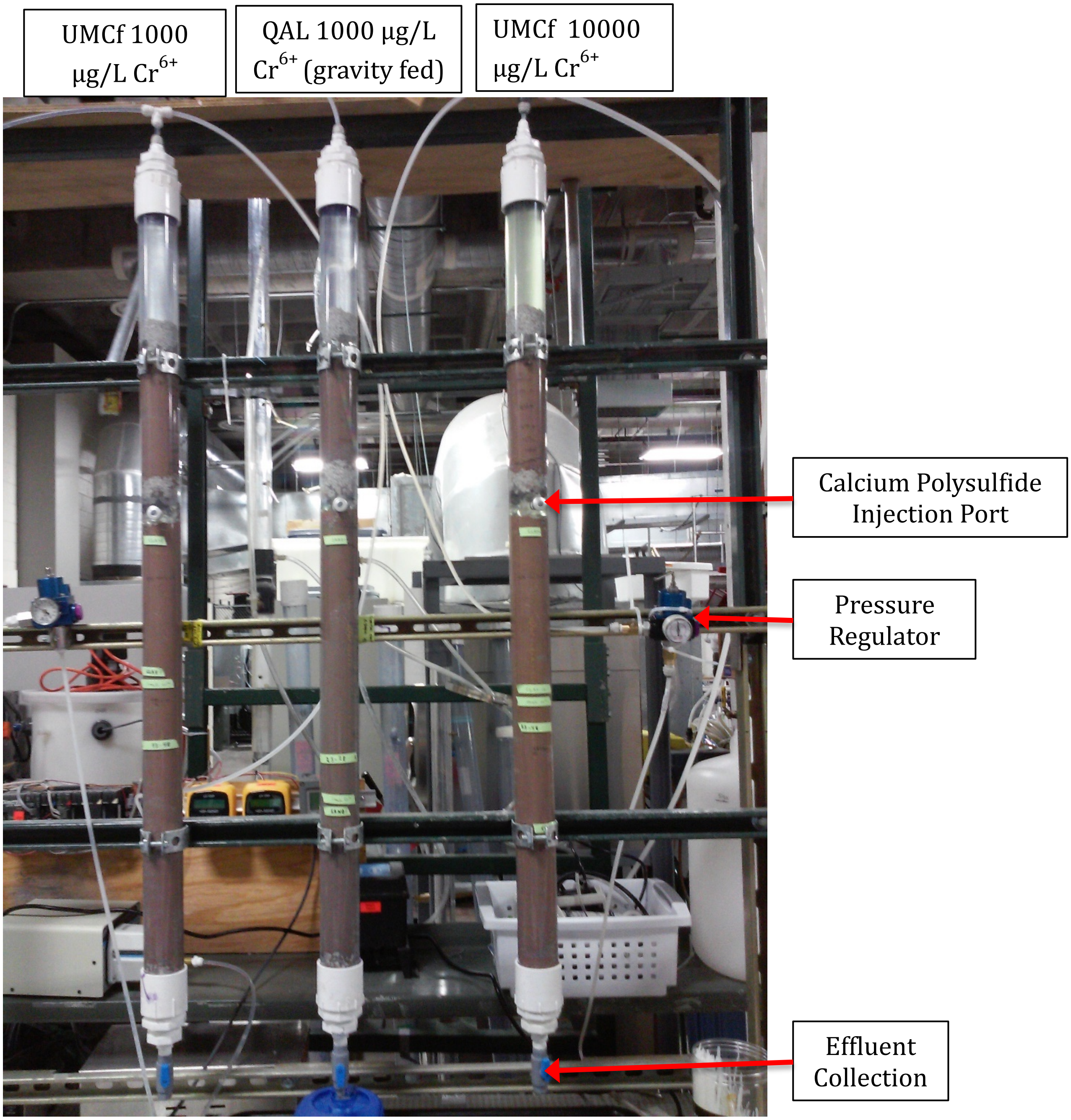


Figure F.11: Set-up of the Final columns for Cr Treatment with CaSX

Figure F.12: Injection port showing with gravel and glass beads.

Appendix G: Raw Data for Microbial Numbers and Diversity in the Microcosms

Table G1: Microbial Data of the Phase 1 Microcosms (Preliminary)

Classification	QAL		QAL		UMCf	
	MIX 4 (chromium reducer)	EOS-PRO 4	MIX 4	MIX 64	MIX 4	MIX 64
Archaea ; Unclassified ; Unclassified ; Unclassified ; Unclassified ; Unclassified ; Unclassified			0.09			
Bacteria ; Actinobacteria ; Actinobacteria ; Corynebacteriales ; Corynebacteriaceae ; Corynebacterium ; Corynebacterium sp	0.49		1.01			0.01
Bacteria ; Actinobacteria ; Actinobacteria ; Corynebacteriales ; Corynebacteriaceae ; Turicella ; Turicella otitidis		0.12				
Bacteria ; Actinobacteria ; Actinobacteria ; Corynebacteriales ; Dietziaceae ; Dietzia ; Dietzia sp			0.01			
Bacteria ; Actinobacteria ; Actinobacteria ; Micrococcales ; Cellulomonadaceae ; Cellulomonas ; Cellulomonas hominis		0.06		0.01		
Bacteria ; Actinobacteria ; Actinobacteria ; Micrococcales ; Cellulomonadaceae ; Cellulomonas ; Cellulomonas sp		3.22	0.05	0.21	0.13	0.36
Bacteria ; Actinobacteria ; Actinobacteria ; Micrococcales ; Microbacteriaceae ; Frigoribacterium ; Frigoribacterium sp						0.04
Bacteria ; Actinobacteria ; Actinobacteria ; Micrococcales ; Micrococcaceae ; Arthrobacter ; Arthrobacter sp	0.98	0.19	3.23	0.78	0.17	0.11
Bacteria ; Actinobacteria ; Actinobacteria ; Micrococcales ; Sanguibacteraceae ; Sanguibacter ; Sanguibacter sp			0.02			
Bacteria ; Actinobacteria ; Actinobacteria ; Propionibacteriales ; Nocardioidaceae ; Nocardioides ; Nocardioides sp		0.12		0.83		0.08
Bacteria ; Actinobacteria ; Actinobacteria ; Streptomycetales ; Streptomycetaceae ; Streptomyces ; Streptomyces sp		0.04				

Bacteria ; Actinobacteria ; Actinobacteria ; Unclassified ; Unclassified ; Unclassified ; Unclassified			0.01		
Bacteria ; Bacteroidetes ; Bacteroidia ; Bacteroidales ; Porphyromonadaceae ; Paludibacter ; Paludibacter sp	0.03				0.08
Bacteria ; Chloroflexi ; Unclassified ; Unclassified ; Unclassified ; Unclassified ; Unclassified		0.01			
Bacteria ; Firmicutes ; Bacilli ; Bacillales ; Bacillaceae ; Bacillus ; Bacillus sp		0.22	0.37		0.01
Bacteria ; Firmicutes ; Bacilli ; Bacillales ; Listeriaceae ; Listeria ; Listeria monocytogenes		0.16	0.18		
Bacteria ; Firmicutes ; Bacilli ; Bacillales ; Paenibacillaceae ; Brevibacillus ; Brevibacillus brevis					0.06
Bacteria ; Firmicutes ; Bacilli ; Bacillales ; Paenibacillaceae ; Paenibacillus ; Paenibacillus sp		0.37	0.01	0.17	0.17
Bacteria ; Firmicutes ; Bacilli ; Bacillales ; Planococcaceae ; Rummeliibacillus ; Rummeliibacillus suwonensis					1.02
Bacteria ; Firmicutes ; Bacilli ; Bacillales ; Planococcaceae ; Ureibacillus ; Ureibacillus thermosphaericus	0.31				
Bacteria ; Firmicutes ; Bacilli ; Bacillales ; Sporolactobacillaceae ; Sporolactobacillus ; Sporolactobacillus nakayamae					0.03
Bacteria ; Firmicutes ; Bacilli ; Bacillales ; Staphylococcaceae ; Staphylococcus ; Staphylococcus sp	0.02	0.09	0.19	0.04	
Bacteria ; Firmicutes ; Bacilli ; Bacillales ; Unclassified ; Exiguobacterium ; Exiguobacterium sp		0.25	0.02		
Bacteria ; Firmicutes ; Bacilli ; Lactobacillales ; Enterococcaceae ; Enterococcus ; Enterococcus faecalis		0.11	0.13		
Bacteria ; Firmicutes ; Bacilli ; Lactobacillales ; Lactobacillaceae ; Lactobacillus ; Lactobacillus amylolyticus		0.31	0.02		0.04
Bacteria ; Firmicutes ; Bacilli ; Lactobacillales ; Lactobacillaceae ; Lactobacillus ; Lactobacillus casei		0.42	0.11	0.03	0.03

Bacteria ; Firmicutes ; Bacilli ; Lactobacillales ; Lactobacillaceae ; Lactobacillus ; Lactobacillus fermentum	0.46	0.45	0.02	0.24
Bacteria ; Firmicutes ; Bacilli ; Lactobacillales ; Lactobacillaceae ; Lactobacillus ; Lactobacillus harbinensis	0.54	0.02	0.06	0.05
Bacteria ; Firmicutes ; Bacilli ; Lactobacillales ; Lactobacillaceae ; Lactobacillus ; Lactobacillus kefiri	0.18	0.01	0.01	0.02
Bacteria ; Firmicutes ; Bacilli ; Lactobacillales ; Lactobacillaceae ; Lactobacillus ; Lactobacillus reuteri	0.28	0.05	0.03	0.05
Bacteria ; Firmicutes ; Bacilli ; Lactobacillales ; Lactobacillaceae ; Lactobacillus ; Lactobacillus sp	0.08	0.03		0.01
Bacteria ; Firmicutes ; Bacilli ; Lactobacillales ; Streptococcaceae ; Streptococcus ; Streptococcus sp			0.01	
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Clostridiaceae ; Clostridium ; Clostridium arbusti				0.36
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Clostridiaceae ; Clostridium ; Clostridium beijerinckii		5.09		8.23
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Clostridiaceae ; Clostridium ; Clostridium kluyveri		3.55		0.35
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Clostridiaceae ; Clostridium ; Clostridium sp		6.37		4.83
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Clostridiaceae ; Clostridium ; Clostridium tertium		0.16		
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Clostridiaceae ; Lactonifactor ; Lactonifactor longoviformis		0.02		
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Lachnospiraceae ; Anaerosporobacter ; Anaerosporobacter mobilis		0.07		
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Lachnospiraceae ; Lachnoclostridium ; Clostridium saccharolyticum		0.40		
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Lachnospiraceae ; Lachnoclostridium ; Eubacterium contortum		0.04		

Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Lachnospiraceae ; Lachnospira ; Lachnospira sp					0.21
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Lachnospiraceae ; Tyzzerella ; Clostridium propionicum			2.89		
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Lachnospiraceae ; Unclassified ; Unclassified			0.51		0.03
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Oscillospiraceae ; Oscillibacter ; Oscillibacter sp			0.26		
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Ruminococcaceae ; Candidatus Soleaferrea ; Candidatus Soleaferrea massiliensis			0.02		
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Ruminococcaceae ; Hydrogenoanaerobacterium ; Hydrogenoanaerobacterium sp			0.10		
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Ruminococcaceae ; Ruminiclostridium ; Clostridium cellulosi					0.06
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Ruminococcaceae ; Ruminiclostridium ; Clostridium sporosphaeroides					0.25
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Ruminococcaceae ; Ruminococcus ; Ruminococcus sp		0.01			
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Unclassified ; Intestinimonas ; Intestinimonas butyriciproducens			0.07		0.07
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Unclassified ; Pseudoflavonifractor ; Pseudoflavonifractor sp			0.02		
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Unclassified ; Unclassified ; Unclassified	0.01		2.63		
Bacteria ; Firmicutes ; Clostridia ; Unclassified ; Unclassified ; Unclassified ; Unclassified			1.24		2.62
Bacteria ; Firmicutes ; Tissierellia ; Unclassified ; Unclassified ; Sedimentibacter ; Sedimentibacter sp			6.09		
Bacteria ; Firmicutes ; Unclassified ; Unclassified ; Unclassified ; Unclassified ; Unclassified		0.01	0.01		1.31

Bacteria ; Planctomycetes ; Planctomycetia ; Unclassified ; Unclassified ; Unclassified ; Unclassified		0.01			
Bacteria ; Proteobacteria ; Alphaproteobacteria ; Rhizobiales ; Phyllobacteriaceae ; Mesorhizobium ; Mesorhizobium sp			0.01		
Bacteria ; Proteobacteria ; Alphaproteobacteria ; Sphingomonadales ; Sphingomonadaceae ; Sphingomonas ; Sphingomonas sp	0.07				
Bacteria ; Proteobacteria ; Betaproteobacteria ; Burkholderiales ; Burkholderiaceae ; Ralstonia ; Ralstonia sp		0.02			
Bacteria ; Proteobacteria ; Betaproteobacteria ; Burkholderiales ; Comamonadaceae ; Comamonas ; Comamonas sp	2.37		0.04		8.85
Bacteria ; Proteobacteria ; Betaproteobacteria ; Burkholderiales ; Comamonadaceae ; Pelomonas ; Pelomonas sp	0.04				
Bacteria ; Proteobacteria ; Betaproteobacteria ; Burkholderiales ; Comamonadaceae ; Rhodoferax ; Rhodoferax sp	0.22				0.01
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Aeromonadales ; Aeromonadaceae ; Aeromonas ; Aeromonas sp	7.89	0.20			
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Alteromonadales ; Shewanellaceae ; Shewanella ; Shewanella sp		1.87			
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Chromatiales ; Chromatiaceae ; Nitrosococcus ; Nitrosococcus sp		0.03			
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Chromatiales ; Ectothiorhodospiraceae ; Arhodomonas ; Arhodomonas sp		0.04			
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Enterobacteriales ; Enterobacteriaceae ; Averyella ; Averyella dalhousiensis	0.07				
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Enterobacteriales ; Enterobacteriaceae ; Cronobacter ; Cronobacter dublinensis		0.17	0.14		1.19

Bacteria ; Proteobacteria ; Gammaproteobacteria ; Enterobacteriales ; Enterobacteriaceae ; Salmonella ; Salmonella enterica				0.10	0.20		
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Pseudomonadales ; Moraxellaceae ; Acinetobacter ; Acinetobacter psychrotolerans	5.46						
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Pseudomonadales ; Moraxellaceae ; Acinetobacter ; Acinetobacter sp	0.07		5.34	19.82	0.52	19.08	0.50
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Pseudomonadales ; Pseudomonadaceae ; Pseudomonas ; Pseudomonas abietaniphila	1.24						
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Pseudomonadales ; Pseudomonadaceae ; Pseudomonas ; Pseudomonas aeruginosa			0.13	0.10	0.11		
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Pseudomonadales ; Pseudomonadaceae ; Pseudomonas ; Pseudomonas salinarum	1.41						
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Pseudomonadales ; Pseudomonadaceae ; Pseudomonas ; Pseudomonas sp	89.97		79.63	69.69	64.93	80.21	67.71
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Pseudomonadales ; Unclassified ; Unclassified ; Unclassified			0.08			0.03	
Bacteria ; Synergistetes ; Synergistia ; Synergistales ; Synergistaceae ; Acetomicrobium ; Acetomicrobium sp					0.10		
Bacteria ; Unclassified ; Unclassified ; Unclassified ; Unclassified ; Unclassified ; Unclassified			0.04		0.99		0.94
No Hit ; No Hit ; No Hit ; No Hit ; No Hit ; No Hit ; No Hit	0.39			0.04			

Table G2: Microbial Data of the Phase 2 Microcosms (3-12)

Classification	**UMCf**		**QAL**		**QAL soil**	**UMCf soil**
	Day 1	Day 70	Day 1	Day 70		
Archaea ; Thaumarchaeota ; Unclassified ; Unclassified ; Unclassified ; Unclassified ; Unclassified		0.06			0.54	2.27
Archaea ; Unclassified ; Unclassified ; Unclassified ; Unclassified ; Unclassified ; Unclassified					0.46	
Bacteria ; Actinobacteria ; Actinobacteria ; Corynebacteriales ; Corynebacteriaceae ; Corynebacterium ; Corynebacterium callunae	0.02	0.01	0.02	0.03		
Bacteria ; Actinobacteria ; Actinobacteria ; Corynebacteriales ; Corynebacteriaceae ; Corynebacterium ; Corynebacterium sp	28.85	1.88	28.69	25.95		
Bacteria ; Actinobacteria ; Actinobacteria ; Corynebacteriales ; Corynebacteriaceae ; Turicella ; Turicella otitidis		0.05				
Bacteria ; Actinobacteria ; Actinobacteria ; Corynebacteriales ; Nocardiaceae ; Rhodococcus ; Rhodococcus sp					0.04	
Bacteria ; Actinobacteria ; Actinobacteria ; Frankiales ; Frankiaceae ; Frankia ; Frankia sp					0.05	
Bacteria ; Actinobacteria ; Actinobacteria ; Geodermatophilales ; Geodermatophilaceae ; Blastococcus ; Blastococcus sp					0.17	
Bacteria ; Actinobacteria ; Actinobacteria ; Micrococcales ; Cellulomonadaceae ; Cellulomonas ; Cellulomonas sp		0.14		0.04	0.02	
Bacteria ; Actinobacteria ; Actinobacteria ; Micrococcales ; Intrasporangiaceae ; Janibacter ; Janibacter sp				0.01	0.03	
Bacteria ; Actinobacteria ; Actinobacteria ; Micrococcales ; Microbacteriaceae ; Leucobacter ; Leucobacter sp					0.35	
Bacteria ; Actinobacteria ; Actinobacteria ; Micrococcales ; Micrococcaceae ; Arthrobacter ; Arthrobacter sp	0.26	0.03	0.05	0.10		

Bacteria ; Actinobacteria ; Actinobacteria ; Micrococcales ; Micrococcaceae ; Kocuria ; Kocuria sp					0.06	
Bacteria ; Actinobacteria ; Actinobacteria ; Propionibacteriales ; Nocardioidaceae ; Nocardioides ; Nocardioides sp	0.02	0.05		0.03	0.04	
Bacteria ; Actinobacteria ; Actinobacteria ; Unclassified ; Unclassified ; Unclassified ; Unclassified					0.38	0.33
Bacteria ; Actinobacteria ; Unclassified ; Unclassified ; Unclassified ; Unclassified ; Unclassified					0.02	
Bacteria ; Bacteroidetes ; Bacteroidia ; Bacteroidales ; Prevotellaceae ; Prevotella ; Prevotella bivia					0.03	
Bacteria ; Bacteroidetes ; Cytophagia ; Cytophagales ; Cytophagaceae ; Cytophaga ; Cytophaga sp					0.06	
Bacteria ; Bacteroidetes ; Flavobacteriia ; Flavobacteriales ; Cryomorphaceae ; Fluviicola ; Fluviicola sp					0.03	
Bacteria ; Bacteroidetes ; Flavobacteriia ; Flavobacteriales ; Cryomorphaceae ; Owenweeksia ; Owenweeksia sp						0.05
Bacteria ; Bacteroidetes ; Flavobacteriia ; Flavobacteriales ; Cryomorphaceae ; Unclassified ; Unclassified					0.03	
Bacteria ; Bacteroidetes ; Flavobacteriia ; Unclassified ; Unclassified ; Unclassified ; Unclassified					0.13	
Bacteria ; Bacteroidetes ; Sphingobacteriia ; Sphingobacteriales ; Sphingobacteriaceae ; Sphingobacterium ; Sphingobacterium sp						0.39
Bacteria ; Chlamydiae ; Chlamydiia ; Chlamydiales ; Parachlamydiaceae ; Parachlamydia ; Parachlamydia acanthamoebae					0.08	
Bacteria ; Chlamydiae ; Chlamydiia ; Unclassified ; Unclassified ; Unclassified ; Unclassified					0.29	
Bacteria ; Chloroflexi ; Anaerolineae ; Anaerolineales ; Unclassified ; Unclassified ; Unclassified					0.04	
Bacteria ; Chloroflexi ; Dehalococcoidia ; Dehalococcoidales ; Dehalococcoidaceae ; Dehalococcoides ; Dehalococcoides sp					0.11	
Bacteria ; Chloroflexi ; Unclassified ; Unclassified ; Unclassified ; Unclassified ; Unclassified					0.06	
Bacteria ; Deinococcus-Thermus ; Deinococci ; Deinococcales ; Unclassified ; Unclassified ; Unclassified					0.11	
Bacteria ; Elusimicrobia ; Elusimicrobia ; Elusimicrobiales ; Elusimicrobiaceae ; Elusimicrobium ; Elusimicrobium sp					1.30	
Bacteria ; Firmicutes ; Bacilli ; Bacillales ; Bacillaceae ; Bacillus ; Bacillus sp	1.23	1.97	0.61	0.22		

Bacteria ; Firmicutes ; Bacilli ; Bacillales ; Paenibacillaceae ; Paenibacillus ; Paenibacillus sp		0.01	0.07	0.06	
Bacteria ; Firmicutes ; Bacilli ; Bacillales ; Paenibacillaceae ; Paenibacillus ; Paenibacillus stellifer		0.04			
Bacteria ; Firmicutes ; Bacilli ; Bacillales ; Planococcaceae ; Rummeliibacillus ; Rummeliibacillus suwonensis	0.07	42.24	0.72	31.20	
Bacteria ; Firmicutes ; Bacilli ; Bacillales ; Sporolactobacillaceae ; Sporolactobacillus ; Sporolactobacillus nakayamae	27.00	14.34	5.46	2.97	
Bacteria ; Firmicutes ; Bacilli ; Bacillales ; Sporolactobacillaceae ; Sporolactobacillus ; Sporolactobacillus terrae	0.26		0.14	0.04	
Bacteria ; Firmicutes ; Bacilli ; Lactobacillales ; Lactobacillaceae ; Lactobacillus ; Lactobacillus amylolyticus			0.02	0.07	
Bacteria ; Firmicutes ; Bacilli ; Lactobacillales ; Lactobacillaceae ; Lactobacillus ; Lactobacillus casei	3.81	0.93	2.00	2.51	
Bacteria ; Firmicutes ; Bacilli ; Lactobacillales ; Lactobacillaceae ; Lactobacillus ; Lactobacillus fermentum	0.06	0.11	0.07	0.10	
Bacteria ; Firmicutes ; Bacilli ; Lactobacillales ; Lactobacillaceae ; Lactobacillus ; Lactobacillus harbinensis	3.81	1.85	2.14	1.98	
Bacteria ; Firmicutes ; Bacilli ; Lactobacillales ; Lactobacillaceae ; Lactobacillus ; Lactobacillus iners					0.04
Bacteria ; Firmicutes ; Bacilli ; Lactobacillales ; Lactobacillaceae ; Lactobacillus ; Lactobacillus jensenii					0.07
Bacteria ; Firmicutes ; Bacilli ; Lactobacillales ; Lactobacillaceae ; Lactobacillus ; Lactobacillus kefiri	5.38	6.94	1.53	2.02	
Bacteria ; Firmicutes ; Bacilli ; Lactobacillales ; Lactobacillaceae ; Lactobacillus ; Lactobacillus reuteri	0.03	0.14	0.06	0.15	
Bacteria ; Firmicutes ; Bacilli ; Lactobacillales ; Lactobacillaceae ; Lactobacillus ; Lactobacillus sp	0.33	0.11	0.07	0.10	
Bacteria ; Firmicutes ; Bacilli ; Lactobacillales ; Streptococcaceae ; Streptococcus ; Streptococcus sp					0.06
Bacteria ; Firmicutes ; Bacilli ; Unclassified ; Unclassified ; Unclassified ; Unclassified				0.04	
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Clostridiaceae ; Clostridium ; Clostridium arbusti	0.03			0.20	
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Clostridiaceae ; Clostridium ; Clostridium beijerinckii	24.39	15.14	48.92	25.44	
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Clostridiaceae ; Clostridium ; Clostridium kluyveri		5.40		0.86	

Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Clostridiaceae ; Clostridium ; Clostridium saccharobutylicum	0.05	0.10	0.38	0.07		
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Clostridiaceae ; Clostridium ; Clostridium sp	2.76	5.07	8.48	4.46	0.01	0.46
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Eubacteriaceae ; Eubacterium ; Eubacterium saphenum					0.02	
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Lachnospiraceae ; Lachnoclostridium ; Clostridium fimetarium			0.49	0.55		
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Lachnospiraceae ; Lachnospira ; Lachnospira sp	1.28	1.67		0.15		
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Ruminococcaceae ; Caproiciproducens ; Caproiciproducens galactitolivorans		0.05	0.01	0.01		
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Ruminococcaceae ; Ruminiclostridium ; Clostridium cellulosi		0.05				
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Ruminococcaceae ; Ruminiclostridium ; Clostridium sporosphaeroides	0.27	0.28				
Bacteria ; Firmicutes ; Clostridia ; Clostridiales ; Unclassified ; Unclassified ; Unclassified		0.02				
Bacteria ; Firmicutes ; Clostridia ; Unclassified ; Unclassified ; Unclassified ; Unclassified	0.05	0.36	0.08	0.63		
Bacteria ; Firmicutes ; Negativicutes ; Selenomonadales ; Veillonellaceae ; Veillonella ; Veillonella sp						0.07
Bacteria ; Firmicutes ; Unclassified ; Unclassified ; Unclassified ; Unclassified ; Unclassified		0.41		0.01		
Bacteria ; Gemmatimonadetes ; Gemmatimonadetes ; Gemmatimonadales ; Gemmatimonadaceae ; Gemmatimonas ; Gemmatimonas sp					0.06	
Bacteria ; Nitrospinae ; Nitrospinia ; Nitrospinales ; Nitrospinaceae ; Nitrospina ; Nitrospina sp					0.71	
Bacteria ; Nitrospirae ; Nitrospira ; Nitrospirales ; Nitrospiraceae ; Nitrospira ; Nitrospira sp					0.20	
Bacteria ; Planctomycetes ; Planctomycetia ; Planctomycetales ; Planctomycetaceae ; Planctomyces ; Planctomyces sp					0.12	
Bacteria ; Planctomycetes ; Planctomycetia ; Planctomycetales ; Unclassified ; Unclassified ; Unclassified						0.12
Bacteria ; Proteobacteria ; Alphaproteobacteria ; Caulobacterales ; Caulobacteraceae ; Phenylobacterium ; Phenylobacterium falsum	0.01	0.08			2.27	4.25

Bacteria ; Proteobacteria ; Alphaproteobacteria ; Caulobacterales ; Caulobacteraceae ; Phenylobacterium ; Phenylobacterium sp	0.44	19.27
Bacteria ; Proteobacteria ; Alphaproteobacteria ; Parvularculales ; Parvularculaceae ; Parvularcula ; Parvularcula sp	0.10	0.76
Bacteria ; Proteobacteria ; Alphaproteobacteria ; Rhizobiales ; Bradyrhizobiaceae ; Nitrobacter ; Nitrobacter sp	0.14	
Bacteria ; Proteobacteria ; Alphaproteobacteria ; Rhizobiales ; Hyphomicrobiaceae ; Devosia ; Devosia sp		0.09
Bacteria ; Proteobacteria ; Alphaproteobacteria ; Rhizobiales ; Phyllobacteriaceae ; Aliihoeflea ; Aliihoeflea sp	0.02	0.35
Bacteria ; Proteobacteria ; Alphaproteobacteria ; Rhizobiales ; Phyllobacteriaceae ; Mesorhizobium ; Mesorhizobium sp	0.04	1.10
Bacteria ; Proteobacteria ; Alphaproteobacteria ; Rhizobiales ; Rhizobiaceae ; Rhizobium ; Rhizobium sp		0.04
Bacteria ; Proteobacteria ; Alphaproteobacteria ; Rhizobiales ; Rhizobiaceae ; Rhizobium ; Rhizobium yanglingense		0.69
Bacteria ; Proteobacteria ; Alphaproteobacteria ; Rhizobiales ; Rhodobiaceae ; Parvibaculum ; Parvibaculum sp	0.02	0.07
Bacteria ; Proteobacteria ; Alphaproteobacteria ; Rhodobacterales ; Rhodobacteraceae ; Paracoccus ; Paracoccus sp	0.08	
Bacteria ; Proteobacteria ; Alphaproteobacteria ; Rhodobacterales ; Rhodobacteraceae ; Rubellimicrobium ; Rubellimicrobium sp	0.07	
Bacteria ; Proteobacteria ; Alphaproteobacteria ; Rhodobacterales ; Unclassified ; Unclassified ; Unclassified	0.17	
Bacteria ; Proteobacteria ; Alphaproteobacteria ; Rhodospirillales ; Acetobacteraceae ; Paracraurococcus ; Paracraurococcus sp	0.05	
Bacteria ; Proteobacteria ; Alphaproteobacteria ; Rhodospirillales ; Unclassified ; Unclassified ; Unclassified	0.08	
Bacteria ; Proteobacteria ; Alphaproteobacteria ; Sphingomonadales ; Erythrobacteraceae ; Altererythrobacter ; Altererythrobacter oceanensis	0.34	
Bacteria ; Proteobacteria ; Alphaproteobacteria ; Sphingomonadales ; Erythrobacteraceae ; Erythrobacter ; Erythrobacter sp	0.05	
Bacteria ; Proteobacteria ; Alphaproteobacteria ; Sphingomonadales ; Sphingomonadaceae ; Novosphingobium ; Novosphingobium sp	0.02	2.66
Bacteria ; Proteobacteria ; Alphaproteobacteria ; Sphingomonadales ; Sphingomonadaceae ; Sphingomonas ; Sphingomonas sp	0.49	

Bacteria ; Proteobacteria ; Alphaproteobacteria ; Sphingomonadales ; Sphingomonadaceae ; Sphingopyxis ; Sphingopyxis sp		0.75	4.73
Bacteria ; Proteobacteria ; Betaproteobacteria ; Burkholderiales ; Burkholderiaceae ; Burkholderia ; Burkholderia sp			0.05
Bacteria ; Proteobacteria ; Betaproteobacteria ; Burkholderiales ; Burkholderiaceae ; Limnobacter ; Limnobacter sp		0.20	7.17
Bacteria ; Proteobacteria ; Betaproteobacteria ; Burkholderiales ; Comamonadaceae ; Hydrogenophaga ; Hydrogenophaga sp		0.01	0.08
Bacteria ; Proteobacteria ; Betaproteobacteria ; Burkholderiales ; Comamonadaceae ; Pelomonas ; Pelomonas sp	0.02	0.05	0.05
Bacteria ; Proteobacteria ; Betaproteobacteria ; Burkholderiales ; Comamonadaceae ; Ramlibacter ; Ramlibacter sp		0.07	0.29
Bacteria ; Proteobacteria ; Betaproteobacteria ; Burkholderiales ; Comamonadaceae ; Simplicispira ; Simplicispira sp			0.56
Bacteria ; Proteobacteria ; Betaproteobacteria ; Burkholderiales ; Oxalobacteraceae ; Herbaspirillum ; Herbaspirillum rhizosphaerae		0.06	0.37
Bacteria ; Proteobacteria ; Betaproteobacteria ; Burkholderiales ; Unclassified ; Unclassified ; Unclassified		0.04	
Bacteria ; Proteobacteria ; Betaproteobacteria ; Nitrosomonadales ; Nitrosomonadaceae ; Nitrosomonas ; Nitrosomonas nitrosa		0.77	
Bacteria ; Proteobacteria ; Betaproteobacteria ; Rhodocyclales ; Rhodocyclaceae ; Methyloversatilis ; Methyloversatilis sp		0.02	0.20
Bacteria ; Proteobacteria ; Deltaproteobacteria ; Desulfuromonadales ; Geobacteraceae ; Geoalkalibacter ; Geoalkalibacter sp		0.12	
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Acidiferrobacterales ; Acidiferrobacteraceae ; Sulfuricaulis ; Sulfuricaulis limicola		0.02	
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Alteromonadales ; Alteromonadaceae ; Alishewanella ; Alishewanella sp		0.02	
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Alteromonadales ; Alteromonadaceae ; Marinobacter ; Marinobacter sp		0.11	
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Alteromonadales ; Colwelliaceae ; Colwellia ; Colwellia sp		0.03	
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Chromatiales ; Chromatiaceae ; Rheinheimera ; Rheinheimera sp		0.01	0.16
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Chromatiales ; Ectothiorhodospiraceae ; Unclassified ; Unclassified			0.03

Bacteria ; Proteobacteria ; Gammaproteobacteria ; Chromatiales ; Thioalkalispiraceae ; Thiohalophilus ; Thiohalophilus thiocyanatoxydans		0.02	
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Legionellales ; Coxiellaceae ; Coxiella ; Coxiella endosymbiont		0.18	
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Legionellales ; Legionellaceae ; Legionella ; Legionella pneumophila		0.02	
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Legionellales ; Legionellaceae ; Legionella ; Legionella sp		0.20	0.69
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Nevskiales ; Sinobacteraceae ; Solimonas ; Solimonas sp			0.89
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Nevskiales ; Sinobacteraceae ; Steroidobacter ; Steroidobacter sp			0.05
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Oceanospirillales ; Alcanivoracaceae ; Alcanivorax ; Alcanivorax indicus		0.66	2.24
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Oceanospirillales ; Alcanivoracaceae ; Alcanivorax ; Alcanivorax sp		0.04	
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Oceanospirillales ; Unclassified ; Unclassified ; Unclassified		0.02	0.11
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Pseudomonadales ; Moraxellaceae ; Acinetobacter ; Acinetobacter sp		0.02	6.64
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Pseudomonadales ; Pseudomonadaceae ; Pseudomonas ; Pseudomonas sp	0.27	82.85	23.57
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Pseudomonadales ; Pseudomonadaceae ; Pseudomonas ; Pseudomonas xinjiangensis		0.05	0.10
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Unclassified ; Unclassified ; Unclassified ; Unclassified			0.39
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Xanthomonadales ; Rhodanobacteraceae ; Rhodanobacter ; Rhodanobacter sp		0.11	
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Xanthomonadales ; Unclassified ; Unclassified ; Unclassified		0.09	0.04
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Xanthomonadales ; Xanthomonadaceae ; Lysobacter ; Lysobacter panaciterrae		0.05	0.53
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Xanthomonadales ; Xanthomonadaceae ; Lysobacter ; Lysobacter sp		0.20	
Bacteria ; Proteobacteria ; Gammaproteobacteria ; Xanthomonadales ; Xanthomonadaceae ; Pseudoxanthomonas ; Pseudoxanthomonas sp		0.27	

Bacteria ; Proteobacteria ; Gammaproteobacteria ; Xanthomonadales ; Xanthomonadaceae ; Xanthomonas ; Xanthomonas sp					0.09	
Bacteria ; Proteobacteria ; Unclassified ; Unclassified ; Unclassified ; Unclassified ; Unclassified					0.04	0.30
Bacteria ; Unclassified ; Unclassified ; Unclassified ; Unclassified ; Unclassified ; Unclassified	0.02	0.19		0.03	2.28	16.45
Bacteria ; Verrucomicrobia ; Opitutae ; Opitutales ; Opitutaceae ; Alterococcus ; Alterococcus agarolyticus					0.02	
No Hit ; No Hit ; No Hit ; No Hit ; No Hit ; No Hit ; No Hit					0.53	1.35

Appendix B

Boring Logs and Well Construction Details

Biological Reduction Study

Table B-1 - Well Construction Details

Central Retention Basin

Well ID	Northing (feet)	Easting (feet)	Latitude	Longitude	Borehole Size (inches)	Well Diameter (inches)	Well Material (blank casing)	Well Vault	Filter Pack Material	Screen Material	Screen Interval (feet bgs)	Screen Top (feet bgs)	Screen Bottom (feet bgs)	Screen Length (feet)	Total Depth of Borehole (feet bgs)	Total Depth of Well (feet bgs)	TOC Elevation (feet amsl)	Ground Surface Elevation (feet amsl)
CTIW-01S	26719202.713	828135.837	36° 02' 48.27" N	115° 00' 05.74" W	8	2	Sch. 40 PVC	18-in. Diameter Round	#2/16 Sand	2-in PVC 0.010"	18.5 - 23.5	18.5	23.5	5	26.5	23.5	1,757.41	1,757.20
CTIW-01D	26719205.172	828140.000	36° 02' 48.29" N	115° 00' 05.69" W	8	2	Sch. 40 PVC	18-in. Diameter Round	#2/16 Sand	2-in PVC 0.010"	33 - 38	33	38	5	61.5	38	1,757.34	1,757.08
CTIW-02S	26719213.064	828154.451	36° 02' 48.37" N	115° 00' 05.51" W	8	2	Sch. 40 PVC	18-in. Diameter Round	#2/16 Sand	2-in PVC 0.020"	19 - 24	19	24	5	26.5	24	1,757.45	1,757.39
CTIW-02D	26719215.001	828157.687	36° 02' 48.39" N	115° 00' 05.47" W	8	2	Sch. 40 PVC	18-in. Diameter Round	#2/16 Sand	2-in PVC 0.020"	34 - 49	34	49	15	51.5	49	1,757.31	1,757.37
CTIW-03S	26719223.844	828169.245	36° 02' 48.48" N	115° 00' 05.33" W	8	2	Sch. 40 PVC	18-in. Diameter Round	#2/16 Sand	2-in PVC 0.020"	19 - 24	19	24	5	26.5	24	1,757.32	1,757.31
CTIW-03D	26719225.419	828172.351	36° 02' 48.49" N	115° 00' 05.29" W	8	2	Sch. 40 PVC	18-in. Diameter Round	#2/16 Sand	2-in PVC 0.020"	34 - 49	34	49	15	51.5	49	1,757.48	1,757.38
CTMW-01S	26719216.935	828141.284	36° 02' 48.41" N	115° 00' 05.67" W	12	2	Sch. 40 PVC	18-in. Diameter Round	#2/16 Sand	2-in PVC 0.020"	19 - 24	19	24	5	61.5	24	1,757.16	1,757.18
CTMW-01D	26719217.228	828141.249	36° 02' 48.41" N	115° 00' 05.67" W	12	2	Sch. 40 PVC	18-in. Diameter Round	#2/16 Sand	2-in PVC 0.020"	34 - 49	34	49	15		49	1,757.14	1,757.18
CTMW-02S	26719235.068	828163.802	36° 02' 48.59" N	115° 00' 05.40" W	12	2	Sch. 40 PVC	18-in. Diameter Round	#2/16 Sand	2-in PVC 0.020"	19 - 24	19	24	5	61.5	24	1,757.21	1,757.32
CTMW-02D	26719234.810	828163.939	36° 02' 48.59" N	115° 00' 05.39" W	12	2	Sch. 40 PVC	18-in. Diameter Round	#2/16 Sand	2-in PVC 0.020"	34 - 49	34	49	15		49	1,757.26	1,757.32
CTMW-03S	26719237.005	828129.568	36° 02' 48.61" N	115° 00' 05.81" W	12	2	Sch. 40 PVC	18-in. Diameter Round	#2/16 Sand	2-in PVC 0.010"	19 - 24	19	24	5	61.5	24	1,757.21	1,757.15
CTMW-03D	26719237.269	828129.763	36° 02' 48.61" N	115° 00' 05.81" W	12	2	Sch. 40 PVC	18-in. Diameter Round	#2/16 Sand	2-in PVC 0.010"	34 - 39	34	39	5		39	1,757.23	1,757.15
CTMW-04S	26719246.990	828147.930	36° 02' 48.71" N	115° 00' 05.59" W	12	2	Sch. 40 PVC	18-in. Diameter Round	#2/16 Sand	2-in PVC 0.020"	19 - 24	19	24	5	61.5	24	1,757.00	1,757.17
CTMW-04D	26719246.759	828147.969	36° 02' 48.71" N	115° 00' 05.59" W	12	2	Sch. 40 PVC	18-in. Diameter Round	#2/16 Sand	2-in PVC 0.020"	34 - 49	34	49	15		29	1,757.00	1,757.17
CTMW-05S	26719266.508	828149.570	36° 02' 49.20" N	115° 00' 05.99" W	12	2	Sch. 40 PVC	18-in. Diameter Round	#2/16 Sand	2-in PVC 0.020"	19 - 24	19	24	5	61.5	24	1,757.24	1,757.15
CTMW-05D	26719266.615	828149.351	36° 02' 49.20" N	115° 00' 05.99" W	12	2	Sch. 40 PVC	18-in. Diameter Round	#2/16 Sand	2-in PVC 0.020"	34 - 54	34	54	20		54	1,757.25	1,757.15
CTMW-06S	26719256.295	828177.643	36° 02' 49.23" N	115° 00' 05.74" W	12	2	Sch. 40 PVC	18-in. Diameter Round	#2/16 Sand	2-in PVC 0.020"	19 - 24	19	24	5	61.5	24	1,757.43	1,757.17
CTMW-06D	26719256.058	828177.537	36° 02' 49.23" N	115° 00' 05.74" W	12	2	Sch. 40 PVC	18-in. Diameter Round	#2/16 Sand	2-in PVC 0.020"	34 - 54	34	54	20		54	1,757.42	1,757.17

Notes:

amsl	Above mean sea level
bgs	Below ground surface
btoc	Below top of casing
GW	Groundwater
in	Inches
PVC	Polyvinyl Chloride
Sch.	Schedule
TOC	Top of Casing

TETRA TECH, INC.

BORING NUMBER CTIW-01D

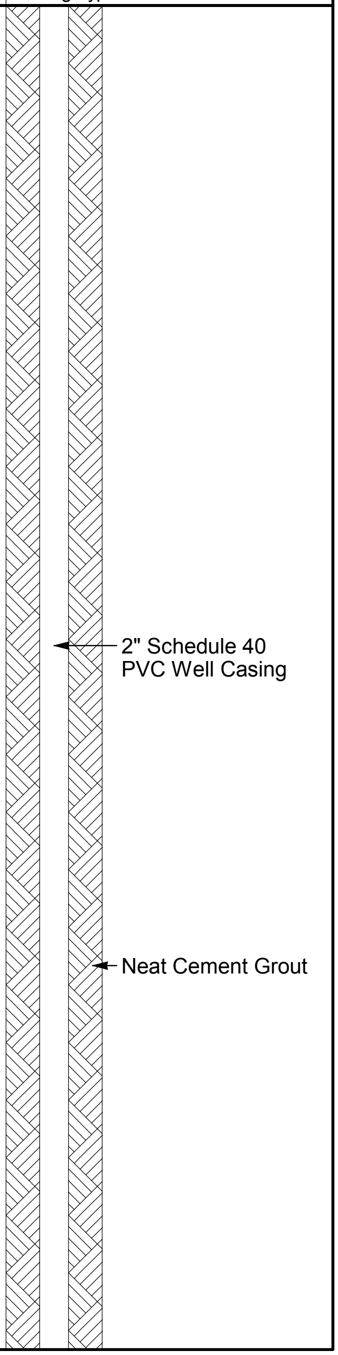
PAGE 1 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV
DATE STARTED 11/28/16 **COMPLETED** 11/29/16
GROUND ELEVATION 1757.34 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP, Inc.
WATER LEVEL AT TIME OF DRILLING 22.00 ft / Elev 1735.34 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 22.21 ft / Elev 1735.13 ft
LOGGED BY Jeff Richeson **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
0	GB		Cr VI = 0.19 Cl04- = 1500		(SM) Silty SAND with Gravel, (15,50,35,0), dark yellowish brown (10YR 4/4), fine to medium grained sand (poorly graded), dense, dry, angular gravel (<30mm), sample collected with hand auger. (Alluvium)
5	GB		Cr VI < = 0.16 Cl04- = 43		(SM) Silty SAND, (5,65,30,0), brown (7.5YR 5/3), fine to medium grained sand (poorly graded), dense, moist, angular gravel (<10mm). (Alluvium)
10	GB	6-13-17 (30)	Cr VI < = 0.17 Cl04- = 17		(SM) Silty SAND, (10,65,25,0) brown (7.5YR 5/4), fine to medium grained sand (poorly graded), dense, moist, angular to subangular gravel (<5mm). (Alluvium)
					(SM) Silty SAND with Gravel, (15,55,30,0), brown (7.5YR 4/4), fine to coarse grained sand (well graded), dense, moist, angular to subangular gravel (<35mm). (Alluvium)
15	MC	21-22-25 (47)	Cr VI < = 0.16 Cl04- = 350		(SM) Silty SAND with Gravel, (15,55,30,0), brown (7.5YR 4/4), medium to coarse grained sand (poorly graded), dense, moist, angular to subangular gravel (<15mm). (Alluvium)
					(SM) Silty SAND, (5,55,40,0), light brown (7.5YR 6/4), fine to medium grained sand (poorly graded), moderate cementation, very dense, moist, angular to subangular gravel (<5mm). (Alluvium)
20	MC	50/4"	Cr VI < = 0.18		

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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ENVIRONMENTAL BH - GINT STD US.GDT - 11/10/17 12:47 - \\TTS318FS1\CES\PROJECTS\87600014-NERT-M12\WORKING\IN-SITU CR TREATABILITY TEST\FIELD PROGRAM\BORING LOGS\GINT\ALL CR TREATABILITY LOGS.GPJ

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA
			Cl04- = 140
25	MC	4-4-8 (12)	Cr VI = 8.4 Dup = 12 Cl04- = 380 Dup = 400
30	MC	2-3-6 (9)	Cr VI = 11 Cl04- = 400
35	MC	6-10-12 (22)	Cr VI = 10 Cl04- = 720
40	MC	7-14-15 (29)	Cr VI = 19 Cl04- = 1400
45			

MATERIAL DESCRIPTION

(SM) Silty SAND, (5,55,40,0), light brown (7.5YR 6/4), fine to medium grained sand (poorly graded), dense, wet, angular to subangular gravel (<5mm). (Alluvium)

23.5 — 1733.8

(SM) Silty SAND, (5,55,40,0), light brown (7.5YR 6/4), fine to medium grained sand (poorly graded), moderate cementation, very dense, moist, angular to subangular gravel (<5mm). (Alluvium)

(ML) SILT, (0,15,85,0), brown (7.5YR 5/4), low to medium plasticity, hard, moist to wet. (UMCf)

(ML) SILT, (0,10,90,0), light brown (7.5YR 6/4), medium plasticity, firm, moist, trace of fine subangular to subrounded gravel (<5mm), sand content is fine to coarse grained. (UMCf)

(ML) SILT, (0,10,90,0), light brown (7.5YR 6/4), medium plasticity, firm, wet, trace of fine subangular to subrounded gravel (<5mm), sand content is fine to coarse grained. (UMCf)

(ML) SILT, (0,10,90,0), light brown (7.5YR 6/4), medium plasticity, firm, moist, trace of fine subangular to subrounded gravel (<5mm), sand content is fine to coarse grained. (UMCf)

(ML) SILT, (0,5,85,0), brown (7.5YR 5/4), medium to high plasticity, firm, moist, sand content is fine to coarse grained. (UMCf)

(ML) SILT, (0,5,70,25), brown (7.5YR 5/4), high plasticity, firm, moist, sand content is fine to coarse grained. (UMCf)

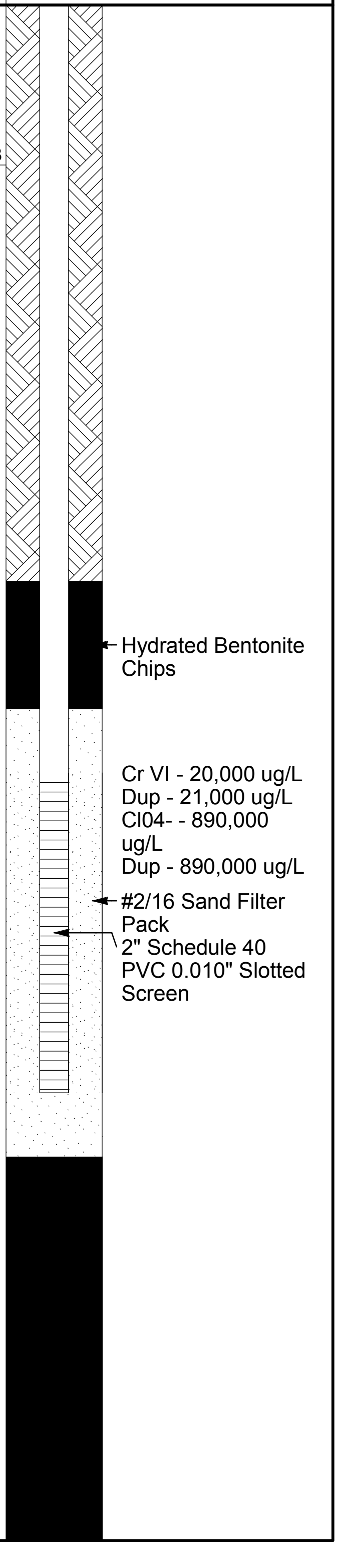
(ML) SILT, (0,15,85,0), brown (7.5YR 5/4), low to medium plasticity, hard, moist, sand content is fine to coarse grained, trace of fine subangular to subrounded gravel (<5mm). (UMCf)

(ML) SILT, (0,5,70,25), brown (7.5YR 5/4), high plasticity, firm, moist, sand content is fine to coarse grained. (UMCf)

(ML) SILT, (0,15,85,0), brown (7.5YR 5/4), low to medium plasticity, hard, moist, sand content is fine to coarse grained, trace of fine subangular to subrounded gravel (<5mm). (UMCf)

(ML) SILT, (0,15,70,15), brown (7.5YR 5/4), medium plasticity, firm, moist, sand content is medium to coarse grained. (UMCf)

WELL DIAGRAM



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BORING NUMBER CTIW-01D

TETRA TECH, INC.

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
45	MC	8-5-6 (11)	Cr VI = 20 Cl04- = 970		(ML) SILT, (0,15,85,0), brown (7.5YR 5/4), medium to high plasticity, hard, moist, small cemented nodules, sand content is medium to coarse grained. (UMCf)	
50	MC	5-7-8 (15)	Cr VI = 16 Cl04- = 520		(ML) SILT, (0,10,70,20), brown (7.5YR 4/4), high plasticity, firm, wet, sand content is fine grained. (UMCf)	Hydrated Bentonite Chips
55	MC	6-14-17 (31)	Cr VI = 6.9 Cl04- = 610		(ML) SILT, (0,10,80,10), brown (7.5YR 4/4), low to medium plasticity, hard, moist, small cemented nodules, sand content is fine to medium grained. (UMCf)	
60	MC	19-22-40 (62)	Cr VI = 0.65 Cl04- = 120	61.5	(ML) SILT, (0,10,80,10), brown (7.5YR 4/4), low to medium plasticity, very hard, moist, small cemented nodules, sand content is fine to medium grained. (UMCf) 1695.8	

Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

BORING NUMBER CTIW-01S

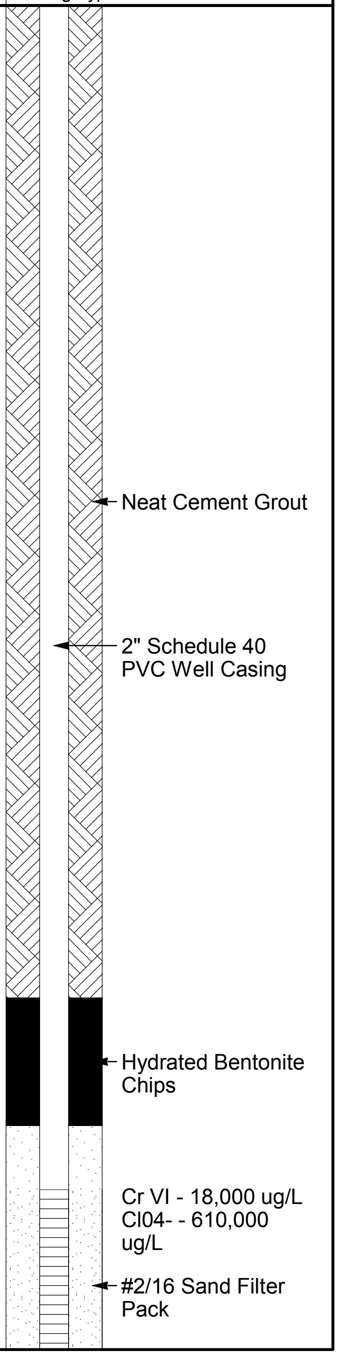
PAGE 1 OF 2

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV
DATE STARTED 12/1/16 **COMPLETED** 12/1/16
GROUND ELEVATION 1757.41 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP, Inc.
WATER LEVEL AT TIME OF DRILLING 22.00 ft / Elev 1735.41 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 22.26 ft / Elev 1735.15 ft
LOGGED BY Jeff Richeson **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
0	GB				(SM) Silty SAND with Gravel, (15,50,35,0), dark yellowish brown (10YR 4/4), fine to medium grained sand (poorly graded), dense, dry, angular gravel (<30mm), sample collected with hand auger. (Alluvium)
5	GB				(SM) Silty SAND, (5,65,30,0), brown (7.5YR 5/3), fine to medium grained sand (poorly graded), dense, moist, angular gravel (<10mm), sample collected with hand auger. (Alluvium).
10	MC	6-13-17 (30)			(SM) Silty SAND, (10,65,25,0), brown (7.5YR 5/4) fine to medium grained sand (poorly graded), dense, moist, angular to subangular gravel (<5mm). (Alluvium)
					(SM) Silty SAND with Gravel, (15,55,30,0), brown (7.5YR 4/4), fine to coarse grained sand (well graded), dense, moist, angular to subangular gravel (<35mm). (Alluvium)
15	MC	21-22-25 (47)			(SM) Silty SAND with Gravel, (15,55,30,0), brown (7.5YR 4/4), medium to coarse grained sand (poorly graded), dense, moist, angular to subangular gravel (<15mm). (Alluvium)
20	MC	50/4"	Cr VI = 0.73 Dup = 0.98		(SM) Silty SAND, (5,55,40,0), light brown (7.5YR 6/4), fine to medium grained sand (poorly graded), very dense, moist, moderate cementation, angular to subangular gravel (<5mm). (Alluvium)

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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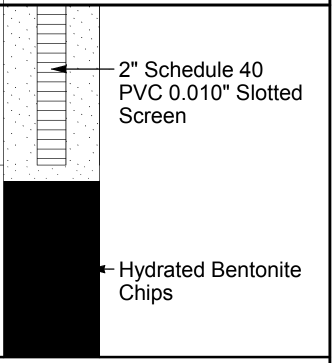
BORING NUMBER CTIW-01S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION
			Cl04- = 35 Dup = 58		(SM) Silty SAND, (5,55,40,0), light brown (7.5YR 6/4), fine to medium grained sand (poorly graded), dense, wet, angular to subangular gravel (<5mm). (Alluvium)	
23.5					(SM) Silty SAND, (5,55,40,0), light brown (7.5YR 6/4), fine to medium grained sand (poorly graded), very dense, moist, moderate cementation, angular to subangular gravel (<5mm). (Alluvium)	1733.9
25	MC	4-4-8 (12)			(ML) SILT, (0,15,85,0), brown (7.5YR 5/4), low to medium plasticity, hard, moist to wet. (UMCf)	
26.5						1730.9

WELL DIAGRAM



Bottom of borehole at 26.5 feet.

TETRA TECH, INC.

BORING NUMBER CTIW-02D

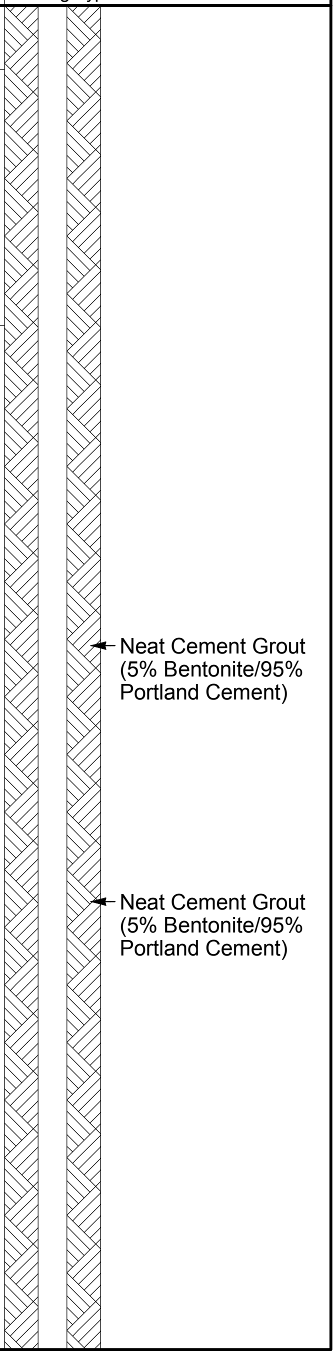
PAGE 1 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV
DATE STARTED 3/20/17 **COMPLETED** 3/24/17
GROUND ELEVATION 1757.31 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR Cascade Drilling
WATER LEVEL AT TIME OF DRILLING 22.50 ft / Elev 1734.81 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 22.52 ft / Elev 1734.79 ft
LOGGED BY Jeff Richeson **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
0	GB		Cr VI = 0.16 Cl04- = 1500	1.0	(SW-SM) Well Graded SAND with Silt, (10,80,10,0) (25,55,30), brown (7.5YR 4/3), dry, loose, well graded sand, subangular to subrounded gravel. (Alluvium) 1756.3 Air knife to 5' bgs (No Recovery)
5	MC	7-16-23 (39)	Cr VI < = 0.2 Cl04- = 350	5.0	1752.3 (SW) Well Graded SAND, (10,85,5,0) (30,40,30), brown (7.5YR 5/3), dry, loose to medium dense, well graded sand, subangular to rounded sand, subangular to subrounded gravel, gravel <1". (Alluvium)
10	MC	17-26-28 (54)	Cr VI < = 0.18 Cl04- = 18		(SW) Well Graded SAND with Gravel, (17,80,3,0) (25,50,25), brown (7.5YR 5/4), dry, medium dense, well graded sand, subangular to rounded sand, subangular to subrounded gravel, gravel <1.5". (Alluvium)
15	MC	20-25-27 (52)	Cr VI < = 0.16 Cl04- = 120		(SW) Well Graded SAND, (10,87,3,0) (25,45,30), brown (7.5YR 5/4), moist, medium dense, well graded sand, subangular to rounded sand, subangular to subrounded gravel, gravel <1". (Alluvium)
20	MC	12-16-19	Cr VI < = 0.2		(SW) Well Graded SAND, same as above. (Alluvium)

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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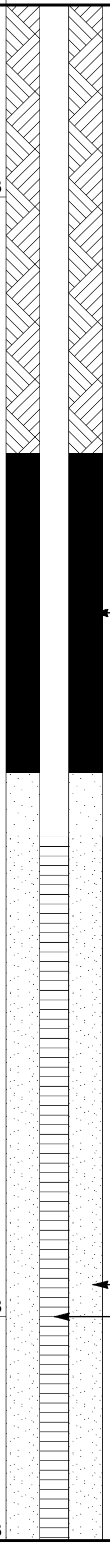
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION		WELL DIAGRAM
		(35)	Cl04- = 530			(SW) Well Graded SAND, same as above. (Alluvium) *(continued)*		
						▽ (SW) Well Graded SAND, same as above, wet, very weak cementation. (Alluvium)		
					24.0	(SM) Silty SAND, (0,70,30,0) (40,30,30), strong brown (7.5YR 5/6), dense to very dense, moist, well graded subangular to rounded sand, strong cementation. (Alluvium)	1733.3	
25	MC	4-5-6 (11)	Cr VI = 7.7 Cl04- = 240			(ML) SILT with Sand, (0,15,85,0) (0,20,80), strong brown (7.5YR 5/6), soft to firm, moist, poorly graded subangular to rounded sand, non plastic, UMCf/Qal contact at 24' bgs. (UMCf)		
						(ML) SILT, (0,5,85,10) (0,0,100), strong brown (7.5YR 5/6), soft to firm, wet from 26-29' bgs, moist from 29-30' bgs, low plasticity, few cemented nodules <0.5" diameter. (UMCf)		
30	MC	3-7-10 (17)	Cr VI = 8.3 Cl04- = 290			(ML) SILT, (0,10,75,15) (0,0,100), strong brown (7.5YR 5/6), soft to firm, moist from 30-31' bgs, wet from 31-32' bgs, moist from 32-35' bgs, low to medium plasticity. (UMCf)		Hydrated Bentonite Pellets
								Cr VI - 20,000 ug/L Dup - 21,000 ug/L Cl04- - 890,000 ug/L Dup - 890,000 ug/L
35	MC	6-9-10 (19)	Cr VI = 8.9 Cl04- = 390			(ML) SILT, (0,10,75,15) (0,0,100), light brown (7.5YR 6/3), firm, wet, low to medium plasticity, strongly cemented nodules throughout 35-39' bgs, weak cementation between 39-40' bgs. (UMCf)		
40	MC	7-9-19 (28)	Cr VI = 12 Cl04- = 820			(ML) SILT, same as 35-40' bgs, except no cementation/no nodules, firm to stiff. (UMCf)		#2/16 Sand Filter Pack
					41.5	No Recovery.	1715.8	2" Schedule 40 PVC 0.020" Slotted Screen
45					45.0		1712.3	



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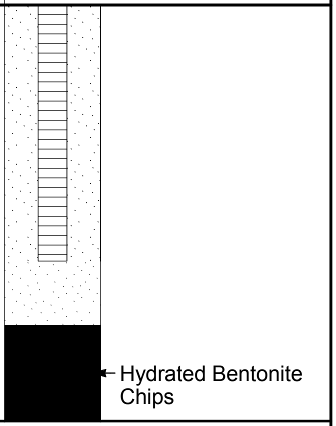
TETRA TECH, INC.

BORING NUMBER CTIW-02D

PAGE 3 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
45	MC	6-10-14 (24)	Cr VI = 13 Cl04- = 890		(ML) SILT, (0,10,65,25) (0,0,100), light brown (7.5YR 6/3), wet, firm to stiff, strongly cemented nodules throughout, medium plasticity, ~15% cemented nodules at 45-45.5' bgs. (UMCf)	
					(ML) SILT, same as above, strong cementation, moist. (UMCf)	
					(ML) SILT, same as above, no cementation/no nodules. (UMCf)	
50	MC	18-23-29 (52)	Cr VI = 6.7 Cl04- = 520	51.5	(ML) Sandy SILT, (0,40,60,5) (0,0,100), dark grayish brown (10YR 4/2), moist, stiff, very weak cementation, small clay nodules, poorly graded subangular to rounded sand. (UMCf)	1705.8



Bottom of borehole at 51.5 feet.

ENVIRONMENTAL BH - GINT STD US.GDT - 11/10/17 12:47 - \\TTS318FS1\CES\PROJECTS\87600014-NERT-M12\WORKING\IN-SITU CR TREATABILITY TESTFIELD PROGRAMBORING LOGS\GINTALL CR TREATABILITY LOGS.GPJ

TETRA TECH, INC.

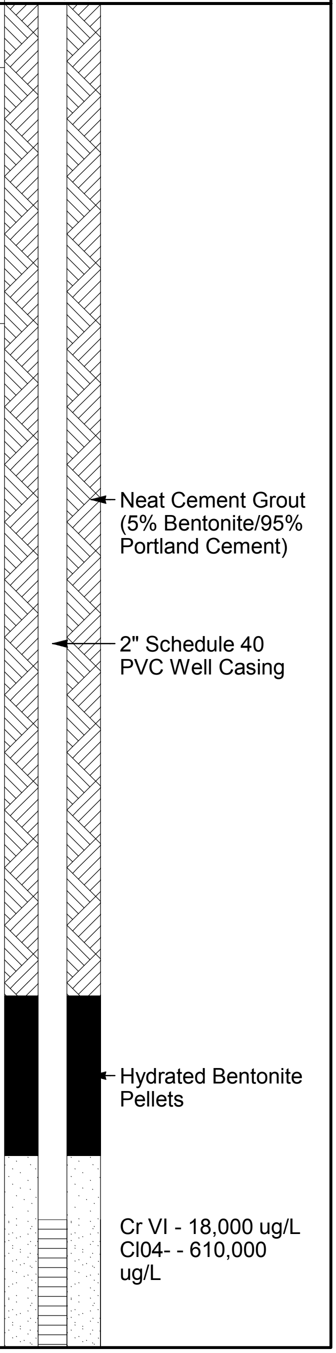
BORING NUMBER CTIW-02S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV
DATE STARTED 3/20/17 **COMPLETED** 3/27/17
GROUND ELEVATION 1757.45 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR Cascade Drilling
WATER LEVEL AT TIME OF DRILLING 22.50 ft / Elev 1734.95 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 22.49 ft / Elev 1734.96 ft
LOGGED BY Jeff Richeson **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0	GB			1.0	(SW-SM) Well Graded SAND with Silt, (10,80,10,0) (25,55,30), brown (7.5YR 4/3), dry, loose, well graded sand, subangular to subrounded sand. (Alluvium)	1756.5
					Air knife to 5' bgs (No Recovery)	
5	MC	7-16-23 (39)		5.0	(SW) Well Graded SAND, (10,85,5,0) (30,40,30), brown (7.5YR 5/3), dry, loose to medium dense, well graded sand, subangular to rounded sand, subangular to subrounded gravel, gravel <1". (Alluvium)	1752.5
10	MC	17-26-28 (54)			(SW) Well Graded SAND with Gravel, (17,80,3,0) (25,50,25), brown (7.5YR 5/4), dry, medium dense, well graded sand, subangular to rounded sand, subangular to subrounded gravel, gravel <1.5". (Alluvium)	
15	MC	20-25-27 (52)			(SW) Well Graded SAND, (10,87,3,0) (25,45,30), brown (7.5YR 5/4), moist, medium dense, well graded subangular to rounded sand, subangular to subrounded gravel, gravel <1". (Alluvium)	
20	MC	12-16-19			(SW) Well Graded SAND, same as above. (Alluvium)	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



Neat Cement Grout (5% Bentonite/95% Portland Cement)

2" Schedule 40 PVC Well Casing

Hydrated Bentonite Pellets

Cr VI - 18,000 ug/L
Cl04- - 610,000 ug/L

(Continued Next Page)

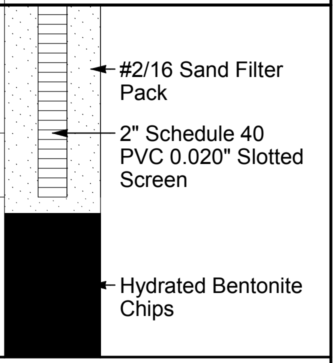
BORING NUMBER CTIW-02S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION	
		(35)				(SW) Well Graded SAND, same as above. (Alluvium) *(continued)*	
					23.0	▽ (SW) Well Graded SAND, same as above, wet, very weak cementation. (Alluvium)	1734.5
					24.0	(SM) Silty SAND, (0,70,30,0) (40,30,30), strong brown (7.5YR 5/6), dense to very dense, moist, well graded subangular to rounded sand, strong cementation. (Alluvium)	1733.5
25	MC	4-5-6 (11)				(ML) SILT with Sand, (0,15,85,0) (0,20,80), strong brown (7.5YR 5/6), soft to firm, moist, poorly graded subangular to rounded sand, non plastic, UMCf/Qal contact at 24' bgs. (UCMf)	
					26.5	(ML) SILT, (0,5,85,10) (0,0,100), strong brown (7.5YR 5/6), soft to firm, wet from 26-29' bgs, moist from 29-30' bgs, low plasticity, few cemented nodules <0.5". (UCMf)	1731.0

Bottom of borehole at 26.5 feet.

WELL DIAGRAM



TETRA TECH, INC.

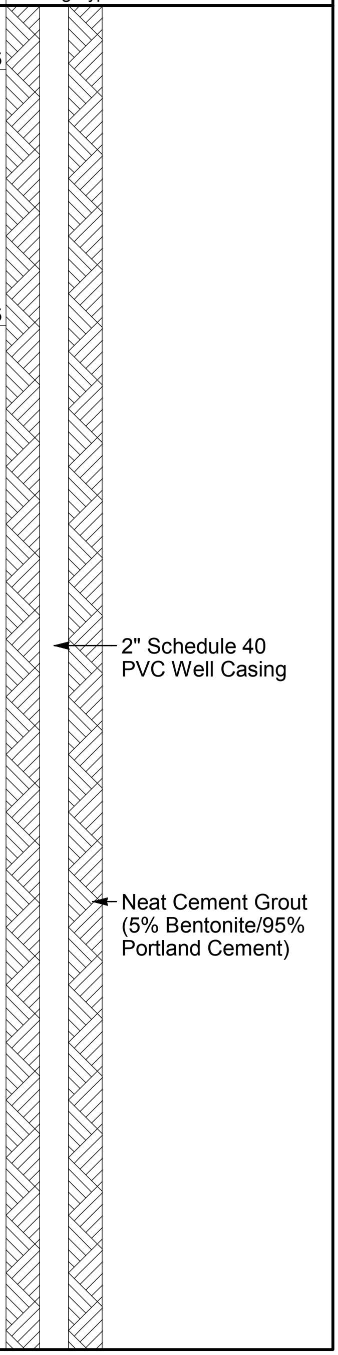
BORING NUMBER CTIW-03D

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV
DATE STARTED 3/20/17 **COMPLETED** 3/27/17
GROUND ELEVATION 1757.48 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR Cascade Drilling
WATER LEVEL AT TIME OF DRILLING 22.50 ft / Elev 1734.98 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 22.80 ft / Elev 1734.68 ft
LOGGED BY Jeff Richeson **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	MATERIAL DESCRIPTION
0	GB		Cr VI = 0.19 Cl04- = 1500	(SW-SM) Well-Graded SAND with Silt and Gravel, (15,77,8,0), (30,35,35), brown (7.5YR 5/4), dry, loose, well graded subangular to rounded sand. (Alluvium)
1.0				1756.5 Air knife to 5' bgs (No Recovery).
5.0	MC	14-29-50 (79)	Cr VI < = 0.16 Cl04- = 43	1752.5 (SW-SM) Well-Graded SAND with Silt and Gravel, (15,75,10,0), (30,35,35), brown (7.5YR 5/4), moist, loose to medium dense, very few weakly cemented nodules, well graded subangular to rounded sand, subangular to subrounded gravel, gravel <1.5". (Alluvium)
10	MC	13-18-37 (55)	Cr VI < = 0.17 Cl04- = 17	(SW) Well-Graded SAND with Silt and Gravel, (15,80,5,0), (25,50,25), brown (7.5YR 5/4), moist, loose to medium dense, well graded subangular to rounded sand, subangular to subrounded gravel, gravel <1.5". (Alluvium)
15	MC	20-29-52 (81)	Cr VI < = 0.16 Cl04- = 350	(SW-SM) Well-Graded SAND with Silt and Gravel, (15,75,10,0) (20,40,40), brown (7.5YR 5/4), moist, medium dense, well graded subangular to rounded sand, subangular to subrounded gravel, gravel <1". (Alluvium)
20	MC	16-20-32	Cr VI < = 0.18	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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CLIENT Nevada Environmental Response Trust (NERT)

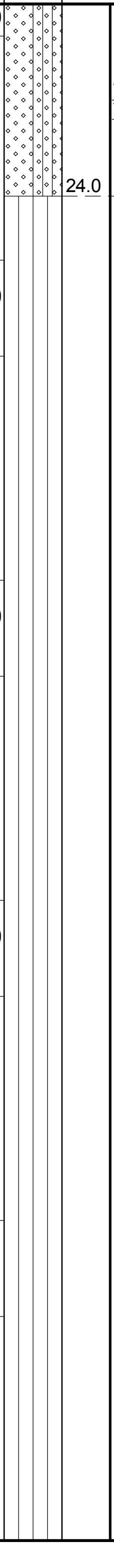
PROJECT NAME NERT - In-Situ Chromium Treatability Study

PROJECT NUMBER 194-87600014-M12

PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA
		(52)	Cl04- = 140
25	MC	9-11-14 (25)	Cr VI = 8.4 Cl04- = 380
30	MC	3-4-6 (10)	Cr VI = 11 Cl04- = 400
35	MC	4-7-7 (14)	Cr VI = 10 Cl04- = 720
40	MC	4-6-8 (14)	Cr VI = 19 Cl04- = 1400
45			

GRAPHIC LOG



MATERIAL DESCRIPTION

(SW-SM) Well-Graded SAND with Silt and Gravel, (15,75,10,0) (20,40,40), brown (7.5YR 5/4), moist, medium dense, well graded subangular to rounded sand, subangular to subrounded gravel, gravel <1". (Alluvium) *(continued)*

▽ ▼

(SW-SM) Well-Graded SAND with Silt and Gravel, (15,75,10,0) (20,40,40), brown (7.5YR 5/4), moist, medium dense, weak cementation, wet, well graded subangular to rounded sand, subangular to subrounded gravel, gravel <1". (Alluvium)

(SW-SM) Well-Graded SAND with Silt and Gravel, (15,75,10,0) (20,40,40), brown (7.5YR 5/4), moist, medium dense, moderate cementation, moist, well graded subangular to rounded sand, subangular to subrounded gravel, gravel <1". (Alluvium)

1733.5

(ML) SILT, (0,10,90,0) (0,0,100), light brown (7.5YR 6/3), wet, moderate to strong cementation, non plastic, very stiff, UMCf/Qal contact at 24' bgs. (UMCf)

(ML) SILT, (0,5,85,10) (0,0,100), strong brown (7.5YR 5/6), 25-26' bgs moist, 26-29' bgs wet, 29-30' bgs moist, soft to firm, low plasticity, very few strongly cemented nodules. (UMCf)

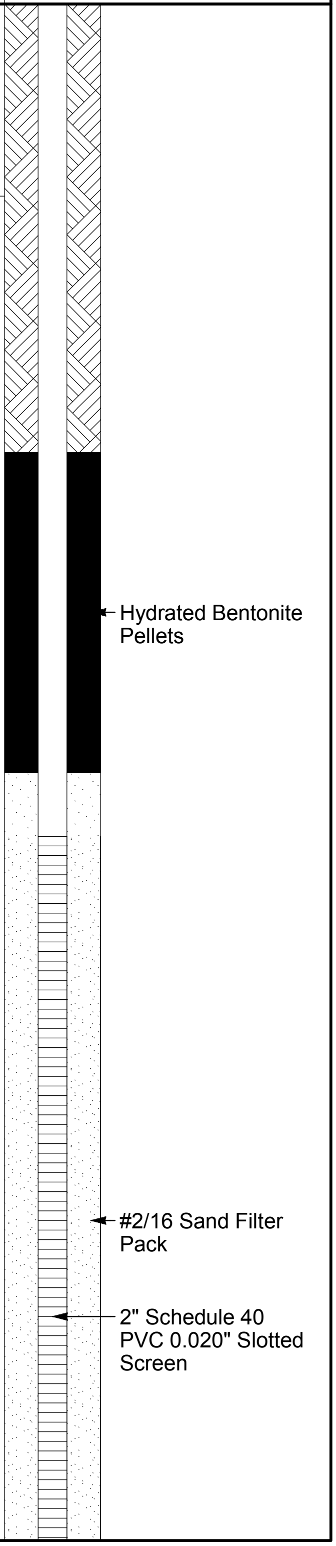
(ML) SILT, (0,10,80,10) (0,0,100), strong brown (7.5YR 5/6), 30-31' bgs moist, 31-35' bgs wet, soft to firm, low plasticity, very few strongly cemented nodules. (UMCf)

(ML) SILT, (0,10,70,20) (0,0,100), brown (7.5YR 5/4), wet, low to medium plasticity, soft to firm, strongly cemented nodules scattered throughout. (UMCf)

(ML) SILT, (0,10,80,10) (0,0,100), brown (7.5YR 5/4), moist, low plasticity, soft to firm, strongly cemented nodules scattered throughout. (UMCf)

(ML) Clayey SILT, (Elastic Silt), (0,10,65,30) (0,0,100), brown (7.5YR 5/4), wet, medium plasticity, soft to firm, strongly cemented nodules, weak cementation throughout, ~15-20% cemented nodules from 42-42.5' bgs. (UMCf)

WELL DIAGRAM



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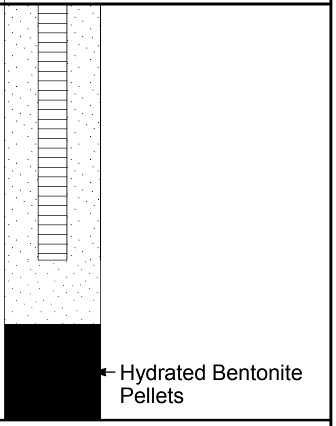
BORING NUMBER CTIW-03D

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
45						
	MC	6-9-10 (19)	Cr VI = 20 Cl04- = 970		(ML) Clayey SILT, (Elastic Silt), (0,10,65,30) (0,0,100), strong brown (7.5YR 5/6), firm, medium plasticity, strongly cemented nodules. (UMCf)	
50	MC	8-12-14 (26)	Cr VI = 16 Cl04- = 520	51.5	(ML) SILT, (0,25,60,15) (0,0,100), brown (7.5YR 5/4), firm, low plasticity, moist, ditto, some clay nodules. (UMCf) 1706.0	

Bottom of borehole at 51.5 feet.

BORING NUMBER CTIW-03S

TETRA TECH, INC.

CLIENT Nevada Environmental Response Trust (NERT)

PROJECT NAME NERT - In-Situ Chromium Treatability Study

PROJECT NUMBER 194-87600014-M12

PROJECT LOCATION Henderson, NV

DATE STARTED 3/20/27 **COMPLETED** 3/27/17

GROUND ELEVATION 1757.32 ft **HOLE SIZE** 8 in

DRILLING CONTRACTOR Cascade Drilling

WATER LEVEL AT TIME OF DRILLING 22.50 ft / Elev 1734.82 ft

DRILLING METHOD Hollow Stem Auger

WATER LEVEL AFTER DRILLING 22.53 ft / Elev 1734.79 ft

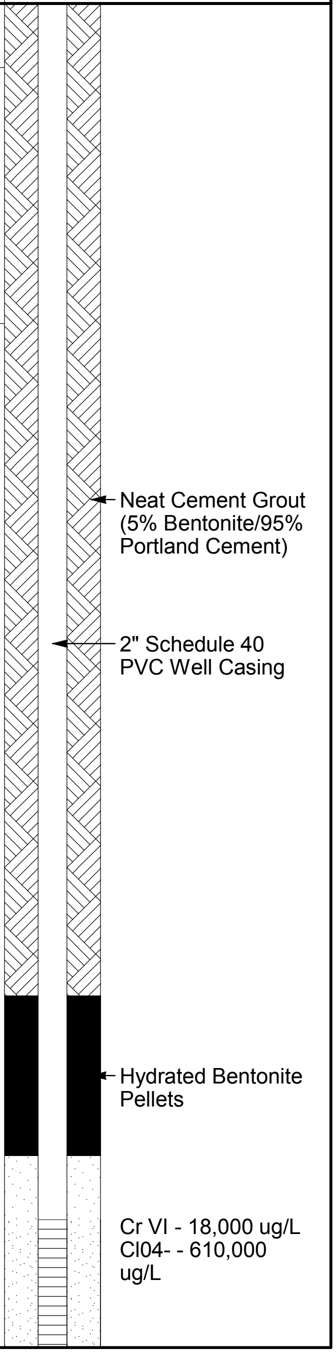
LOGGED BY Jeff Richeson **CHECKED BY** M. Crews

NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION	
0	GB				1.0	(SW-SM) Well Graded SAND with Silt and Gravel. (15,77,8,0) (30,35,35) 7.5YR 5/4 Brown, dry, loose, well graded subangular to rounded sand. (Alluvium)	1756.3
						Air knife to 5' bgs (No Recovery).	
5	MC	14-29-50 (79)			5.0	(SW-SM) Well Graded SAND with Silt and Gravel. (15,75,10,0) (30,35,35) 7.5YR 5/4 Brown, moist, loose to medium dense, very few weakly cemented nodules, well graded subangular to rounded sand, subangular to subrounded gravel, gravel <1.5". (Alluvium)	1752.3
10	MC	13-18-37 (55)				(SW) Well Graded SAND with Gravel. (15,80,5,0) (25,50,25) 7.5YR 5/4 Brown, moist, loose to medium dense, well graded subangular to rounded sand, subangular to subrounded gravel, gravel <1". (Alluvium)	
15	MC	20-29-52 (81)				(SW-SM) Well Graded SAND with Silt and Gravel (15,75,10,0) (20,40,40) 7.5YR 5/4 Brown, moist, medium dense, well graded subangular to rounded sand, subangular to subrounded gravel, gravel <1". (Alluvium)	
20	MC	16-20-32				(SW-SM) Same as above. Well Graded Sand with Silt and Gravel. (Alluvium)	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



Cr VI - 18,000 ug/L
Cl04- - 610,000 ug/L

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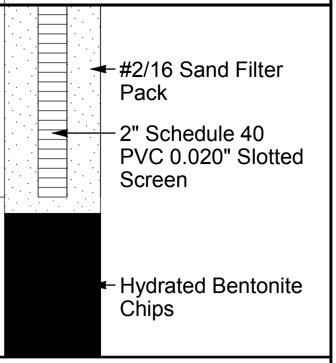
TETRA TECH, INC.

BORING NUMBER CTIW-03S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION	
		(52)				(SW-SM) Same as above. Well Graded Sand with Silt and Gravel. (Alluvium) *(continued)*	
						▼ (SW-SM) Same as above, Well Graded SAND with Silt and Gravel, weak cementation, wet. (Alluvium)	
					24.0	(SW-SM) Same as above, Well Graded SAND with Silt and Gravel, moderate cementation, moist. (Alluvium)	1733.3
25						(ML) SILT. (0,10,90,0) (0,0,100) 7.5YR 6/3 Light Brown, wet moderate to strong cementation, non plastic, very stiff. (UMCf)	
	MC	9-11-14 (25)			26.5	(ML) SILT. (0,5,85,10) (0,0,100) 7.5YR 5/6 Strong Brown, 25-26' bgs moist, 26-26.5' bgs wet, soft to firm, low plasticity, very few strongly cemented nodules. (UMCf)	1730.8

WELL DIAGRAM



Bottom of borehole at 26.5 feet.

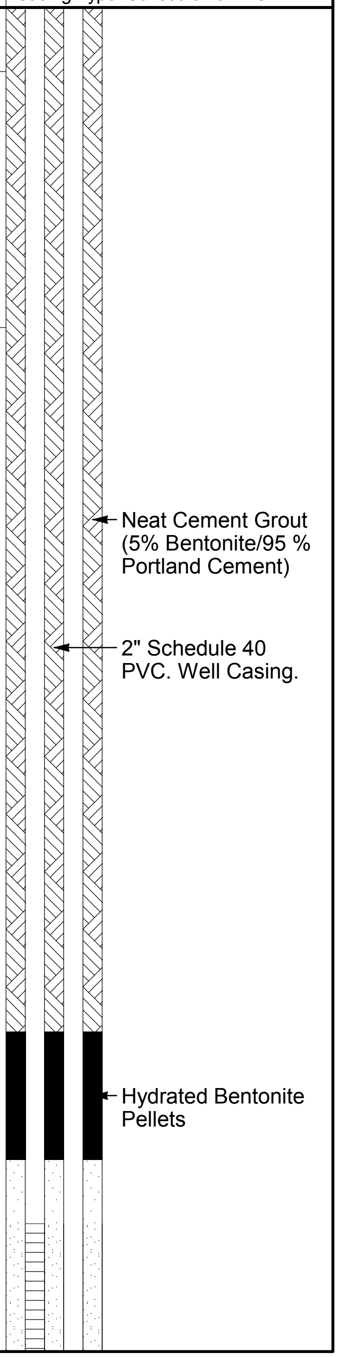
TETRA TECH, INC.

BORING NUMBER CTMW-01D

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV
DATE STARTED 3/20/17 **COMPLETED** 3/21/17
GROUND ELEVATION 1757.14 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR Cascade Drilling
WATER LEVEL AT TIME OF DRILLING 22.50 ft / Elev 1734.64 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 22.37 ft / Elev 1734.77 ft
LOGGED BY Jeff Richeson **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	GB 0.5		Cr VI < = 0.17 Cl04- = 6.7	1.0	(SW) Well-Graded SAND, (10,87,3,0) (20,70,10), brown (7.5 YR 5/4), dry, loose, well-graded gravel and sand, subangular to round gravel and sand. (Alluvium)	1756.1
					Air knife to 5' bgs (No Recovery).	
5	MC 5	16-19-32 (51)	Cr VI < = 0.17 Cl04- = 160	5.0	(SW) Well-Graded SAND with Gravel, (15,82,3,0) (25,50,25), same as above except medium dense to dense, gravel <3". (Alluvium)	1752.1
					(SW) Well-Graded SAND with Gravel, (15,82,3,0) (20,40,40), same as above except medium dense to dense, gravel <3". (Alluvium)	
10	MC 10	14-23-35 (58)	Cr VI < = 0.16 Cl04- = 190		(SW) Well-Graded SAND, (10,90,5,0) (30,40,30), brown (7.5YR 5/4), moist, medium dense to dense, well graded gravel and sand, subangular to subround gravel and sand, gravel <3". (Alluvium)	
15	MC 15	26-44-47 (91)	Cr VI < = 0.16 Cl04- = 540		(SW-SM) Well-Graded SAND with Silt, (10,90,5,0) (30,60,10), same as above, silt content increases to 10% at 20.5'. (Alluvium)	
20		12-29-48	Cr VI = 1.8 Cl04- = 240			

Casing Type: Schedule 40 PVC



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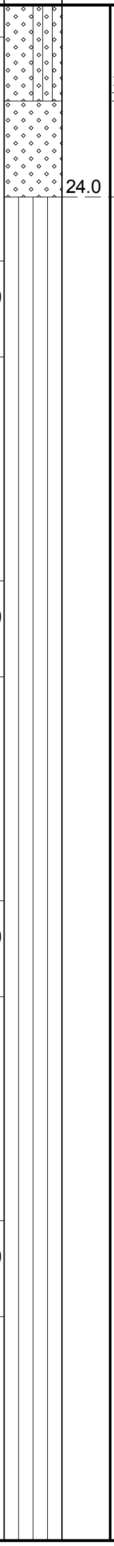
BORING NUMBER CTMW-01D

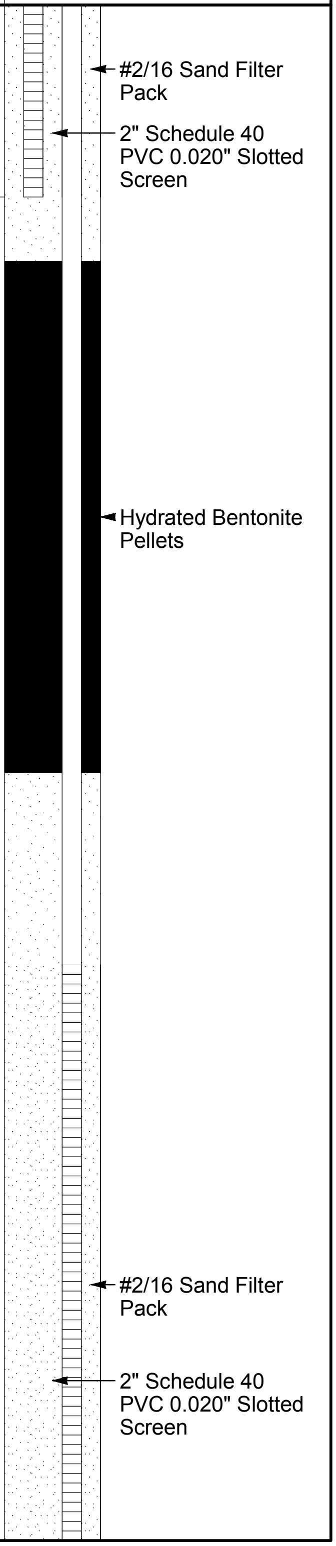
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	MATERIAL DESCRIPTION
	MC 20	(77)		(SW-SM) Well Graded SAND with Silt, (10,85,10,0) (30,60,10), same as above, strong cementation and cemented nodules present. (Alluvium)
				(SW) Well-Graded SAND with Gravel, (15,80,5,0) (33,33,34), brown (7.5YR 5/4), wet, medium dense, well graded sand, subangular to round sand and gravel, gravel <1". (Alluvium) 1733.1
				(ML) SILT, (0,10,80,10) (0,10,90), light brown (7.5YR 6/4), medium dense to dense, wet, some cemented nodules <1", low plasticity. (UMCf)
25	MC 25	17-26-39 (65)	Cr VI = 4.8 Cl04- = 140	(ML) SILT, (0,10,87,3) (0,0,100), light brown (7.5YR 6/4), medium dense, wet, non plastic. (UMCf)
30	MC 30	4-7-10 (17)	Cr VI = 11 Cl04- = 430	(ML) SILT, (0,5,95,0) (0,0,100), strong brown (7.5YR 5/6), firm to stiff, wet, non plastic. (UMCf)
35	MC 35	11-13-17 (30)	Cr VI = 9.4 Cl04- = 530	(ML) SILT, (0,5,95,0) (0,0,100), strong brown (7.5YR 5/6), firm to stiff, wet, non plastic. (UMCf)
				(ML) SILT, (0,5,55,45) (0,0,100), brown (7.5YR 4/4), medium to high plasticity, wet, stiff, some cemented nodules, elastic silt. (UMCf)
				(ML) SILT, (0,10,80,10) (0,0,100) same as 30-35' bgs. (UMCf)
40	MC 40	20-29-32 (61)	Cr VI = 13 Cl04- = 600	(ML) SILT, (0,10,80,10) (0,0,100), brown (7.5YR 5/4), moist, very stiff, low plasticity. (UMCf)
45				(ML) SILT, (0,10,80,10) (0,0,100), brown (7.5YR 5/4), moist, very stiff, low plasticity, with very small cemented

GRAPHIC LOG



WELL DIAGRAM



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TETRA TECH, INC.

BORING NUMBER CTMW-01D

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
45	MC 45	13-15-23 (38)	Cr VI = 13 Cl04- = 750		nodules. (UMCf) (ML) SILT, same as 40-44' bgs, stiff to very stiff. (UMCf)	
50	MC 50	14-19-23 (42)	Cr VI = 13 Cl04- = 570		(ML) SILT, (0,10,80,10) (0,0,100), same as above, stiff to very stiff. (UMCf)	
55	MC 55	15-26-41 (67)	Cr VI = 11 Dup = 9.7 Cl04- = 710 Dup = 580		(ML) SILT, (0,10,80,10) (0,0,100), same as above, stiff to very stiff, with cemented nodules. (UMCf) (ML) SILT, (0,10,80,10) (0,0,100), same as above, stiff to very stiff. (UMCf) (ML) SILT, same as above with increase in cemented nodules-white to grey in color, approximately 15-20% of core comprised of cemented nodules. (UMCf) (ML) SILT, same as above 50-54.5, small weakly cemented nodules pervasive throughout interval. (UMCf)	Hydrated Bentonite Chips
60	MC 60	7-10-16 (26)	Cr VI = 10 Cl04- = 950	61.5	(ML) SILT, same as above, firm to stiff. (UMCf)	1695.6

Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

BORING NUMBER CTMW-01S

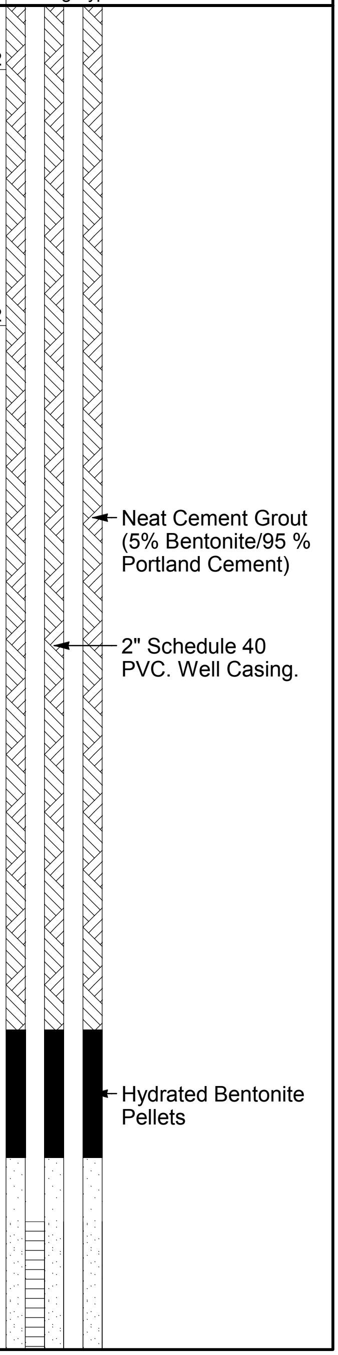
PAGE 1 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV
DATE STARTED 3/20/17 **COMPLETED** 3/21/17
GROUND ELEVATION 1757.16 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR Cascade Drilling
WATER LEVEL AT TIME OF DRILLING 22.50 ft / Elev 1734.66 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 22.21 ft / Elev 1734.95 ft
LOGGED BY Jeff Richeson **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	Elev.
0	GB 0.5		Cr VI < = 0.17 Cl04- = 6.7	1.0	(SW) Well-Graded SAND, (10,87,3,0) (20,70,10), brown (7.5 YR 5/4), dry, loose, well-graded gravel and sand, subangular to round gravel and sand. (Alluvium)	1756.2
					Air knife to 5' bgs (No Recovery).	
5	MC 5	16-19-32 (51)	Cr VI < = 0.17 Cl04- = 160	5.0	(SW) Well-Graded SAND with Gravel, (15,82,3,0) (25,50,25), same as above except medium dense to dense, gravel <3". (Alluvium)	1752.2
					(SW) Well-Graded SAND with Gravel, (15,82,3,0) (20,40,40), same as above except medium dense to dense, gravel <3". (Alluvium)	
10	MC 10	14-23-35 (58)	Cr VI < = 0.16 Cl04- = 190		(SW) Well-Graded SAND, (10,90,5,0) (30,40,30), brown (7.5YR 5/4), moist, medium dense to dense, well graded gravel and sand, subangular to subround gravel and sand, gravel <3". (Alluvium)	
15	MC 15	26-44-47 (91)	Cr VI < = 0.16 Cl04- = 540		(SW-SM) Well-Graded SAND with Silt, (10,90,5,0) (30,60,10), same as above, silt content increases to 10% at 20.5'. (Alluvium)	
20		12-29-48	Cr VI = 1.8 Cl04- = 240			

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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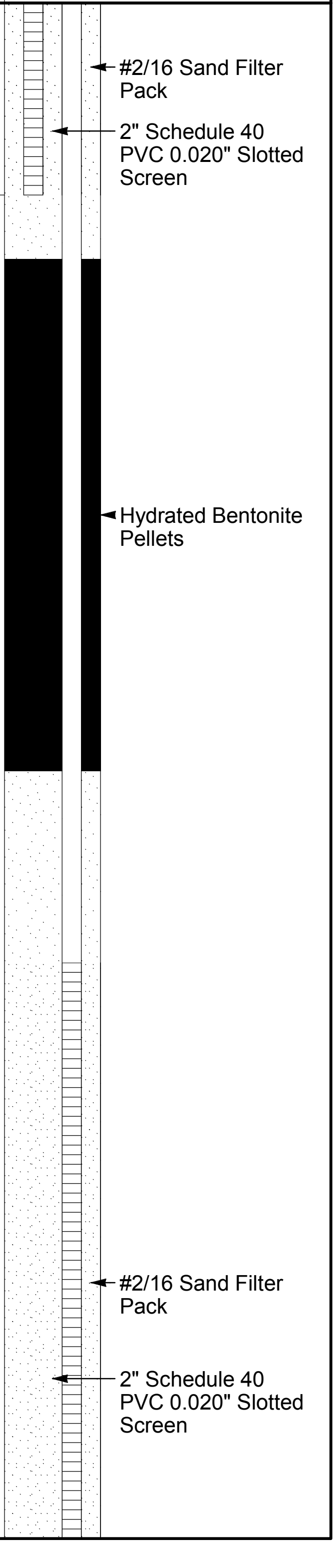
TETRA TECH, INC.

BORING NUMBER CTMW-01S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	MATERIAL DESCRIPTION
	MC 20	(77)		(SW-SM) Well Graded SAND with Silt, (10,85,10,0) (30,60,10), same as above, strong cementation and cemented nodules present. (Alluvium)
				(SW) Well-Graded SAND with Gravel, (15,80,5,0) (33,33,34), brown (7.5YR 5/4), wet, medium dense, well graded sand, subangular to round sand and gravel, gravel <1". (Alluvium)
24.0				1733.2
				(ML) SILT, (0,10,80,10) (0,10,90), light brown (7.5YR 6/4), medium dense to dense, wet, some cemented nodules <1", low plasticity. (UMCf)
25	MC 25	17-26-39 (65)	Cr VI = 4.8 Cl04- = 140	(ML) SILT, (0,10,87,3) (0,0,100), light brown (7.5YR 6/4), medium dense, wet, non plastic. (UMCf)
30	MC 30	4-7-10 (17)	Cr VI = 11 Cl04- = 430	(ML) SILT, (0,5,95,0) (0,0,100), strong brown (7.5YR 5/6), firm to stiff, wet, non plastic. (UMCf)
35	MC 35	11-13-17 (30)	Cr VI = 9.4 Cl04- = 530	(ML) SILT, (0,5,95,0) (0,0,100), strong brown (7.5YR 5/6), firm to stiff, wet, non plastic. (UMCf)
				(ML) SILT, (0,5,55,45) (0,0,100), brown (7.5YR 4/4), medium to high plasticity, wet, stiff, some cemented nodules, elastic silt. (UMCf)
				(ML) SILT, (0,10,80,10) (0,0,100) same as 30-35' bgs. (UMCf)
40	MC 40	20-29-32 (61)	Cr VI = 13 Cl04- = 600	(ML) SILT, (0,10,80,10) (0,0,100), brown (7.5YR 5/4), moist, very stiff, low plasticity. (UMCf)
45				(ML) SILT, (0,10,80,10) (0,0,100), brown (7.5YR 5/4), moist, very stiff, low plasticity, with very small cemented

WELL DIAGRAM



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TETRA TECH, INC.

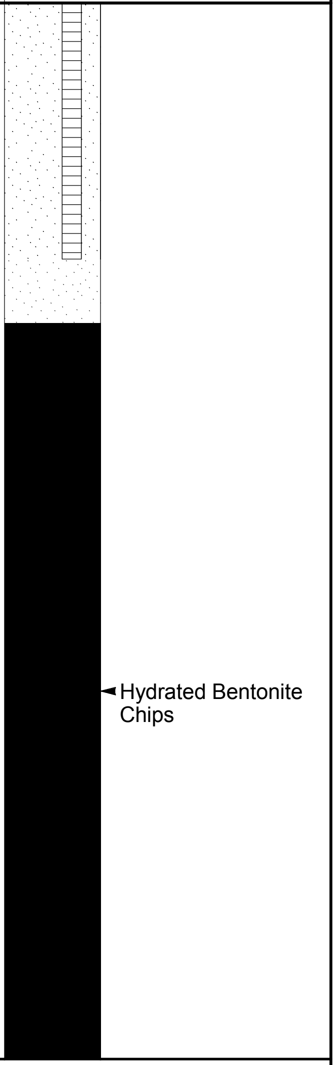
BORING NUMBER CTMW-01S

PAGE 3 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC 45	13-15-23 (38)	Cr VI = 13 Cl04- = 750		nodules. (UMCf) (ML) SILT, same as 40-44' bgs, stiff to very stiff. (UMCf)
50	MC 50	14-19-23 (42)	Cr VI = 13 Cl04- = 570		(ML) SILT, (0,10,80,10) (0,0,100), same as above, stiff to very stiff. (UMCf)
55	MC 55	15-26-41 (67)	Cr VI = 11 Dup = 9.7 Cl04- = 710 Dup = 580		(ML) SILT, (0,10,80,10) (0,0,100), same as above, stiff to very stiff, with cemented nodules. (UMCf) (ML) SILT, (0,10,80,10) (0,0,100), same as above, stiff to very stiff. (UMCf) (ML) SILT, same as above with increase in cemented nodules-white to grey in color, approximately 15-20% of core comprised of cemented nodules. (UMCf) (ML) SILT, same as above 50-54.5, small weakly cemented nodules pervasive throughout interval. (UMCf)
60	MC 60	7-10-16 (26)	Cr VI = 10 Cl04- = 950	61.5	(ML) SILT, same as above, firm to stiff. (UMCf) 1695.7

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

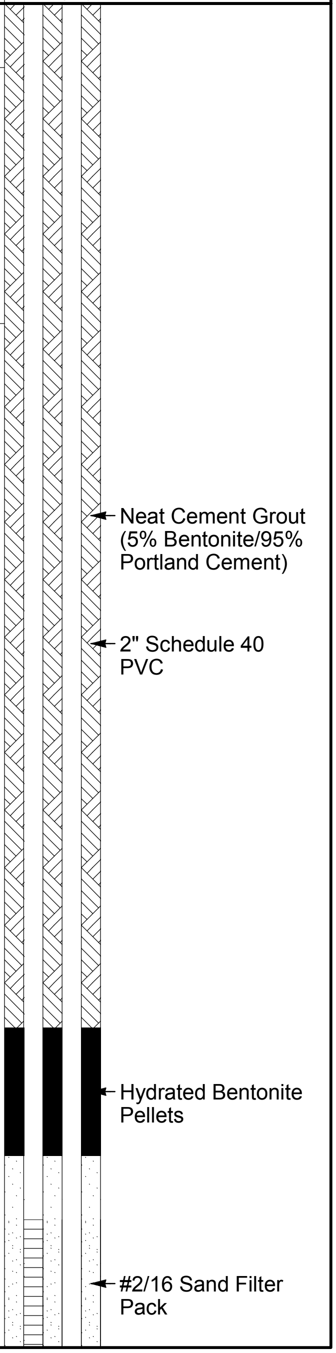
BORING NUMBER CTMW-02D

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV
DATE STARTED 3/20/17 **COMPLETED** 3/23/17
GROUND ELEVATION 1757.26 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR Cascade Drilling
WATER LEVEL AT TIME OF DRILLING 22.50 ft / Elev 1734.76 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 22.72 ft / Elev 1734.54 ft
LOGGED BY Jeff Richeson **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
0	GB		Cr VI < = 0.16 Cl04- = 0.7	1.0	(SW) Well-Graded SAND with Gravel, (15,81,4,0) (25,25,50), brown (7.5YR 5/4), dry loose, well graded sand and gravel, subangular to rounded gravel and sand. (Alluvium) 1756.3 Air knife to 5' bgs (no recovery)
5	MC	18-26-29 (55)	Cr VI < = 0.17 Cl04- = 1800	5.0	1752.3 (SW) Well Graded SAND with Gravel, (15,82,3,0) (30,50,20) brown (7.5YR 5/4), dry, medium dense, well graded gravel and sand, subangular to rounded sand, subangular to subrounded gravel, <3" gravel. (Alluvium)
10	MC	12-17-25 (42)	Cr VI < = 0.16 Cl04- = 420		(SW) Well Graded SAND with Gravel, (20,75,5,0) (30,50,20), brown (7.5YR 4/3), dry, loose to medium dense, well graded gravel and sand, subangular to rounded sand, subangular to subrounded gravel, gravel <3". (Alluvium)
15	MC	21-26-37 (63)	Cr VI < = 0.16 Cl04- = 260		(SW-SM) Well Graded SAND with Silt and Gravel, (15,70,15,0) (20,30,50), brown (7.5YR 4/3), dry from 15-18.5, moist from 18.5-20, medium dense, subangular to rounded sand, well graded gravel and sand, subangular to subrounded gravel, gravel <2". (Alluvium)
20	MC	19-31-42	Cr VI = 1.4 Cl04- = 580		

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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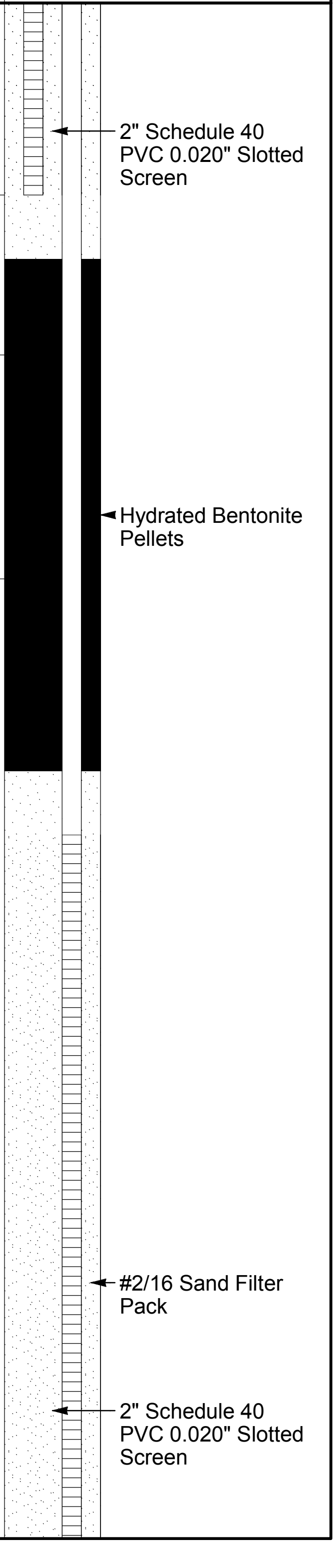
ENVIRONMENTAL BH - GINT STD US.GDT - 11/10/17 12:47 - \\TTS318FS1\CES\PROJECTS\87600014-NERT-M12\WORKING\IN-SITU CR TREATABILITY TEST\FIELD PROGRAM\BORING LOGS\GINT\ALL CR TREATABILITY LOGS.GPJ

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
		(73)			(SW-SM) Well Graded SAND with Silt and Gravel, (15,70,15,0) (20,30,50), brown (7.5YR 4/3), dry from 15-18.5, moist from 18.5-20, medium dense, subangular to rounded sand, well graded gravel and sand, subangular to subrounded gravel, gravel <2". (Alluvium) *(continued)*		
					(SM) SILT, (3,82,15,0) (40,30,30), brown (7.5YR 5/4), moist, well graded gravel and sand, medium dense, subangular to rounded sand, subangular to subrounded gravel, gravel <0.5", strong cementation. (Alluvium)		
				24.0	(SW-SM) Well Graded SAND with Silt, (3,87,10,0) same as above, weak cementation, wet, silt content decreases to 10%. (Alluvium)	1733.3	
25	MC	4-5-7 (12)	Cr VI = 1.7 Cl04- = 87		(SM) Silty SAND, same as 21.5-22' bgs, UMCf/Qal contact at 24' bgs. (Alluvium)		
				26.5	(ML) SILT, (0,10,90,0) (0,15,85), light brown (7.5YR 6/4), moist, poorly graded sand, subangular to rounded sand, weakly cemented, soft to firm. (UMCf)	1730.8	
					(ML) SILT, (0,10,90,0) (0,10,90), light brown (7.5YR 6/4), wet from 25-25.5' bgs, moist from 25.5-26.5' bgs, soft to firm, poorly graded sand, subangular to rounded sand. (UMCf)		
					No Recovery		
30	MC	3-6-6 (12)	Cr VI = 9.5 Dup = 11 Cl04- = 410 Dup = 380	30.0	(ML) SILT, (0,10,80,10) (0,5,95), brown (7.5YR 5/4), wet from 30-34' bgs, moist from 34-35' bgs, soft to firm, poorly graded subangular to rounded sand, low plasticity. (UMCf)	1727.3	
35	MC	5-18-26 (44)	Cr VI = 6.2 Cl04- = 290		(ML) SILT, (0,10,75,15) (0,0,100), strong brown (7.5YR 5/6), wet from 35-37' bgs, moist from 37-40' bgs, few strongly cemented nodules throughout, low plasticity. (UMCf)		
40	MC	2-7-8 (15)	Cr VI = 13 Cl04- = 1100		(ML) SILT, (0,10,75,15) (0,0,100) brown (7.5YR 4/4), moist from 40-41.5' bgs, wet from 41.5-42.5' bgs, moist from 42.5-43' bgs, wet from 43-44' bgs, moist from 44-45' bgs, weak cementation throughout with few strongly cemented nodules, soft to firm, low plasti		
45							



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CLIENT Nevada Environmental Response Trust (NERT)

PROJECT NAME NERT - In-Situ Chromium Treatability Study

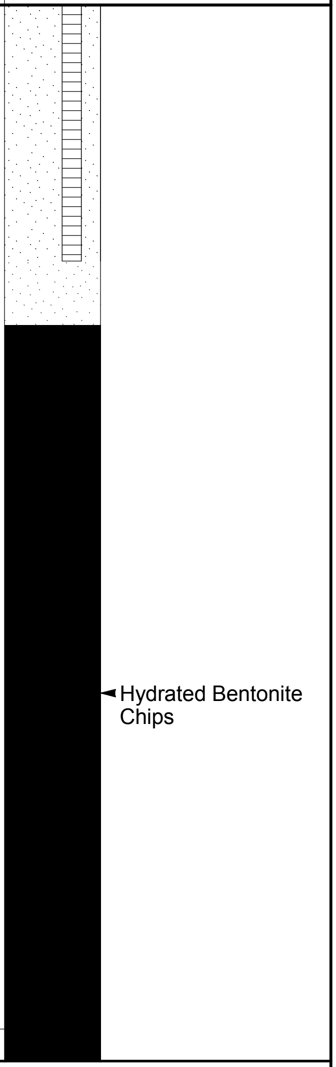
PROJECT NUMBER 194-87600014-M12

PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	4-5-10 (15)	Cr VI = 17 Cl04- = 1100		(ML) SILT, (0,10,70,20) (0,0,100) brown (7.5YR 4/4), moist from 45-48' bgs, wet from 48-48.5' bgs, moist from 48.5-50' bgs, soft to firm, few strongly cemented nodules, low to medium plasticity. (UMCf)
50	MC	6-11-15 (26)	Cr VI = 13 Cl04- = 650		(ML) SILT, (0,5,60,35) (0,0,100), brown (7.5YR 5/4), moist from 50-52' bgs, wet from 52-52.5' bgs, moist from 52.5-54' bgs, wet from 54-54.5' bgs, moist from 54.5-55' bgs, firm to stiff, weak cementation from 50-51' bgs with a few large (2") strongly cemented
55	MC	3-18-25 (43)	Cr VI = 9.2 Cl04- = 430		(ML) SILT, (0,10,75,15) (0,0,100) brown (7.5YR 4/4), moist from 55-55.5' bgs, wet from 55.5-56' bgs, moist from 56-60' bgs, stiff to very stiff, low plasticity, strongly cemented nodules throughout (<1"), ~15% of core from 59-60' bgs is comprised of cemented n
60	MC	9-12-21 (33)	Cr VI = 1.8 Cl04- = 340	61.0	(ML) SILT, (0,10,75,15) (0,0,100) brown (7.5YR 4/4), moist from 55-55.5' bgs, wet from 55.5-56' bgs, moist from 56-60' bgs, stiff to very stiff, low plasticity, strongly cemented nodules throughout (<1"), ~15% of core from 59-60' bgs is comprised of cemented n

1696.3

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

BORING NUMBER CTMW-02S

PAGE 1 OF 3

CLIENT Nevada Environmental Response Trust (NERT)

PROJECT NAME NERT - In-Situ Chromium Treatability Study

PROJECT NUMBER 194-87600014-M12

PROJECT LOCATION Henderson, NV

DATE STARTED 3/20/17 **COMPLETED** 3/23/17

GROUND ELEVATION 1757.21 ft **HOLE SIZE** 12 in

DRILLING CONTRACTOR Cascade Drilling

WATER LEVEL AT TIME OF DRILLING 22.50 ft / Elev 1734.71 ft

DRILLING METHOD Hollow Stem Auger

WATER LEVEL AFTER DRILLING 22.47 ft / Elev 1734.74 ft

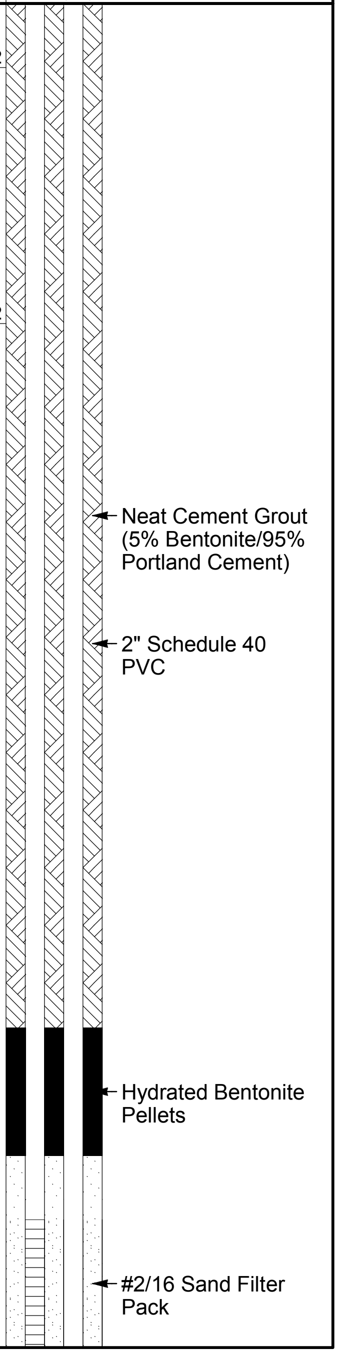
LOGGED BY Jeff Richeson **CHECKED BY** M. Crews

NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION	
0	GB		Cr VI < = 0.16 Cl04- = 0.7		1.0	(SW) Well-Graded SAND with Gravel, (15,81,4,0) (25,25,50), brown (7.5YR 5/4), dry loose, well graded sand and gravel, subangular to rounded gravel and sand. (Alluvium) Air knife to 5' bgs (no recovery)	1756.2
5	MC	18-26-29 (55)	Cr VI < = 0.17 Cl04- = 1800		5.0	(SW) Well Graded SAND with Gravel, (15,82,3,0) (30,50,20) brown (7.5YR 5/4), dry, medium dense, well graded gravel and sand, subangular to rounded sand, subangular to subrounded gravel, <3" gravel. (Alluvium)	1752.2
10	MC	12-17-25 (42)	Cr VI < = 0.16 Cl04- = 420			(SW) Well Graded SAND with Gravel, (20,75,5,0) (30,50,20), brown (7.5YR 4/3), dry, loose to medium dense, well graded gravel and sand, subangular to rounded sand, subangular to subrounded gravel, gravel <3". (Alluvium)	
15	MC	21-26-37 (63)	Cr VI < = 0.16 Cl04- = 260			(SW-SM) Well Graded SAND with Silt and Gravel, (15,70,15,0) (20,30,50), brown (7.5YR 4/3), dry from 15-18.5, moist from 18.5-20, medium dense, subangular to rounded sand, well graded gravel and sand, subangular to subrounded gravel, gravel <2". (Alluvium)	
20	MC	19-31-42	Cr VI = 1.4 Cl04- = 580				

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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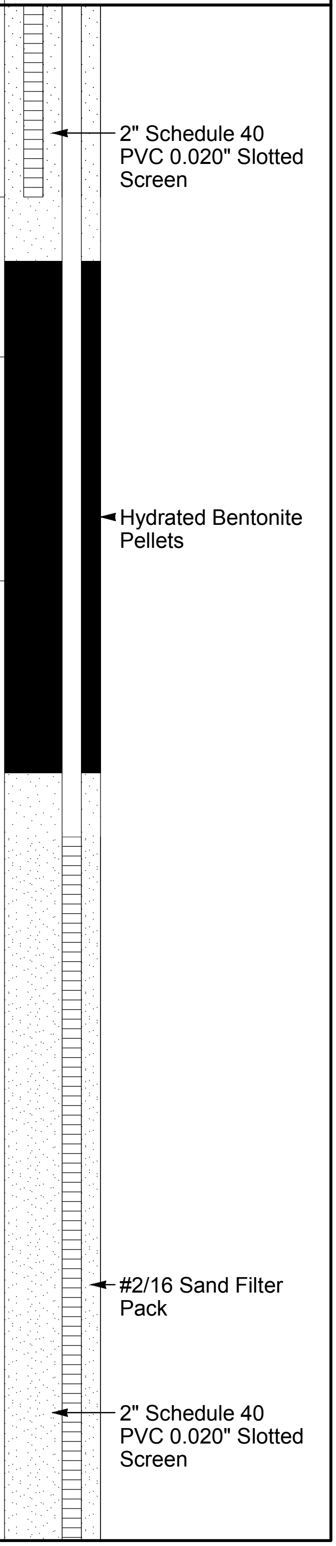
BORING NUMBER CTMW-02S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
		(73)		▽	(SW-SM) Well Graded SAND with Silt and Gravel, (15,70,15,0) (20,30,50), brown (7.5YR 4/3), dry from 15-18.5, moist from 18.5-20, medium dense, subangular to rounded sand, well graded gravel and sand, subangular to subrounded gravel, gravel <2". (Alluvium) *(continued)* (SM) SILT, (3,82,15,0) (40,30,30), brown (7.5YR 5/4), moist, well graded gravel and sand, medium dense, subangular to rounded sand, subangular to subrounded gravel, gravel <0.5", strong cementation. (Alluvium)
				24.0	1733.2
					(SW-SM) Well Graded SAND with Silt, (3,87,10,0) same as above, weak cementation, wet, silt content decreases to 10%. (Alluvium)
25	MC	4-5-7 (12)	Cr VI = 1.7 Cl04- = 87		(SM) Silty SAND, same as 21.5-22' bgs, UMCf/Qal contact at 24' bgs. (Alluvium)
				26.5	1730.7
					(ML) SILT, (0,10,90,0) (0,15,85), light brown (7.5YR 6/4), moist, poorly graded sand, subangular to rounded sand, weakly cemented, soft to firm. (UMCf) (ML) SILT, (0,10,90,0) (0,10,90), light brown (7.5YR 6/4), wet from 25-25.5' bgs, moist from 25.5-26.5' bgs, soft to firm, poorly graded sand, subangular to rounded sand. (UMCf) No Recovery
30				30.0	1727.2
	MC	3-6-6 (12)	Cr VI = 9.5 Dup = 11 Cl04- = 410 Dup = 380		(ML) SILT, (0,10,80,10) (0,5,95), brown (7.5YR 5/4), wet from 30-34' bgs, moist from 34-35' bgs, soft to firm, poorly graded subangular to rounded sand, low plasticity. (UMCf)
35	MC	5-18-26 (44)	Cr VI = 6.2 Cl04- = 290		(ML) SILT, (0,10,75,15) (0,0,100), strong brown (7.5YR 5/6), wet from 35-37' bgs, moist from 37-40' bgs, few strongly cemented nodules throughout, low plasticity. (UMCf)
40	MC	2-7-8 (15)	Cr VI = 13 Cl04- = 1100		(ML) SILT, (0,10,75,15) (0,0,100) brown (7.5YR 4/4), moist from 40-41.5' bgs, wet from 41.5-42.5' bgs, moist from 42.5-43' bgs, wet from 43-44' bgs, moist from 44-45' bgs, weak cementation throughout with few strongly cemented nodules, soft to firm, low plasti
45					

WELL DIAGRAM



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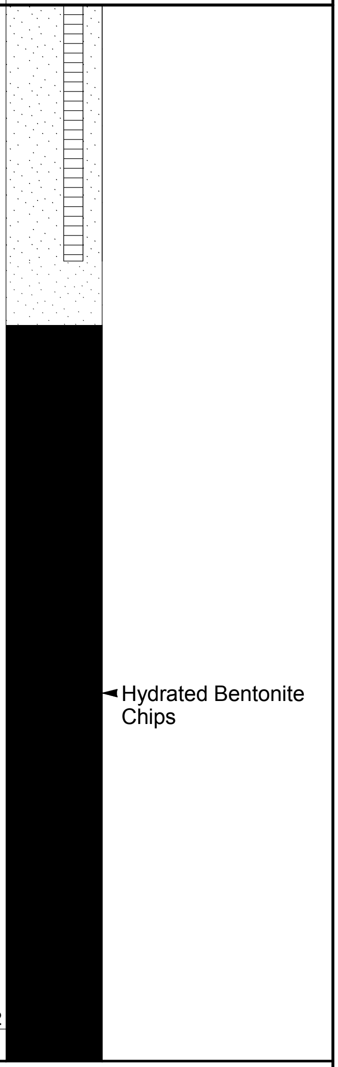
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	4-5-10 (15)	Cr VI = 17 Cl04- = 1100		(ML) SILT, (0,10,70,20) (0,0,100) brown (7.5YR 4/4), moist from 45-48' bgs, wet from 48-48.5' bgs, moist from 48.5-50' bgs, soft to firm, few strongly cemented nodules, low to medium plasticity. (UMCf)
50	MC	6-11-15 (26)	Cr VI = 13 Cl04- = 650		(ML) SILT, (0,5,60,35) (0,0,100), brown (7.5YR 5/4), moist from 50-52' bgs, wet from 52-52.5' bgs, moist from 52.5-54' bgs, wet from 54-54.5' bgs, moist from 54.5-55' bgs, firm to stiff, weak cementation from 50-51' bgs with a few large (2") strongly cemented
55	MC	3-18-25 (43)	Cr VI = 9.2 Cl04- = 430		(ML) SILT, (0,10,75,15) (0,0,100) brown (7.5YR 4/4), moist from 55-55.5' bgs, wet from 55.5-56' bgs, moist from 56-60' bgs, stiff to very stiff, low plasticity, strongly cemented nodules throughout (<1"), ~15% of core from 59-60' bgs is comprised of cemented n
60	MC	9-12-21 (33)	Cr VI = 1.8 Cl04- = 340	61.0	(ML) SILT, (0,10,75,15) (0,0,100) brown (7.5YR 4/4), moist from 55-55.5' bgs, wet from 55.5-56' bgs, moist from 56-60' bgs, stiff to very stiff, low plasticity, strongly cemented nodules throughout (<1"), ~15% of core from 59-60' bgs is comprised of cemented n 1696.2

Bottom of borehole at 61.5 feet.

WELL DIAGRAM



BORING NUMBER CTMW-03D

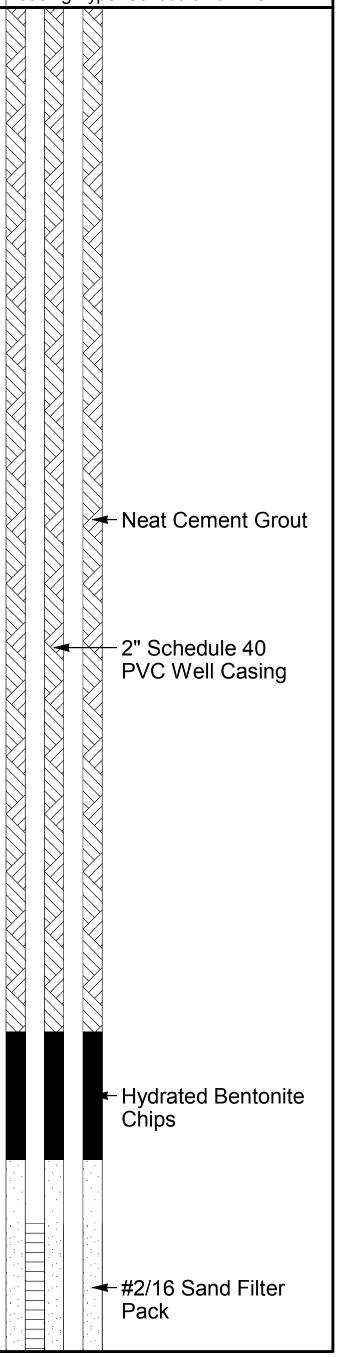
CLIENT	Nevada Environmental Response Trust (NERT)	**PROJECT NAME**	NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER	194-87600014-M12	**PROJECT LOCATION**	Henderson, NV
DATE STARTED	11/30/16 **COMPLETED** 12/1/16	**GROUND ELEVATION**	1757.23 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR	National EWP, Inc.	**WATER LEVEL AT TIME OF DRILLING**	22.50 ft / Elev 1734.73 ft
DRILLING METHOD	Hollow Stem Auger	**WATER LEVEL AFTER DRILLING**	22.43 ft / Elev 1734.80 ft
LOGGED BY	Jeff Richeson **CHECKED BY** M. Crews		

NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
0	GB		Cr VI < = 0.16 Cl04- = 0.7		(SM) Silty SAND with Gravel, dark yellowish brown (10YR 4/4), (15,50,35,0), fine to coarse grained sand, dense, dry, angular gravel (<30mm), sample collected with hand auger. (Alluvium)
5	GB		Cr VI < = 0.17 Cl04- = 1800		(SM) Sity SAND, brown (7.5YR 5/3), (10,65,25,0), fine to medium grained sand (poorly graded), dense, moist, angular gravel (<10mm), sample collected with hand auger. (Alluvium)
10	MC	12-14-16 (30)	Cr VI < = 0.16 Cl04- = 420		(SM) Silty SAND, brown (7.5YR 5/4), (10,60,30,0), fine to medium grained sand (poorly graded), dense, weak cementation, moist, angular to subangular gravel (<10mm). (Alluvium)
15	MC	18-20-22 (42)	Cr VI < = 0.16 Cl04- = 260		(SM) Sity SAND, brown (7.5 YR 5/4), (10,70,20,0), fine to coarse grained sand (well graded), dense, moist, angular to subangular gravel (<30mm). (Alluvium)
20	MC	18-29-29	Cr VI = 1.4 Cl04- = 580		

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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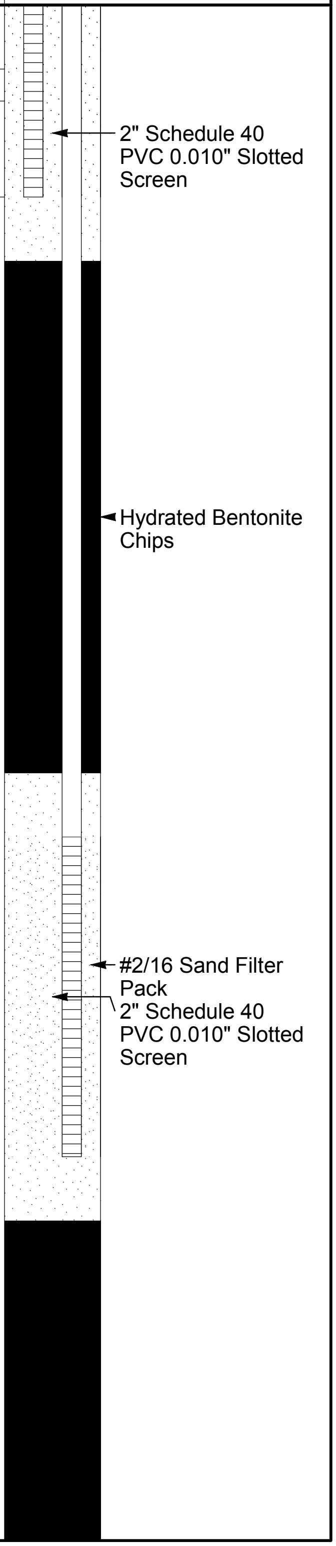
BORING NUMBER CTMW-03D

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
		(58)		22.0	(SM) Sitty SAND, light brown (7.5 YR 6/4), (5,75,20,00, fine to medium grained sand (poorly graded), dense, moist, angular to subangular gravel (<5mm). (Alluvium) *(continued)*	1735.2
				22.5 ▽	(SW) SAND with Gravel, light brown (7.5YR 6/3), (35,55,10,0), fine to coarse grained sand (well graded), medium dense, wet, angular to subangular well graded gravel (<15mm). (Alluvium)	1734.7
				24.0	(SM) Silty SAND, light brown (7.5 YR 6/4), (5,75,20,0), fine to medium grained sand (poorly graded), dense, moist, angular to subangular gravel (<5mm). (Alluvium)	1733.2
25	MC	14-15-20 (35)	Cr VI = 1.7 Cl04- = 87		(ML) SILT, brown (7.5 YR 5/4), (0,15,85,0), medium plasticity, hard, wet, coarse grained sand. (UMCf)	
					(ML) SILT, brown (7.5 YR 5/4), (0,5,85,10), medium to high plasticity, firm, moist, fine to coarse grained sand. (UMCf)	
30	MC	4-7-9 (16)	Cr VI = 9.5 Dup = 11 Cl04- = 410 Dup = 380		(ML) SILT, brown (7.5YR 5/4), (0,5,70,25), high plasticity, hard, moist, fine to coarse grained sand. (UMCf)	
					(ML) SILT, brown (7.5YR 5/4), (2,15,83,0), low to medium plasticity, hard, wet, fine to coarse grained sand, subangular to subrounded gravel (<5mm). (UMCf)	
					(ML) SILT, brown (7.5YR 5/4), (0,5,70,25), high plasticity, hard, moist, fine to coarse grained. (UMCf)	
35	MC	7-10-13 (23)	Cr VI = 6.2 Cl04- = 290			
					(ML) SILT, light brown (7.5YR 6/4), (5,15,50,20), high plasticity, firm, wet, fine to coarse grained, angular to subangular gravel (<10mm). (UMCf)	
40	MC	6-9-10 (19)	Cr VI = 13 Cl04- = 1100		(ML) SILT, brown (7.5 YR 5/4),(0,15,70,15), medium plasticity, firm, moist, medium to coarse grained sand. (UMCf)	
45						

WELL DIAGRAM



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CLIENT Nevada Environmental Response Trust (NERT)

PROJECT NAME NERT - In-Situ Chromium Treatability Study

PROJECT NUMBER 194-87600014-M12

PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
45	MC	6-8-9 (17)	Cr VI = 17 Cl04- = 1100		(ML) SILT, brown (7.5YR 5/4), (5,10,75,10), medium plasticity, hard, wet, medium to coarse grained sand, angular to subangular gravel (<15mm). (UMCf) *(continued)*	
					(ML) SILT, brown (7.5YR 5/4), (5,10,70,15), medium plasticity, hard, wet, coarse sand, angular to subangular gravel (<10mm). (UMCf)	
50	MC	4-5-5 (10)	Cr VI = 13 Cl04- = 650		(ML) SILT, brown (7.5YR 4/4), (0,5,70,250, high plasticity, firm, moist, fine grained sand. (UMCf)	Hydrated Bentonite Chips
					(ML) SILT, brown (7.5YR 4/4), (5,10,75,10), medium plasticity, hard with small cemented nodules, moist, medium to coarse grainedn sand, angular to subangular gravel (<5mm). (UMCf)	
55	MC	7-9-10 (19)	Cr VI = 9.2 Cl04- = 430			
					(ML) SILT, very pale brown (10YR 7/3), (5,10,80,5), low to medium plasticity, hard with small cemented nodules, moist, coarse grained sand, angular to subangular gravel (<5mm). (UMCf)	
60	MC	27-39-40 (79)	Cr VI = 1.8 Cl04- = 340			
				61.5	1695.7	

Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

BORING NUMBER CTMW-03S

CLIENT Nevada Environmental Response Trust (NERT)

PROJECT NAME NERT - In-Situ Chromium Treatability Study

PROJECT NUMBER 194-87600014-M12

PROJECT LOCATION Henderson, NV

DATE STARTED 11/30/16 **COMPLETED** 12/1/16

GROUND ELEVATION 1757.21 ft **HOLE SIZE** 12 in

DRILLING CONTRACTOR National EWP, Inc.

WATER LEVEL AT TIME OF DRILLING 22.50 ft / Elev 1734.71 ft

DRILLING METHOD Hollow Stem Auger

WATER LEVEL AFTER DRILLING 22.36 ft / Elev 1734.85 ft

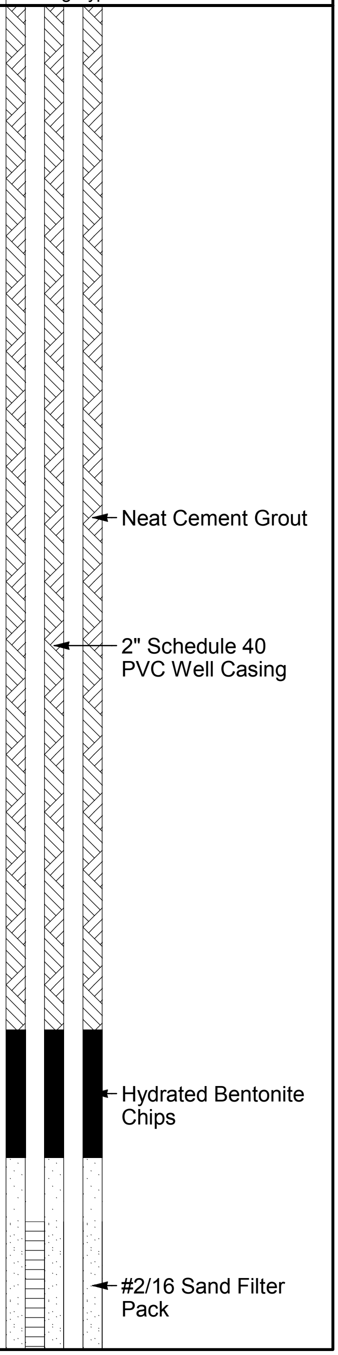
LOGGED BY Jeff Richeson **CHECKED BY** M. Crews

NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
0	GB		Cr VI < = 0.16 Cl04- = 0.7		(SM) Silty SAND with Gravel, dark yellowish brown (10YR 4/4), (15,50,35,0), fine to coarse grained sand, dense, dry, angular gravel (<30mm), sample collected with hand auger. (Alluvium)
5	GB		Cr VI < = 0.17 Cl04- = 1800		(SM) Sity SAND, brown (7.5YR 5/3), (10,65,25,0), fine to medium grained sand (poorly graded), dense, moist, angular gravel (<10mm), sample collected with hand auger. (Alluvium)
10	MC	12-14-16 (30)	Cr VI < = 0.16 Cl04- = 420		(SM) Silty SAND, brown (7.5YR 5/4), (10,60,30,0), fine to medium grained sand (poorly graded), dense, weak cementation, moist, angular to subangular gravel (<10mm). (Alluvium)
15	MC	18-20-22 (42)	Cr VI < = 0.16 Cl04- = 260		(SM) Sity SAND, brown (7.5 YR 5/4), (10,70,20,0), fine to coarse grained sand (well graded), dense, moist, angular to subangular gravel (<30mm). (Alluvium)
20	MC	18-29-29	Cr VI = 1.4 Cl04- = 580		

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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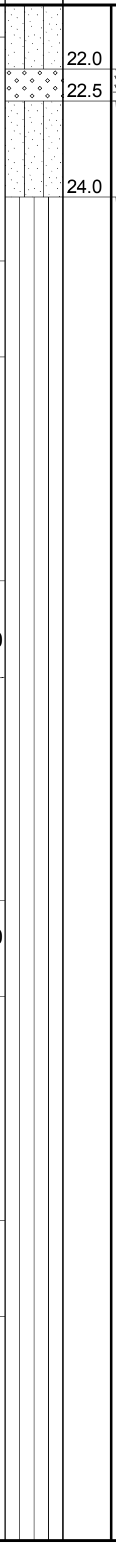
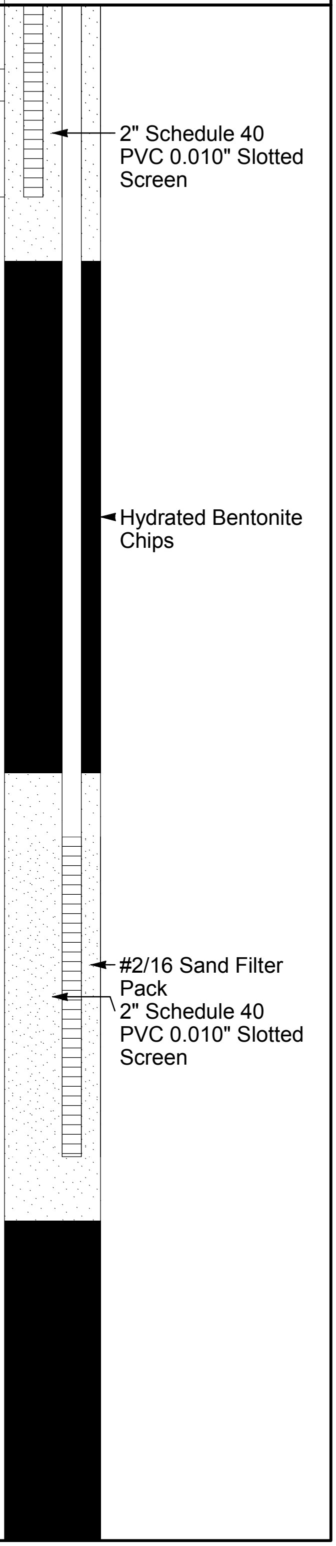
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA
		(58)	
25	MC	14-15-20 (35)	Cr VI = 1.7 Cl04- = 87
30	MC	4-7-9 (16)	Cr VI = 9.5 Dup = 11 Cl04- = 410 Dup = 380
35	MC	7-10-13 (23)	Cr VI = 6.2 Cl04- = 290
40	MC	6-9-10 (19)	Cr VI = 13 Cl04- = 1100
45			



Depth (ft)	MATERIAL DESCRIPTION	Elevation
	(SM) Sitty SAND, light brown (7.5 YR 6/4), (5,75,20,00, fine to medium grained sand (poorly graded), dense, moist, angular to subangular gravel (<5mm). (Alluvium) *(continued)*	
22.0		1735.2
22.5 ▽	(SW) SAND with Gravel, light brown (7.5YR 6/3), (35,55,10,0), fine to coarse grained sand (well graded), medium dense, wet, angular to subangular well graded gravel (<15mm). (Alluvium)	1734.7
24.0	(SM) Silty SAND, light brown (7.5 YR 6/4), (5,75,20,0), fine to medium grained sand (poorly graded), dense, moist, angular to subangular gravel (<5mm). (Alluvium)	1733.2
	(ML) SILT, brown (7.5 YR 5/4), (0,15,85,0), medium plasticity, hard, wet, coarse grained sand. (UMCf)	
	(ML) SILT, brown (7.5 YR 5/4), (0,5,85,10), medium to high plasticity, firm, moist, fine to coarse grained sand. (UMCf)	
	(ML) SILT, brown (7.5YR 5/4), (0,5,70,25), high plasticity, hard, moist, fine to coarse grained sand. (UMCf)	
	(ML) SILT, brown (7.5YR 5/4), (2,15,83,0), low to medium plasticity, hard, wet, fine to coarse grained sand, subangular to subrounded gravel (<5mm). (UMCf)	
	(ML) SILT, brown (7.5YR 5/4), (0,5,70,25), high plasticity, hard, moist, fine to coarse grained. (UMCf)	
	(ML) SILT, light brown (7.5YR 6/4), (5,15,50,20), high plasticity, firm, wet, fine to coarse grained, angular to subangular gravel (<10mm). (UMCf)	
	(ML) SILT, brown (7.5 YR 5/4),(0,15,70,15), medium plasticity, firm, moist, medium to coarse grained sand. (UMCf)	



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BORING NUMBER CTMW-03S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
45	MC	6-8-9 (17)	Cr VI = 17 Cl04- = 1100		(ML) SILT, brown (7.5YR 5/4), (5,10,75,10), medium plasticity, hard, wet, medium to coarse grained sand, angular to subangular gravel (<15mm). (UMCf) *(continued)*	
					(ML) SILT, brown (7.5YR 5/4), (5,10,70,15), medium plasticity, hard, wet, coarse sand, angular to subangular gravel (<10mm). (UMCf)	
50	MC	4-5-5 (10)	Cr VI = 13 Cl04- = 650		(ML) SILT, brown (7.5YR 4/4), (0,5,70,250, high plasticity, firm, moist, fine grained sand. (UMCf)	Hydrated Bentonite Chips
					(ML) SILT, brown (7.5YR 4/4), (5,10,75,10), medium plasticity, hard with small cemented nodules, moist, medium to coarse grainedn sand, angular to subangular gravel (<5mm). (UMCf)	
55	MC	7-9-10 (19)	Cr VI = 9.2 Cl04- = 430			
					(ML) SILT, very pale brown (10YR 7/3), (5,10,80,5), low to medium plasticity, hard with small cemented nodules, moist, coarse grained sand, angular to subangular gravel (<5mm). (UMCf)	
60	MC	27-39-40 (79)	Cr VI = 1.8 Cl04- = 340	61.5	1695.7	

Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

BORING NUMBER CTMW-04D

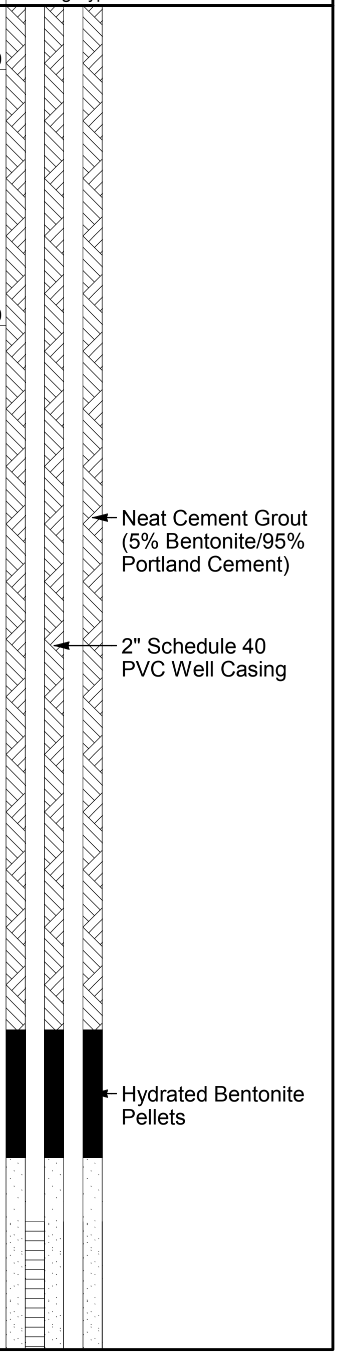
CLIENT	Nevada Environmental Response Trust (NERT)	**PROJECT NAME**	NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER	194-87600014-M12	**PROJECT LOCATION**	Henderson, NV
DATE STARTED	3/20/17 **COMPLETED** 3/22/17	**GROUND ELEVATION**	1757 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR	Cascade Drilling	**WATER LEVEL AT TIME OF DRILLING**	22.50 ft / Elev 1734.50 ft
DRILLING METHOD	Hollow Stem Auger	**WATER LEVEL AFTER DRILLING**	22.62 ft / Elev 1734.38 ft
LOGGED BY	Jeff Richeson **CHECKED BY** M. Crews		

NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION	
0	GB		Cr VI < = 0.22 Cl04- = 32		1.0	(SW-SM) Well Graded SAND with Silt and Gravel, (15,75,10,0) (33,33,34), brown (7.5YR 5/4), dry, loose, well graded gravel and sand, subangular to rounded sand. (Alluvium) Air knife to 5' bgs (no recovery)	1756.0
5	MC	16-20-24 (44)	Cr VI < = 0.16 Cl04- = 350		5.0	(SW) Well Graded SAND with Gravel, (15,80,5,0) (25,50,25), brown (7.5YR 4/4), dry, medium dense, well graded gravel and sand, subangular to rounded sand, subangular to subrounded gravel, gravel <3". (Alluvium)	1752.0
10	MC	29-39-50 (89)	Cr VI < = 0.26 Cl04- = 1800			(SW) Well Graded SAND, (18,79,3,0) (30,60,10), brown (7.5YR 5/4), moist, medium dense, well graded gravel and sand, subangular to rounded sand, subangular to subrounded gravel, gravel <1". (Alluvium)	
15	MC	17-28-47 (75)	Cr VI < = 0.2 Cl04- = 3000			(SW) Well Graded SAND, (12,85,3,0) (30,60,10), brown (7.5YR 5/4), moist, medium dense, well graded sand, subangular to rounded sand, subangular to subrounded gravel, gravel <1". (Alluvium)	
20	MC	22-24-30	Cr VI = 0.16 Cl04- =				

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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TETRA TECH, INC.

BORING NUMBER CTMW-04D

PAGE 2 OF 3

CLIENT Nevada Environmental Response Trust (NERT)

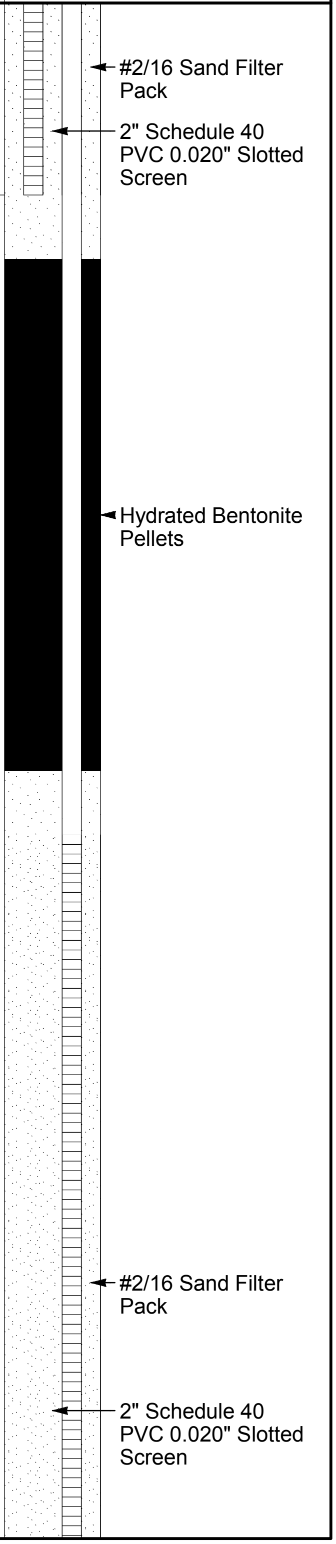
PROJECT NAME NERT - In-Situ Chromium Treatability Study

PROJECT NUMBER 194-87600014-M12

PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	MATERIAL DESCRIPTION
		(54)	3300	(SW) Well Graded SAND, (12,85,3,0) (30,60,10), brown (7.5YR 5/4), moist, medium dense, well graded sand, subangular to rounded sand, subangular to subrounded gravel, gravel <1". (Alluvium) *(continued)*
				(SW-SM) Well Graded SAND with Silt, (10,80,10,0) (33,33,34), brown (7.5YR 5/4), medium dense, well graded sand, subangular to subrounded gravel and sand, strong cementation, cemented nodules. (Alluvium)
24.0				(SW) Well Graded SAND. Same as 20-21.5' bgs, except wet between 22.5-23' bgs, moist between 23-24' bgs. (Alluvium)
25	MC	4-7-7 (14)	Cr VI = 8.1 Dup = 6.2 Cl04- = 240 Dup = 260	(ML) SILT with Sand, (3,17,78,2) (10,10,80), light brown (7.5YR 6/4), moist, soft to firm, non plastic. (UMCf) (ML) SILT, (0,10,90,0) (0,0,100), light brown (7.5YR 6/4), wet soft to firm, non plastic. (UMCf)
30	MC	10-12-14 (26)	Cr VI = 9.6 Cl04- = 330	(ML) SILT, (0,5,60,35) (0,0,100), strong brown (7.5YR 5/6), moist, firm to stiff, low to medium plasticity. (UMCf) No Recovery.
35	MC	13-20-23 (43)	Cr VI = 11 Cl04- = 480	(ML) SILT, (0,10,75,15) (0,0,100), strong brown (7.5YR 5/6), moist, stiff to very stiff, low plasticity. (UMCf) (ML) SILT, (0,10,65,25) (0,0,100), strong brown (7.5YR 5/6), wet, low to medium plasticity, clay nodules, stiff to very stiff. (UMCf) (ML) SILT, (0,10,80,10) (0,0,100), brown (7.5YR 5/4), moist, stiff, low plasticity, weakly cemented nodules. (UMCf)
40	MC	7-9-15 (24)	Cr VI = 11 Cl04- = 710	(ML) SILT, (0,10,80,10) (0,10,90), brown (7.5YR 5/3), moist, firm to stiff, low plasticity, very few cemented nodules. (UMCf)
45				

WELL DIAGRAM



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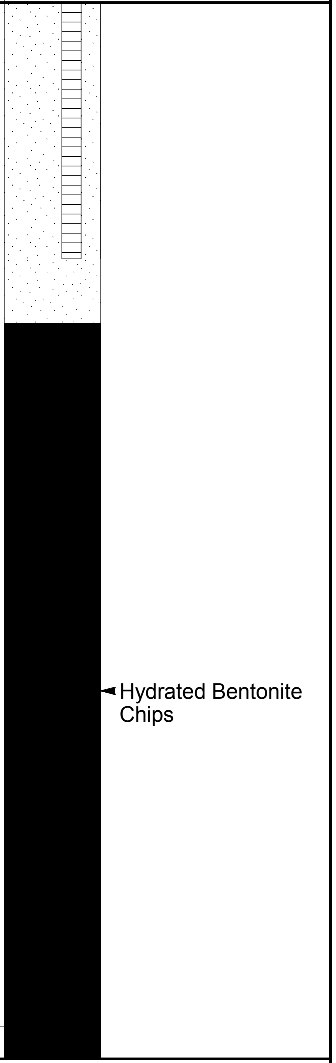
TETRA TECH, INC.

BORING NUMBER CTMW-04D

PAGE 3 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
45	MC	6-8-17 (25)	Cr VI = 16 Cl04- = 910		(ML) SILT, (0,10,80,10) (0,0,100), brown (7.5YR 5/4), moist, firm to stiff, low plasticity, few strongly cemented nodules. (UMCf)	
50	MC	9-15-16 (31)	Cr VI = 8.1 Cl04- = 450		(ML) SILT, (0,10,80,10) (0,0,100), brown (7.5YR 5/4), moist, firm to stiff, low plasticity, few strongly cemented nodules, with strongly cemented nodules 1"- 4" diameter. (UMCf)	
55	MC	3-8-19 (27)	Cr VI = 11 Cl04- = 830		(ML) SILT. Same as above, from 59-60' bgs approximately 30% of interval comprised of moderate to strong cemented nodules. (UMCf)	Hydrated Bentonite Chips
60	MC	9-18-55 (73)	Cr VI = 10 Cl04- = 770	61.0	(ML) SILT. Same as above with approximately 30% comprised of moderate cementation. (UMCf)	1696.0
				61.5	(SM) Silty SAND, (5,75,20,0) (10,60,30), brown (7.5YR 4/4), moist, medium dense to dense, subangular to rounded sand, well graded sand, subangular to subrounded gravel, gravel <0.5", very small weakly cemented nodules throughout. (UMCf)	1695.5



Bottom of borehole at 61.5 feet.

BORING NUMBER CTMW-04S

TETRA TECH, INC.

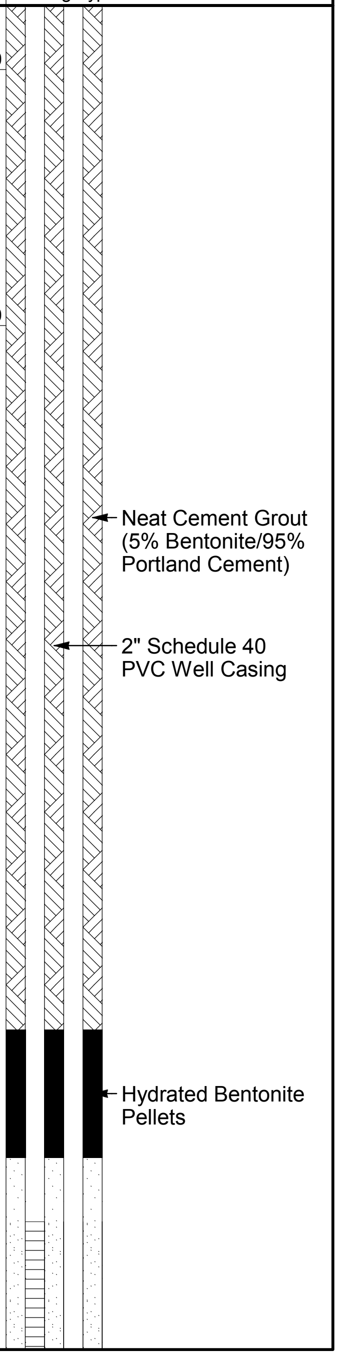
CLIENT	Nevada Environmental Response Trust (NERT)	**PROJECT NAME**	NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER	194-87600014-M12	**PROJECT LOCATION**	Henderson, NV
DATE STARTED	3/20/17 **COMPLETED** 3/22/17	**GROUND ELEVATION**	1757 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR	Cascade Drilling	**WATER LEVEL AT TIME OF DRILLING**	22.50 ft / Elev 1734.50 ft
DRILLING METHOD	Hollow Stem Auger	**WATER LEVEL AFTER DRILLING**	22.37 ft / Elev 1734.63 ft
LOGGED BY	Jeff Richeson **CHECKED BY** M. Crews		

NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
0	GB		Cr VI < = 0.22 Cl04- = 32	1.0	(SW-SM) Well Graded SAND with Silt and Gravel, (15,75,10,0) (33,33,34), brown (7.5YR 5/4), dry, loose, well graded gravel and sand, subangular to rounded sand. (Alluvium) — 1756.0 Air knife to 5' bgs (no recovery)
5	MC	16-20-24 (44)	Cr VI < = 0.16 Cl04- = 350	5.0	1752.0 (SW) Well Graded SAND with Gravel, (15,80,5,0) (25,50,25), brown (7.5YR 4/4), dry, medium dense, well graded gravel and sand, subangular to rounded sand, subangular to subrounded gravel, gravel <3". (Alluvium)
10	MC	29-39-50 (89)	Cr VI < = 0.26 Cl04- = 1800		(SW) Well Graded SAND, (18,79,3,0) (30,60,10), brown (7.5YR 5/4), moist, medium dense, well graded gravel and sand, subangular to rounded sand, subangular to subrounded gravel, gravel <1". (Alluvium)
15	MC	17-28-47 (75)	Cr VI < = 0.2 Cl04- = 3000		(SW) Well Graded SAND, (12,85,3,0) (30,60,10), brown (7.5YR 5/4), moist, medium dense, well graded sand, subangular to rounded sand, subangular to subrounded gravel, gravel <1". (Alluvium)
20	MC	22-24-30	Cr VI = 0.16 Cl04- =		

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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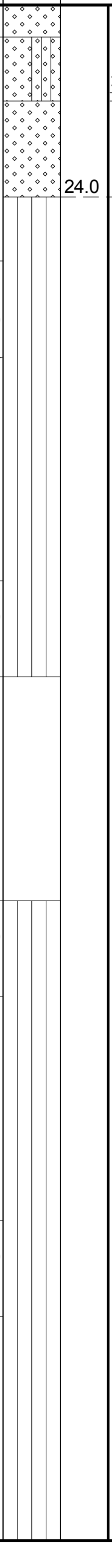
BORING NUMBER CTMW-04S

TETRA TECH, INC.

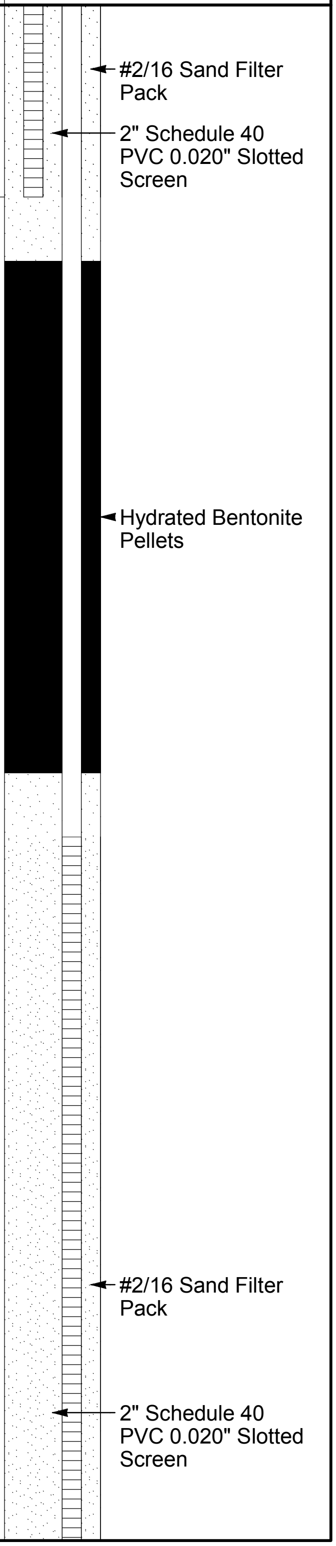
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	MATERIAL DESCRIPTION
		(54)	3300	(SW) Well Graded SAND, (12,85,3,0) (30,60,10), brown (7.5YR 5/4), moist, medium dense, well graded sand, subangular to rounded sand, subangular to subrounded gravel, gravel <1". (Alluvium) *(continued)*
				(SW-SM) Well Graded SAND with Silt, (10,80,10,0) (33,33,34), brown (7.5YR 5/4), medium dense, well graded sand, subangular to subrounded gravel and sand, strong cementation, cemented nodules. (Alluvium)
24.0 1733.0				(SW) Well Graded SAND. Same as 20-21.5' bgs, except wet between 22.5-23' bgs, moist between 23-24' bgs. (Alluvium)
25	MC	4-7-7 (14)	Cr VI = 8.1 Dup = 6.2 Cl04- = 240 Dup = 260	(ML) SILT with Sand, (3,17,78,2) (10,10,80), light brown (7.5YR 6/4), moist, soft to firm, non plastic. (UMCf)
				(ML) SILT, (0,10,90,0) (0,0,100), light brown (7.5YR 6/4), wet soft to firm, non plastic. (UMCf)
30	MC	10-12-14 (26)	Cr VI = 9.6 Cl04- = 330	(ML) SILT, (0,5,60,35) (0,0,100), strong brown (7.5YR 5/6), moist, firm to stiff, low to medium plasticity. (UMCf)
				No Recovery.
35	MC	13-20-23 (43)	Cr VI = 11 Cl04- = 480	(ML) SILT, (0,10,75,15) (0,0,100), strong brown (7.5YR 5/6), moist, stiff to very stiff, low plasticity. (UMCf)
				(ML) SILT, (0,10,65,25) (0,0,100), strong brown (7.5YR 5/6), wet, low to medium plasticity, clay nodules, stiff to very stiff. (UMCf)
				(ML) SILT, (0,10,80,10) (0,0,100), brown (7.5YR 5/4), moist, stiff, low plasticity, weakly cemented nodules. (UMCf)
40	MC	7-9-15 (24)	Cr VI = 11 Cl04- = 710	(ML) SILT, (0,10,80,10) (0,10,90), brown (7.5YR 5/3), moist, firm to stiff, low plasticity, very few cemented nodules. (UMCf)
45				

GRAPHIC LOG



WELL DIAGRAM



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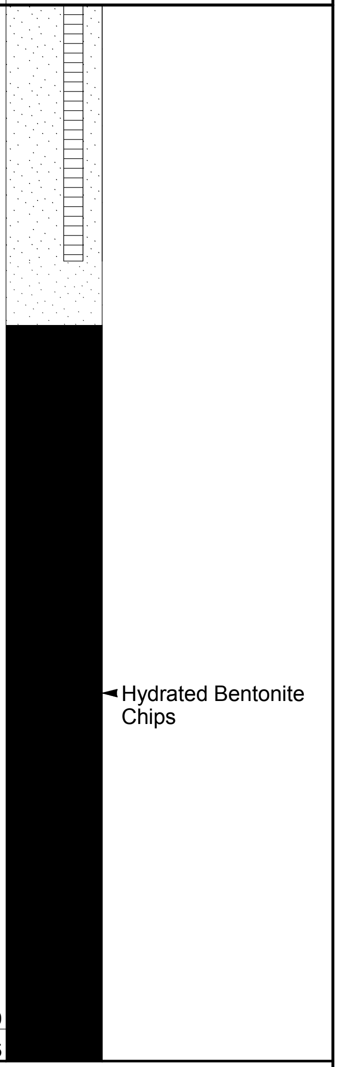
BORING NUMBER CTMW-04S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
45	MC	6-8-17 (25)	Cr VI = 16 Cl04- = 910		(ML) SILT, (0,10,80,10) (0,0,100), brown (7.5YR 5/4), moist, firm to stiff, low plasticity, few strongly cemented nodules. (UMCf)	
50	MC	9-15-16 (31)	Cr VI = 8.1 Cl04- = 450		(ML) SILT, (0,10,80,10) (0,0,100), brown (7.5YR 5/4), moist, firm to stiff, low plasticity, few strongly cemented nodules, with strongly cemented nodules 1"- 4" diameter. (UMCf)	
55	MC	3-8-19 (27)	Cr VI = 11 Cl04- = 830		(ML) SILT. Same as above, from 59-60' bgs approximately 30% of interval comprised of moderate to strong cemented nodules. (UMCf)	
60	MC	9-18-55 (73)	Cr VI = 10 Cl04- = 770	61.0	(ML) SILT. Same as above with approximately 30% comprised of moderate cementation. (UMCf)	1696.0
				61.5	(SM) Silty SAND, (5,75,20,0) (10,60,30), brown (7.5YR 4/4), moist, medium dense to dense, subangular to rounded sand, well graded sand, subangular to subrounded gravel, gravel <0.5", very small weakly cemented nodules throughout. (UMCf)	1695.5

Bottom of borehole at 61.5 feet.

WELL DIAGRAM



TETRA TECH, INC.

BORING NUMBER CTMW-05D

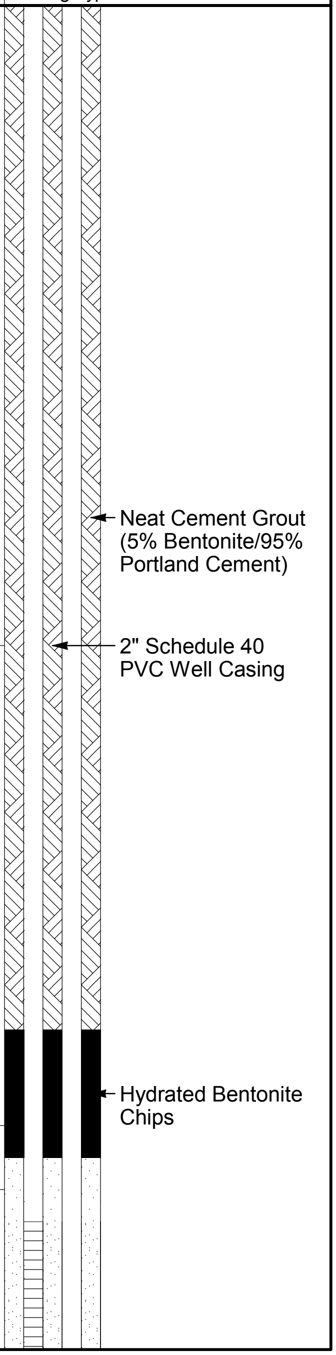
PAGE 1 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV
DATE STARTED 6/5/17 **COMPLETED** 6/5/17
GROUND ELEVATION 1757.25 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR Cascade Drilling
WATER LEVEL AT TIME OF DRILLING 22.50 ft / Elev 1734.75 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 23.36 ft / Elev 1733.89 ft
LOGGED BY Jeff Richeson **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	Elevation
0	MC	12-16-26 (42)			(SM) Silty SAND, (20,60,20,0) (30,60,10), pale brown (10YR 6/3), dry, dense, well graded gravel and sand, gravel <2" Subangular to Subrounded (SA/SR). (Alluvium)	
5	MC	20-43-50 (93)			(SM) Silty SAND, (10,70,20,0) (30,40,30), light yellowish brown (10YR 6/4), fine to coarse grained sand, moist, moderate cementation from 8-9' below ground surface (bgs), dense, gravel <1" SA/SR. (Alluvium)	
10.0	MC	23-29-39 (68)			(SW) Well-Graded SAND, (10,80,10,0) (33,33,34), dark yellowish brown (10YR 4/4), fine to coarse grained sand, moist, medium dense, gravel <2.5" SA/SR. (Alluvium)	1747.3
15	MC	16-27-31 (58)				
17.5					(SP) Poorly-Graded SAND, (10,80,10,0) (10,40,50), dark yellowish brown (10YR 4/4), fine to medium grained sand, moist, medium dense, gravel <0.5" SA/SR. (Alluvium)	1739.8
18.5					(SW) Well-Graded SAND, (10,80,10,0) (33,33,34), dark yellowish brown (10YR 4/4), fine to coarse grained sand, moist, medium dense, gravel <2.5" SA/SR. (Alluvium)	1738.8
20	MC	10-50				

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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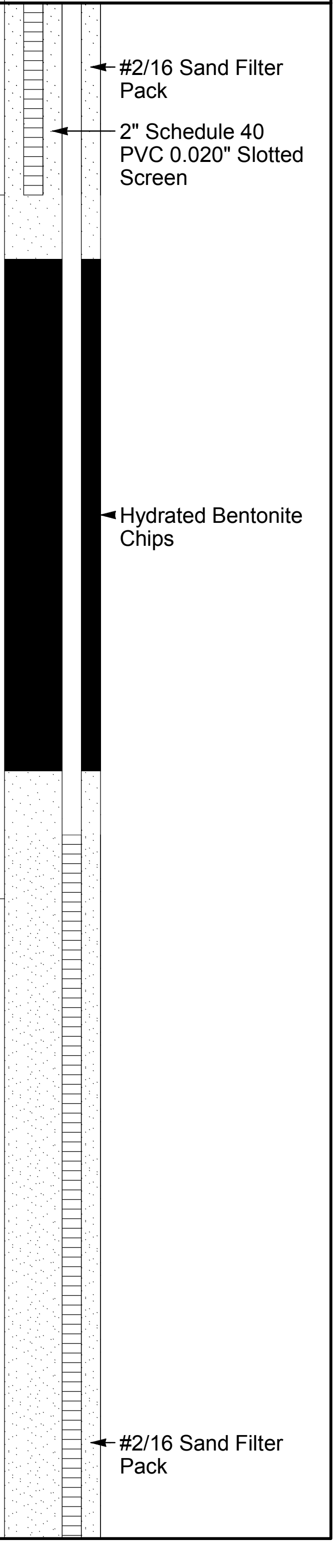
BORING NUMBER CTMW-05D

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION	
						(SW) Well-Graded SAND, (10,80,10,0) (33,33,34), dark yellowish brown (10YR 4/4), fine to coarse grained sand, moist, medium dense, gravel <2.5" SA/SR. (Alluvium) *(continued)*	
						▽ ▼ (SW) Well-Graded SAND, (10,80,10,0) (33,33,34), dark yellowish brown (10YR 4/4), fine to coarse grained sand, wet, medium dense, gravel <2.5" SA/SR. (Alluvium)	
					24.0	(SW) Well-Graded SAND, (10,80,10,0) (33,33,34), dark yellowish brown (10YR 4/4), fine to coarse grained sand, moist, dense, strong cementation, gravel <2.5" SA/SR. (Alluvium)	1733.3
25	MC	1-1-2 (3)				(ML) SILT, (0,10,80,10) (0,10,90), light brown (7.5YR 6/4), firm, wet, some cemented nodules, low plasticity. (UMCf)	
30	MC	2-5-10 (15)				No Recovery 30-35' bgs.	
35	MC	15-17-18 (35)			35.0	(ML) SILT, (0,10,90,0) (0,0,100), yellowish brown (10YR 5/4), stiff, wet, contains ~15% cemented nodules (between 35-37' bgs), low plasticity. (UMCf)	1722.3
40	MC	2-2-8 (10)				(ML) SILT, (0,10,80,10) (0,0,100), brown (7.5YR 5/4), wet, stiff, low plasticity, small <0.5" cemented nodules present throughout interval, large 3" cemented nodule @ 43.5' bgs. (UMCf)	
45							

WELL DIAGRAM



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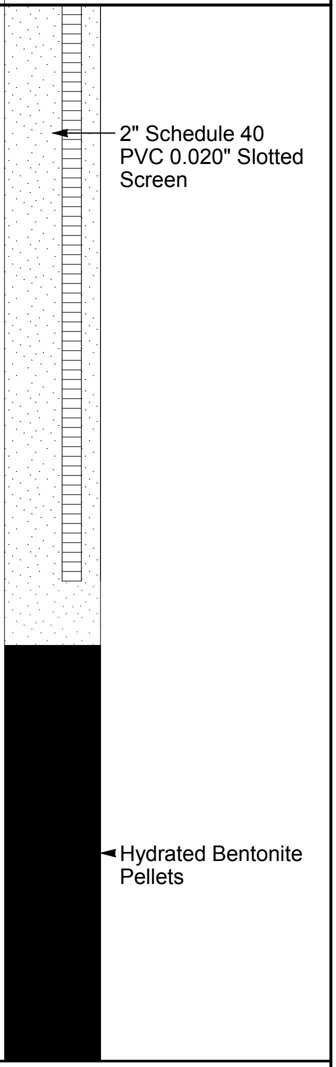
TETRA TECH, INC.

BORING NUMBER CTMW-05D

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	2-2-3 (5)			(ML) SILT, (0,10,80,10) (0,0,100), brown (7.5YR 5/4), wet, stiff, low plasticity, small <0.5" cemented nodules present throughout interval. (UMCf)
50	MC	8-7-6 (13)			(ML) SILT, (0.10.80.10) (0,0,100), brown (7.5YR 5/4), wet, stiff, low to medium plasticity, small <0.5" cemented nodules present throughout interval. (UMCf)
					(ML) SILT, (0,10,80,10) (0,0,100), brown (7.5YR 5/4), wet, stiff, low plasticity, small <0.5" cemented nodules present throughout interval. (UMCf)
55	MC	3-7-8 (15)			
					(ML) SILT, (0,0,85,15) (0,0,100), pale brown (10YR 6/3), stiff, wet, ~15% of sample comprised of cemented nodules, low to medium plasticity. (UMCf)
60	MC	6-7-10 (17)		61.5	1695.8

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

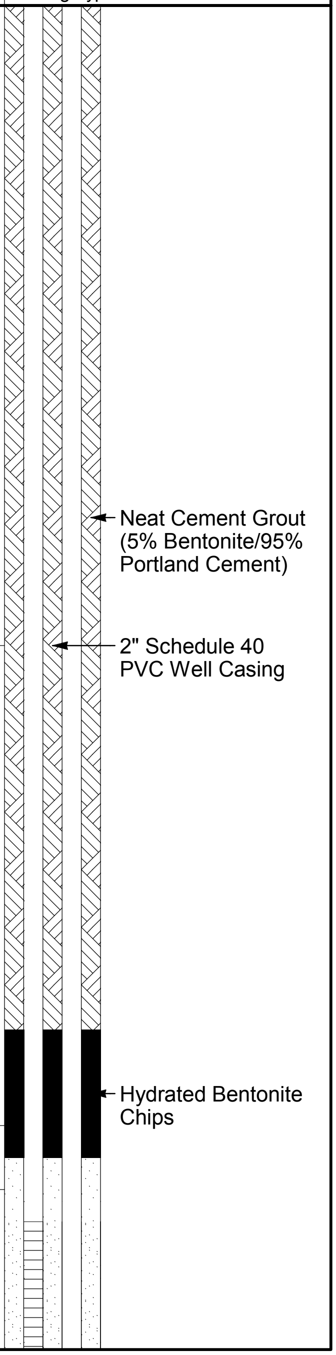
TETRA TECH, INC.

BORING NUMBER CTMW-05S

PAGE 1 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV
DATE STARTED 6/5/17 **COMPLETED** 6/5/17
GROUND ELEVATION 1757.24 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR Cascade Drilling
WATER LEVEL AT TIME OF DRILLING 22.50 ft / Elev 1734.74 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 23.18 ft / Elev 1734.06 ft
LOGGED BY Jeff Richeson **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0						Casing Type: Schedule 40 PVC
	MC	12-16-26 (42)			(SM) Silty SAND, (20,60,20,0) (30,60,10), pale brown (10YR 6/3), dry, dense, well graded gravel and sand, gravel <2" Subangular to Subrounded (SA/SR). (Alluvium)	
5	MC	20-43-50 (93)			(SM) Silty SAND, (10,70,20,0) (30,40,30), light yellowish brown (10YR 6/4), fine to coarse grained sand, moist, moderate cementation from 8-9' below ground surface (bgs), dense, gravel <1" SA/SR. (Alluvium)	
10	MC	23-29-39 (68)		10.0	(SW) Well-Graded SAND, (10,80,10,0) (33,33,34), dark yellowish brown (10YR 4/4), fine to coarse grained sand, moist, medium dense, gravel <2.5" SA/SR. (Alluvium)	1747.2
15	MC	16-27-31 (58)				
				17.5	(SP) Poorly-Graded SAND, (10,80,10,0) (10,40,50), dark yellowish brown (10YR 4/4), fine to medium grained sand, moist, medium dense, gravel <0.5" SA/SR. (Alluvium)	1739.7
				18.5	(SW) Well-Graded SAND, (10,80,10,0) (33,33,34), dark yellowish brown (10YR 4/4), fine to coarse grained sand, moist, medium dense, gravel <2.5" SA/SR. (Alluvium)	1738.7
20	MC	10-50				



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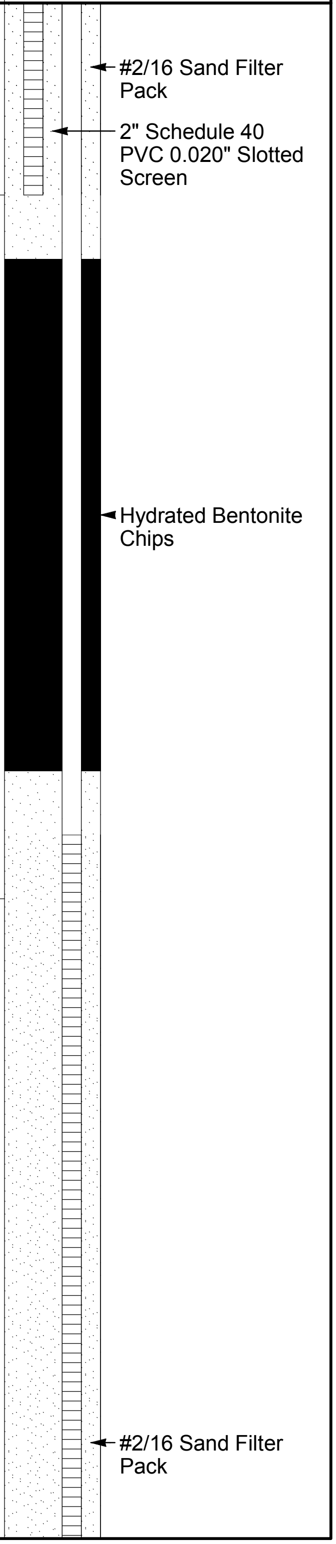
TETRA TECH, INC.

BORING NUMBER CTMW-05S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION	
						(SW) Well-Graded SAND, (10,80,10,0) (33,33,34), dark yellowish brown (10YR 4/4), fine to coarse grained sand, moist, medium dense, gravel <2.5" SA/SR. (Alluvium) *(continued)*	
					∇ ▼	(SW) Well-Graded SAND, (10,80,10,0) (33,33,34), dark yellowish brown (10YR 4/4), fine to coarse grained sand, wet, medium dense, gravel <2.5" SA/SR. (Alluvium)	
					24.0	(SW) Well-Graded SAND, (10,80,10,0) (33,33,34), dark yellowish brown (10YR 4/4), fine to coarse grained sand, moist, dense, strong cementation, gravel <2.5" SA/SR. (Alluvium)	1733.2
25	MC	1-1-2 (3)				(ML) SILT, (0,10,80,10) (0,10,90), light brown (7.5YR 6/4), firm, wet, some cemented nodules, low plasticity. (UMCf)	
30	MC	2-5-10 (15)				No Recovery 30-35' bgs.	
35	MC	15-17-18 (35)			35.0	(ML) SILT, (0,10,90,0) (0,0,100), yellowish brown (10YR 5/4), stiff, wet, contains ~15% cemented nodules (between 35-37' bgs), low plasticity. (UMCf)	1722.2
40	MC	2-2-8 (10)				(ML) SILT, (0,10,80,10) (0,0,100), brown (7.5YR 5/4), wet, stiff, low plasticity, small <0.5" cemented nodules present throughout interval, large 3" cemented nodule @ 43.5' bgs. (UMCf)	
45							

WELL DIAGRAM



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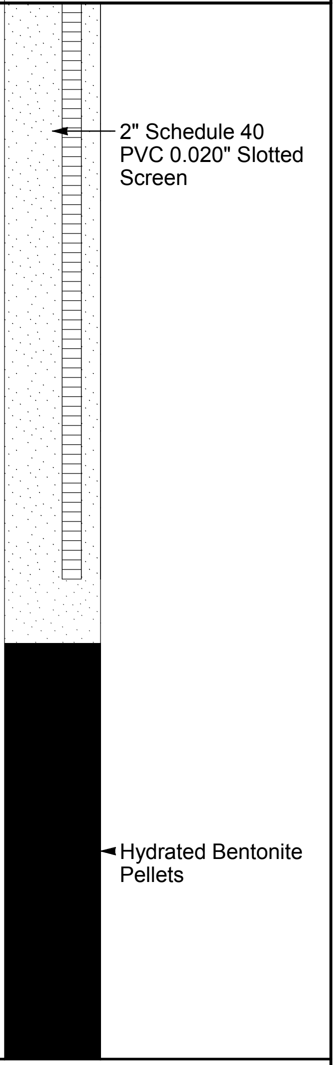
TETRA TECH, INC.

BORING NUMBER CTMW-05S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	2-2-3 (5)			(ML) SILT, (0,10,80,10) (0,0,100), brown (7.5YR 5/4), wet, stiff, low plasticity, small <0.5" cemented nodules present throughout interval. (UMCf)
50	MC	8-7-6 (13)			(ML) SILT, (0.10.80.10) (0,0,100), brown (7.5YR 5/4), wet, stiff, low to medium plasticity, small <0.5" cemented nodules present throughout interval. (UMCf)
					(ML) SILT, (0,10,80,10) (0,0,100), brown (7.5YR 5/4), wet, stiff, low plasticity, small <0.5" cemented nodules present throughout interval. (UMCf)
55	MC	3-7-8 (15)			
					(ML) SILT, (0,0,85,15) (0,0,100), pale brown (10YR 6/3), stiff, wet, ~15% of sample comprised of cemented nodules, low to medium plasticity. (UMCf)
60	MC	6-7-10 (17)		61.5	1695.7

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

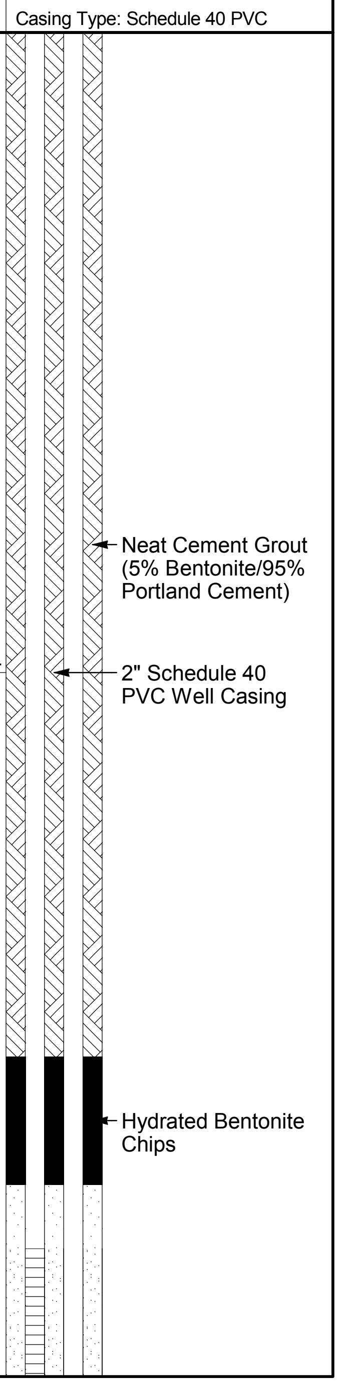
BORING NUMBER CTMW-06D

PAGE 1 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV
DATE STARTED 6/6/17 **COMPLETED** 6/6/17
GROUND ELEVATION 1757.42 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR Cascade Drilling
WATER LEVEL AT TIME OF DRILLING 22.50 ft / Elev 1734.92 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 23.74 ft / Elev 1733.68 ft
LOGGED BY Jeff Richeson **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
0	MC	14-17-28 (45)			(SM) Silty SAND, (20,60,20,0) (30,50,20), pale brown (10YR 6/3), dry, dense, well graded gravel and sand, gravel, subangular to subrounded <3" SA/SR. (Alluvium)
5	MC	19-45-50 (95)			(SM) Silty SAND, (0,70,20,0) (30,40,30), light yellowish brown (10YR 6/4), fine to coarse grained sand, moist, moderate cementation between 7-9' below ground surface (bgs), dense, gravel <2" SA/SR. (Alluvium)
10				10.0	1747.4
	MC	22-31-40 (71)			(SW) Well-Graded SAND, (10,75,15,0) (33,34,33), dark yellowish brown (10YR 4/4), fine to coarse grained sand and gravel, medium dense, moist, gravel <2.5" SA/SR. (Alluvium)
15	MC	19-30-35 (65)			(SW) Well-Graded SAND, (15,70,10,0) (30,40,30) dark yellowish brown (10YR 4/4), dense, moist, gravel <2" SA/SR, fine to coarse grained sand. (Alluvium)
20	MC	15-44-50			

WELL DIAGRAM



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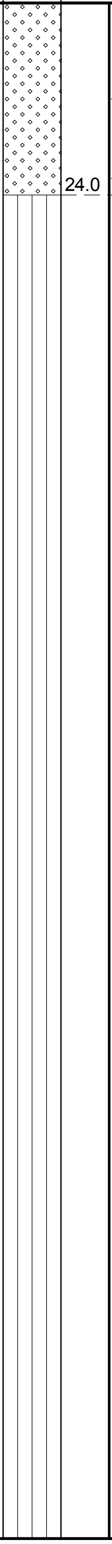
TETRA TECH, INC.

BORING NUMBER CTMW-06D

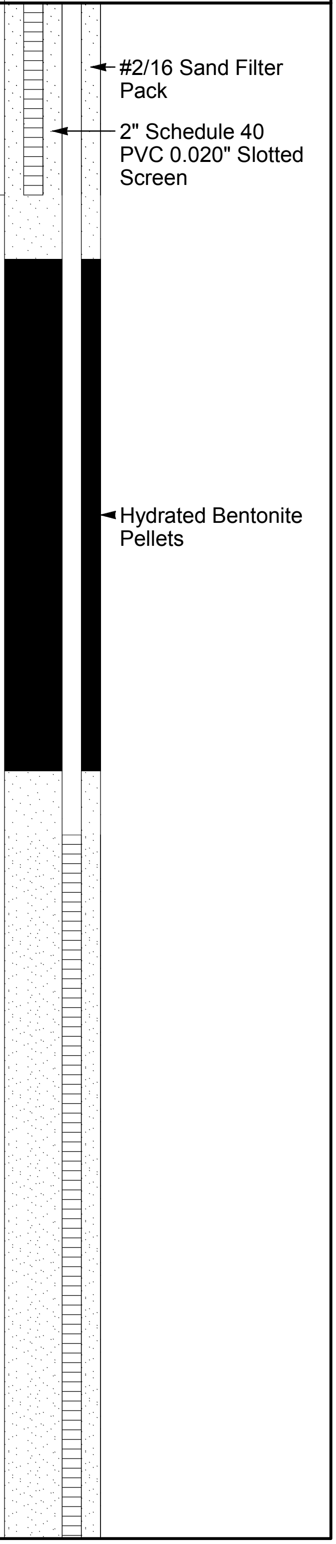
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	MATERIAL DESCRIPTION
		(94)		(SW) Well-Graded SAND, (15,70,10,0) (30,40,30) dark yellowish brown (10YR 4/4), dense, moist, gravel <2" SA/SR, fine to coarse grained sand. (Alluvium) *(continued)*
				▽ (SW) Well-Graded SAND, (15,70,10,0) (30,40,30)), dark yellowish brown (10YR 4/4), dense, wet, gravel <2" SA/SR, fine to coarse grained sand. (Alluvium)
24.0				▼ (SW) Well-Graded SAND, (15,70,10,0) (30,40,30), dark yellowish brown (10YR 4/4), dense, moist, gravel <2" SA/SR, fine to coarse grained sand, moderate cementation. (Alluvium) 1733.4
25	MC	1-2-2 (4)		(ML) SILT, (0,10,80,10) (0,10,90), light brown (7.5YR 6/4), stiff, moderate cementation, non plastic. (UMCf) (ML) SILT, (0,10,80,10) (0,10,90), light brown (7.5YR 6/4), firm, wet, non plastic. (UMCf)
30	MC	3-6-9 (15)		(ML) SILT, (0,10,90,0) (0,0,100), light brown (7.5 YR 6/4), firm, wet, some small <0.5" cemented nodules, non plastic. (UMCf)
35	MC	17-19-20 (39)		(ML) SILT, (0,10,90,0) (0,0,100), yellowish brown (10YR 5/4), stiff, wet, contains ~5% cemented nodules throughout interval, low plasticity. (UMCf)
40	MC	3-4-9 (13)		(ML) SILT, (0,10,80,10) (0,0,100), yellowish brown (7.5YR 5/4), wet, stiff, small <0.5" cemented nodules throughout interval, low plasticity. (UMCf)
45				

GRAPHIC LOG



WELL DIAGRAM



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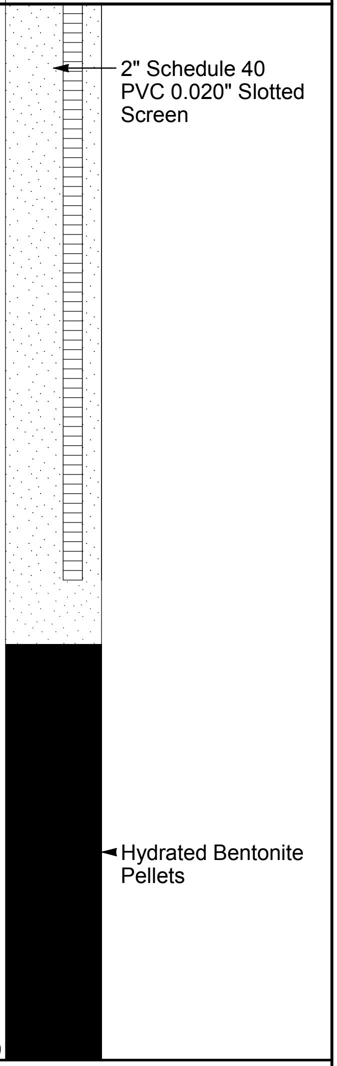
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	3-4-6 (10)			(ML) SILT, (0,10,80,10) (0,0,100), yellowish brown (7.5YR 5/4), wet, stiff, small <0.5" cemented nodules throughout interval, low plasticity. (UMCf) *(continued)*
50	MC	9-8-5 (13)			(ML) Clayey SILT, (0,10,75,15) (0,0,100), brown (7.5YR 5/4), wet, stiff, low to medium plasticity, small <0.5" cemented nodules present throughout interval. (UMCf)
					(ML) SILT, (0,10,75,15) (0,0,100), brown (7.5YR 5/4), wet, stiff, low plasticity, small <0.5" cemented nodules present throughout interval. (UMCf)
55	MC	4-9-10 (19)			
					(ML) Clayey SILT, (0,0,80,20), pale brown (10YR 6/3), stiff, wet, ~10% of sample comprised of cemented nodules throughout interval, medium plasticity. (UMCf)
60	MC	7-9-11 (20)		61.5	1695.9

WELL DIAGRAM



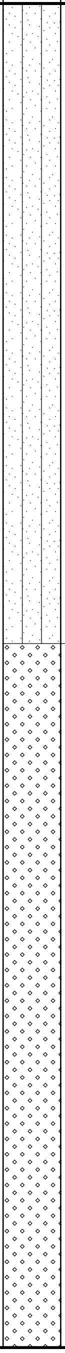
Bottom of borehole at 61.5 feet.

ENVIRONMENTAL BH - GINT STD US.GDT - 11/10/17 12:47 - \\TTS318FS1\CES\PROJECTS\87600014-NERT-M12\WORKING\IN-SITU CR TREATABILITY TEST\FIELD PROGRAM\BORING LOGS\GINT\ALL CR TREATABILITY LOGS.GPJ

TETRA TECH, INC.

BORING NUMBER CTMW-06S

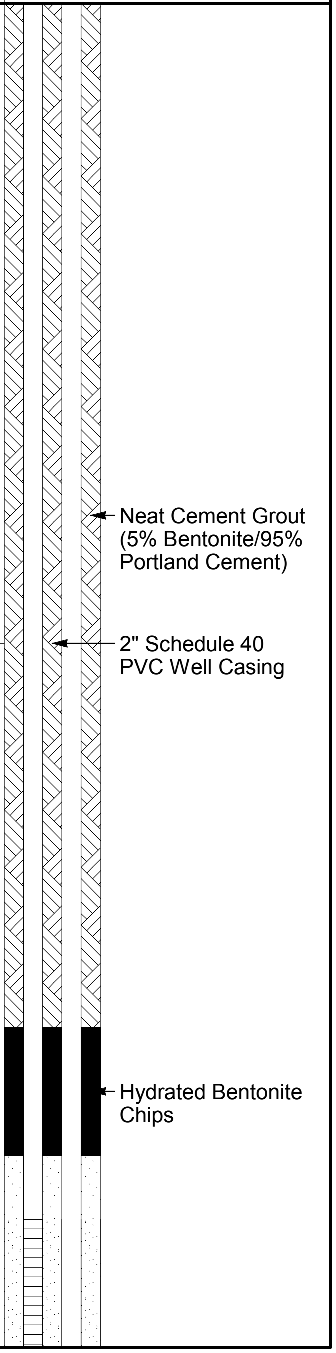
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV
DATE STARTED 6/6/17 **COMPLETED** 6/6/17
GROUND ELEVATION 1757.43 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR Cascade Drilling
WATER LEVEL AT TIME OF DRILLING 22.50 ft / Elev 1734.93 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 23.41 ft / Elev 1734.02 ft
LOGGED BY Jeff Richeson **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.



DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	MATERIAL DESCRIPTION
0	MC	14-17-28 (45)		(SM) Silty SAND, (20,60,20,0) (30,50,20), pale brown (10YR 6/3), dry, dense, well graded gravel and sand, gravel, subangular to subrounded <3" SA/SR. (Alluvium)
5	MC	19-45-50 (95)		(SM) Silty SAND, (0,70,20,0) (30,40,30), light yellowish brown (10YR 6/4), fine to coarse grained sand, moist, moderate cementation between 7-9' below ground surface (bgs), dense, gravel <2" SA/SR. (Alluvium)
10	MC	22-31-40 (71)		10.0 — 1747.4 (SW) Well-Graded SAND, (10,75,15,0) (33,34,33), dark yellowish brown (10YR 4/4), fine to coarse grained sand and gravel, medium dense, moist, gravel <2.5" SA/SR. (Alluvium)
15	MC	19-30-35 (65)		(SW) Well-Graded SAND, (15,70,10,0) (30,40,30) dark yellowish brown (10YR 4/4), dense, moist, gravel <2" SA/SR, fine to coarse grained sand. (Alluvium)
20	MC	15-44-50		

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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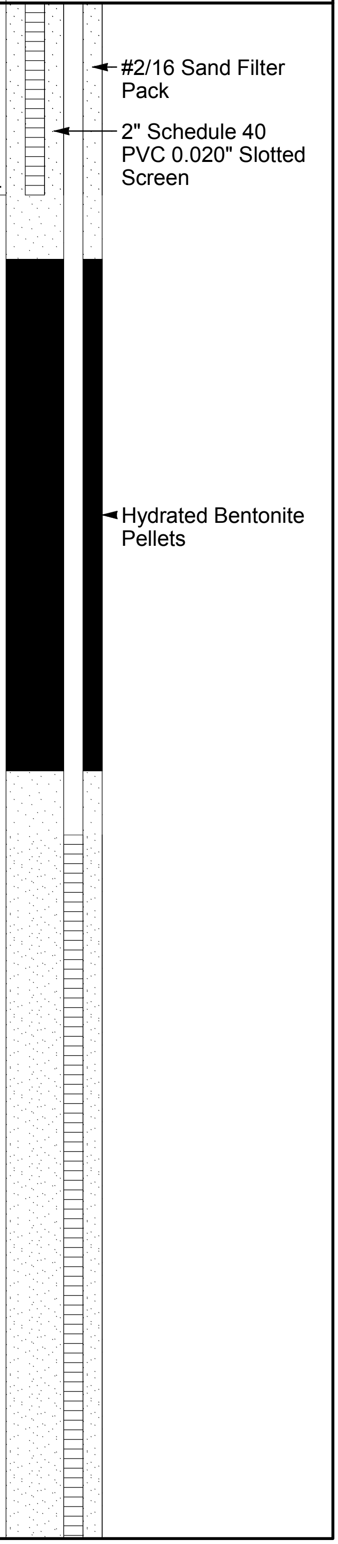
CLIENT Nevada Environmental Response Trust (NERT)	**PROJECT NAME** NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12	**PROJECT LOCATION** Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
		(94)			(SW) Well-Graded SAND, (15,70,10,0) (30,40,30) dark yellowish brown (10YR 4/4), dense, moist, gravel <2" SA/SR, fine to coarse grained sand. (Alluvium) *(continued)*
					▽ ▼ (SW) Well-Graded SAND, (15,70,10,0) (30,40,30)), dark yellowish brown (10YR 4/4), dense, wet, gravel <2" SA/SR, fine to coarse grained sand. (Alluvium)
				24.0	(SW) Well-Graded SAND, (15,70,10,0) (30,40,30), dark yellowish brown (10YR 4/4), dense, moist, gravel <2" SA/SR, fine to coarse grained sand, moderate cementation. (Alluvium) 1733.4
25	MC	1-2-2 (4)			(ML) SILT, (0,10,80,10) (0,10,90), light brown (7.5YR 6/4), stiff, moderate cementation, non plastic. (UMCf) (ML) SILT, (0,10,80,10) (0,10,90), light brown (7.5YR 6/4), firm, wet, non plastic. (UMCf)
30	MC	3-6-9 (15)			(ML) SILT, (0,10,90,0) (0,0,100), light brown (7.5 YR 6/4), firm, wet, some small <0.5" cemented nodules, non plastic. (UMCf)
35	MC	17-19-20 (39)			(ML) SILT, (0,10,90,0) (0,0,100), yellowish brown (10YR 5/4), stiff, wet, contains ~5% cemented nodules throughout interval, low plasticity. (UMCf)
40	MC	3-4-9 (13)			(ML) SILT, (0,10,80,10) (0,0,100), yellowish brown (7.5YR 5/4), wet, stiff, small <0.5" cemented nodules throughout interval, low plasticity. (UMCf)
45					

WELL DIAGRAM



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TETRA TECH, INC.

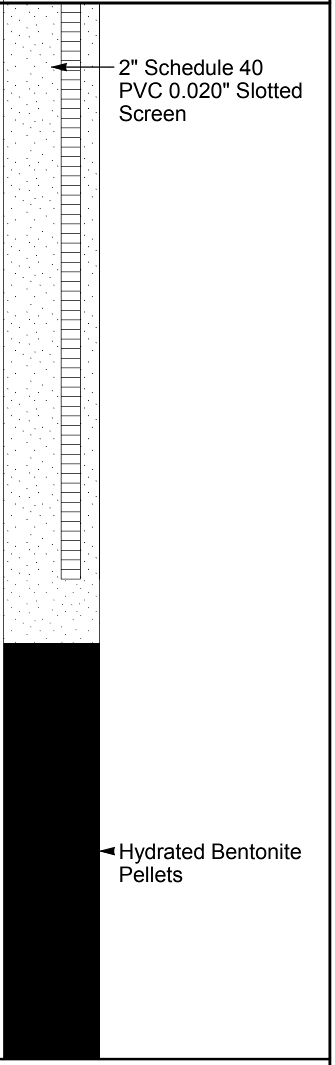
BORING NUMBER CTMW-06S

PAGE 3 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - In-Situ Chromium Treatability Study
PROJECT NUMBER 194-87600014-M12
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	3-4-6 (10)			(ML) SILT, (0,10,80,10) (0,0,100), yellowish brown (7.5YR 5/4), wet, stiff, small <0.5" cemented nodules throughout interval, low plasticity. (UMCf) *(continued)*
50	MC	9-8-5 (13)			(ML) Clayey SILT, (0,10,75,15) (0,0,100), brown (7.5YR 5/4), wet, stiff, low to medium plasticity, small <0.5" cemented nodules present throughout interval. (UMCf) (ML) SILT, (0,10,75,15) (0,0,100), brown (7.5YR 5/4), wet, stiff, low plasticity, small <0.5" cemented nodules present throughout interval. (UMCf)
55	MC	4-9-10 (19)			(ML) Clayey SILT, (0,0,80,20), pale brown (10YR 6/3), stiff, wet, ~10% of sample comprised of cemented nodules throughout interval, medium plasticity. (UMCf)
60	MC	7-9-11 (20)		61.5	1695.9

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

Chemical Reduction Study

Table B-2 - Well Construction Details

AP Area

Well ID	Northing (feet)	Easting (feet)	Latitude	Longitude	Borehole Size (inches)	Well Diameter (inches)	Well Material (blank casing)	Well Vault	Filter Pack Material	Screen Material	Screen Interval (feet bgs)	Screen Top (feet bgs)	Screen Bottom (feet bgs)	Screen Interval (feet btoc)	Screen Top (feet btoc)	Screen Bottom (feet btoc)	Screen Length (feet)	Total Depth of Borehole (feet bgs)	TOC Elevation (feet amsl)	Ground Surface Elevation (feet amsl)
UFIW-01S	26719540.562	827314.237	36.04782° N	115.00433° W	8	2	Sch. 40 PVC	18-in Diameter Round	#3 Monterey Sand	2-in PVC 0.020"	23 - 28	23	28	22.7 - 27.7	22.70	27.70	5	28.1	1,755.11	1,755.41
UFIW-01I	26719541.816	827319.017	36.04782° N	115.00431° W	8	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	33 - 38	33	38	32.6 - 37.6	32.6	37.6	5	38.1	1,755.08	1,755.51
UFIW-01D	26719542.292	827324.566	36.04781° N	115.00432° W	8	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	43 - 48	43	48	42.7 - 47.7	42.7	47.7	5	61.5	1,755.21	1,755.55
UFIW-02S	26719536.782	827342.924	36.04782° N	115.00426° W	8	2	Sch. 40 PVC	18-in Diameter Round	#3 Monterey Sand	2-in PVC 0.020"	23 - 28	23	28	22.6 - 27.6	22.6	27.6	5	28.1	1,754.97	1,755.41
UFIW-02I	26719537.024	827346.383	36.04782° N	115.00425° W	8	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	31 - 41	31	41	30.5 - 40.5	30.5	40.5	10	41.1	1,754.85	1,755.39
UFIW-02D	26719533.321	827344.214	36.04781° N	115.00426° W	8	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	43 - 48	43	48	42.6 - 47.6	42.6	47.6	5	61.5	1,755.01	1,755.45
UFIW-03S	26719537.055	827360.668	36.04782° N	115.00420° W	8	2	Sch. 40 PVC	18-in Diameter Round	#3 Monterey Sand	2-in PVC 0.020"	25 - 30	25	30	24.7 - 29.7	24.7	29.7	5	35.0	1,755.22	1,755.55
UFIW-03I	26719537.079	827364.669	36.04782° N	115.00419° W	8	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	35 - 40	35	40	34.2 - 39.2	34.2	39.2	5	40.0	1,754.89	1,755.67
UFIW-03D	26719533.833	827362.838	36.04781° N	115.00420° W	8	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	45 - 50	45	50	44.7 - 49.7	44.7	49.7	5	61.5	1,755.38	1,755.71
UFIW-04S	26719537.499	827378.974	36.04782° N	115.00414° W	8	2	Sch. 40 PVC	18-in Diameter Round	#3 Monterey Sand	2-in PVC 0.020"	23 - 28	23	28	22.5 - 27.5	22.5	27.5	5	28.0	1,755.28	1,755.80
UFIW-04I	26719536.893	827382.838	36.04782° N	115.00413° W	8	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	33 - 38	33	38	32.5 - 37.5	32.5	37.5	5	38.0	1,755.33	1,755.83
UFIW-04D	26719533.460	827380.800	36.04781° N	115.00414° W	8	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	43 - 48	43	48	42.5 - 47.5	42.5	47.5	5	61.5	1,755.39	1,755.90
UFIW-05S	26719356.906	827324.545	36.04733° N	115.00433° W	8	2	Sch. 40 PVC	18-in Diameter Round	#3 Monterey Sand	2-in PVC 0.020"	24.5 - 29.5	24.5	29.5	24.0 - 29.0	24.0	29.0	5	30.0	1,759.63	1,760.11
UFIW-05I	26719358.197	827328.233	36.04733° N	115.00432° W	8	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	34.5 - 39.5	34.5	39.5	34.1 - 39.1	34.1	39.1	5	40.0	1,759.71	1,760.11
UFIW-05D	26719353.491	827326.739	36.04732° N	115.00432° W	8	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	44.5 - 49.5	44.5	49.5	44.1 - 49.1	44.1	49.1	5	61.5	1,759.78	1,760.18
UFIW-06S	26719356.818	827342.877	36.04733° N	115.00427° W	8	2	Sch. 40 PVC	18-in Diameter Round	#3 Monterey Sand	2-in PVC 0.020"	27 - 32	27	32	26.7 - 31.7	26.7	31.7	5	32.0	1,759.76	1,760.10
UFIW-06I	26719356.987	827346.786	36.04733° N	115.00425° W	8	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	35 - 45	35	45	34.6 - 44.6	34.6	44.6	10	45.0	1,759.71	1,760.10
UFIW-06D	26719353.775	827344.375	36.04732° N	115.00426° W	8	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	47 - 52	47	52	46.6 - 51.6	46.6	51.6	5	61.5	1,759.85	1,760.24
UFIW-07S	26719357.178	827360.466	36.04733° N	115.00421° W	8	2	Sch. 40 PVC	18-in Diameter Round	#3 Monterey Sand	2-in PVC 0.020"	26 - 31	26	31	25.6 - 30.6	25.6	30.6	5	31.0	1,759.76	1,760.14
UFIW-07I	26719357.283	827364.425	36.04733° N	115.00419° W	8	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	36 - 41	36	41	35.6 - 40.6	35.6	40.6	5	41.4	1,759.63	1,760.05
UFIW-07D	26719353.909	827362.364	36.04732° N	115.00420° W	8	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	46 - 51	46	51	45.7 - 50.7	45.7	50.7	5	61.5	1,759.79	1,760.10
UFIW-08S	26719357.073	827378.270	36.04733° N	115.00415° W	8	2	Sch. 40 PVC	18-in Diameter Round	#3 Monterey Sand	2-in PVC 0.020"	25 - 30	25	30	24.6 - 29.6	24.6	29.6	5	30.0	1,759.60	1,759.99
UFIW-08I	26719357.398	827382.269	36.04733° N	115.00413° W	8	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	35 - 40	35	40	34.6 - 39.6	34.6	39.6	5	40.1	1,759.61	1,760.03
UFIW-08D	26719353.422	827380.664	36.04732° N	115.00414° W	8	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	45 - 50	45	50	44.6 - 49.6	44.6	49.6	5	61.5	1,759.77	1,760.19
UFMW-01S	26719557.741	827322.226	36.04788° N	115.00432° W	12	2	Sch. 40 PVC	2 ft x 2 ft Square	#3 Monterey Sand	2-in PVC 0.020"	24 - 29	24	29	23.6 - 28.6	23.6	28.6	5	61.5	1,755.07	1,755.49
UFMW-01I	26719557.863	827322.690	36.04788° N	115.00432° W	12	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	34 - 39	34	39	33.5 - 38.5	33.5	38.5	5		1,755.03	1,755.49
UFMW-01D	26719558.151	827322.333	36.04788° N	115.00432° W	12	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	44 - 49	44	49	43.6 - 48.6	43.6	48.6	5		1,755.12	1,755.49
UFMW-02S	26719562.049	827348.779	36.04788° N	115.00424° W	12	2	Sch. 40 PVC	2 ft x 2 ft Square	#3 Monterey Sand	2-in PVC 0.020"	24 - 29	24	29	23.6 - 28.6	23.6	28.6	5	61.5	1,755.02	1,755.42
UFMW-02I	26719562.257	827348.705	36.04788° N	115.00424° W	12	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	34 - 39	34	39	33.6 - 38.6	33.6	38.6	5		1,755.05	1,755.42
UFMW-02D	26719562.018	827348.509	36.04788° N	115.00424° W	12	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	44 - 49	44	49	43.6 - 48.6	43.6	48.6	5		1,755.02	1,755.42
UFMW-03S	26719554.177	827375.383	36.04788° N	115.00417° W	12	2	Sch. 40 PVC	2 ft x 2 ft Square	#3 Monterey Sand	2-in PVC 0.020"	21 - 26	21	26	20.3 - 25.3	20.3	25.3	5	61.5	1,754.68	1,755.37
UFMW-03I	26719554.071	827375.068	36.04788° N	115.00417° W	12	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	30 - 40	30	40	29.3 - 39.3	29.3	39.3	10		1,754.70	1,755.37
UFMW-03D	26719554.600	827375.336	36.04788° N	115.00417° W	12	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	45 - 50	45	50	44.4 - 49.4	44.4	49.4	5		1,754.77	1,755.37
UFMW-04S	26719383.022	827323.589	36.04740° N	115.00433° W	12	2	Sch. 40 PVC	18-in Diameter Round	#3 Monterey Sand	2-in PVC 0.020"	24 - 29	24	29	23.8 - 28.8	23.8	28.8	5	61.5	1,758.79	1,759.03
UFMW-04I	26719383.413	827323.445	36.04740° N	115.00433° W	12	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	34 - 39	34	39	33.8 - 38.8	33.8	38.8	5		1,758.84	1,759.03
UFMW-04D	26719383.319	827323.878	36.04740° N	115.00433° W	12	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	44 - 49	44	49	43.8 - 48.8	43.8	48.8	5		1,758.83	1,759.03
UFMW-05S	26719382.716	827353.392	36.04740° N	115.00423° W	12	2	Sch. 40 PVC	18-in Diameter Round	#3 Monterey Sand	2-in PVC 0.020"	25 - 30	25	30	24.7 - 29.7	24.7	29.7	5	61.5	1,758.94	1,759.26
UFMW-05I	26719382.708	827353.377	36.04740° N	115.00423° W	12	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	35 - 40	35	40	34.7 - 39.7	34.7	39.7	5		1,758.92	1,759.26
UFMW-05D	26719382.960	827353.791	36.04740° N	115.00423° W	12	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	45 - 50	45	50	44.6 - 49.6	44.6	49.6	5		1,758.91	1,759.26
UFMW-06S	26719383.527	827382.753	36.04740° N	115.00413° W	12	2	Sch. 40 PVC	18-in Diameter Round	#3 Monterey Sand	2-in PVC 0.020"	25 - 30	25	30	24.5 - 29.5	24.5	29.5	5	61.5	1,758.74	1,759.25
UFMW-06I	26719383.348	827383.091	36.04740° N	115.00413° W	12	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	35 - 40	35	40	34.5 - 39.5	34.5	39.5	5		1,758.71	1,759.25
UFMW-06D	26719383.109	827382.807	36.04740° N	115.00413° W	12	2	Sch. 40 PVC		#3 Monterey Sand	2-in PVC 0.020"	45 - 50	45	50	44.5 - 49.5	44.5	49.5	5		1,758.76	1,759.25

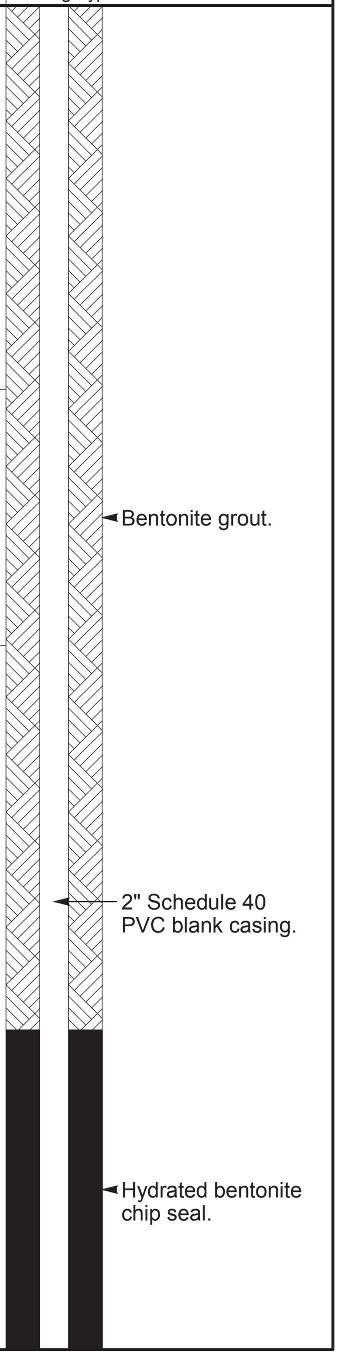
Notes:

amsl	Above mean sea level
bgs	Below ground surface
btoc	Below top of casing
ft	Feet
in	Inches
PVC	Polyvinyl Chloride
Sch.	Schedule
TOC	Top of Casing

BORING NUMBER UFIW-01S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/12/16 **COMPLETED** 7/20/16
GROUND ELEVATION 1755.11 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING ---
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.63 ft / Elev 1727.48 ft
LOGGED BY Daniel Keady **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION		WELL DIAGRAM
0						(SM) Silty SAND, very pale brown (10YR 8/3), 15/70/15/0, fine to coarse sand, loose, dry, well graded, little fine to coarse gravel.		Casing Type: Schedule 40 PVC
5								
					6.0	Moderate to strong cementation 6' to 10'.	1749.1	
10					10.0	(SM) Silty SAND, brown (7.5YR 5/4), 10/70/20/0, fine to medium sand, medium dense to very dense, moist, well graded, little fine gravel.	1745.1	
15						Silty SAND, brown (7.5YR 5/4), 0/80/20/0, fine to medium sand, medium dense, moist, well graded.		
20						Silty SAND, brown (7.5YR 5/4), 10/70/20/0, fine to medium sand, loose to medium dense, moist, well graded,		



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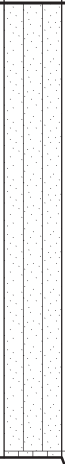
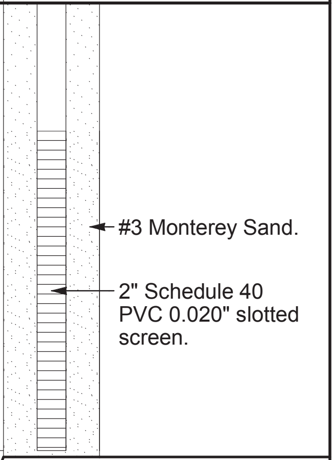
BORING NUMBER UFIW-01S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION		WELL DIAGRAM
						little fine gravel. (SM) *(continued)*		
25						Silty SAND, brown (7.5YR 5/4), 10/70/20/0, fine to medium sand, medium dense, moist, well graded, little fine gravel.		
					28.0	▽	1727.1	
					28.1	(ML) Sandy SILT, brown (7.5YR 5/4), 0/25/75/0, no to low plasticity, fine sand, moist.	1727.0	

Bottom of borehole at 28.1 feet.

BORING NUMBER UFIW-01I

TETRA TECH, INC.

CLIENT Nevada Environmental Response Trust (NERT)

PROJECT NAME NERT - AP Area Treatability Study

PROJECT NUMBER 194-87600012-M13

PROJECT LOCATION Henderson, NV

DATE STARTED 7/13/16 **COMPLETED** 7/21/16

GROUND ELEVATION 1755.08 ft **HOLE SIZE** 8 in

DRILLING CONTRACTOR National EWP

WATER LEVEL AT TIME OF DRILLING 32.00 ft / Elev 1723.08 ft

DRILLING METHOD Hollow Stem Auger

WATER LEVEL AFTER DRILLING 27.54 ft / Elev 1727.54 ft

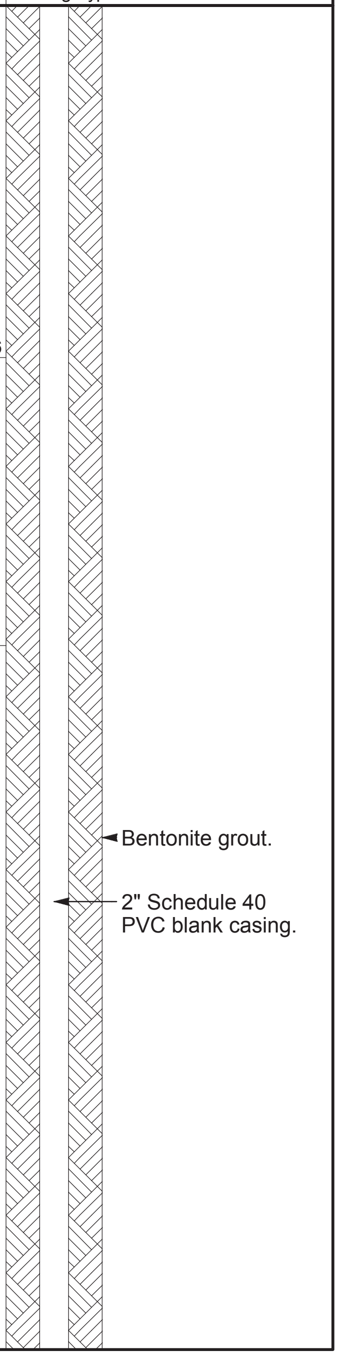
LOGGED BY Daniel Keady **CHECKED BY** M. Crews

NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0					(SM) Silty SAND, very pale brown (10YR 8/4), 15/70/15/0, fine to coarse sand, loose, dry, well graded, little fine to coarse gravel, concrete and asphalt debris present.	
5.5					Moderate to strong cementation 5.5' to 10'.	1749.6
10.0					(SM) Silty SAND with gravel, light brown (7.5YR 6/3), 20/65/15/0, fine to coarse sand, fine to coarse gravel, moist, well graded.	1745.1
15					Silty SAND with gravel, light brown (7.5YR 6/3), 20/65/15/0, fine to coarse sand, fine to coarse gravel, moist, well graded.	
20					Silty SAND with gravel, light brown (7.5YR 6/3), 20/65/15/0, fine to coarse sand, fine to coarse gravel,	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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TETRA TECH, INC.

BORING NUMBER UFIW-01I

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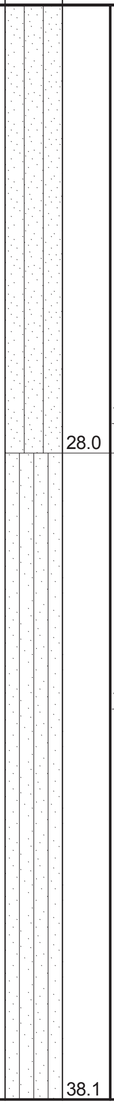
CLIENT Nevada Environmental Response Trust (NERT)

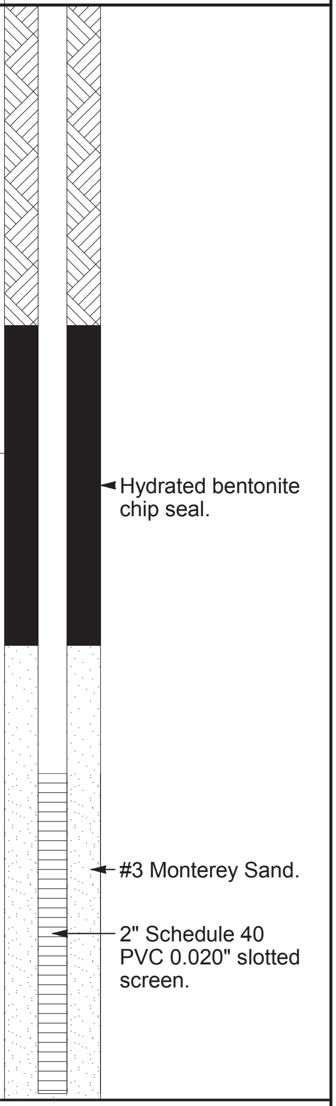
PROJECT NAME NERT - AP Area Treatability Study

PROJECT NUMBER 194-87600012-M13

PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
					moist, well graded. (SM) *(continued)*	
25					Silty SAND with gravel, light brown (7.5YR 6/3), 20/65/15/0, fine to coarse sand, fine to coarse gravel, moist, well graded.	
				28.0	(ML) Sandy SILT, brown (7.5YR 4/4), 0/20/80/0, no to low plasticity, fine to medium sand, hard, moist.	1727.1
30					Sandy SILT, brown (7.5YR 4/4), 0/20/80/0, no to low plasticity, fine to medium sand, hard, moist.	
35					Sandy SILT, brown (7.5YR 4/4), 0/20/80/0, no to low plasticity, fine to medium sand, hard, wet.	
				38.1		1717.0





Bottom of borehole at 38.1 feet.

TETRA TECH, INC.

BORING NUMBER UFIW-01D

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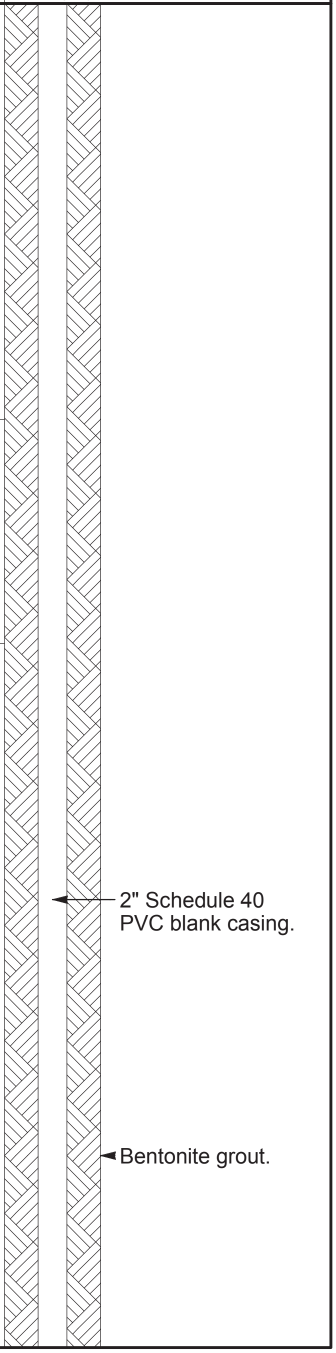
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/13/16 **COMPLETED** 7/20/16
GROUND ELEVATION 1755.21 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 32.00 ft / Elev 1723.21 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 20.37 ft / Elev 1734.84 ft
LOGGED BY Eric Peirce **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					(SM) Silty SAND with Gravel, light yellowish brown (10YR 6/4), 20/65/15/0, fine to coarse sand, fine to coarse gravel, loose, dry, well graded.	Casing Type: Schedule 40 PVC
5					Silty SAND with Gravel, light yellowish brown (10YR 6/4), 20/65/15/0, fine to coarse sand, fine to coarse gravel, loose, dry, well graded, few cemented fragments.	
				6.5	1748.7 Moderate to strong cementation 6.5' to 10'.	
10				10.0	1745.2	
	MC	15-25-30 (55)			(SM) Silty SAND with Gravel, light brown (7.5YR 6/3), 20/65/15/0, fine to coarse sand, fine to coarse gravel, medium dense, moist, well graded.	
	CC					
15	MC	6-6-8 (14)			Silty SAND with Gravel, light brown (7.5YR 6/3), 20/65/15/0, fine to coarse sand, fine to coarse gravel, medium dense, moist, well graded.	
	CC				Silty SAND, light brown (7.5YR 6/3), 0/85/15/0, fine to coarse sand, moist, well graded.	
20	MC	18-28-40			▽ Silty SAND with Gravel, light brown (7.5YR 6/3), 20/65/15/0, fine to coarse sand, fine to coarse gravel,	



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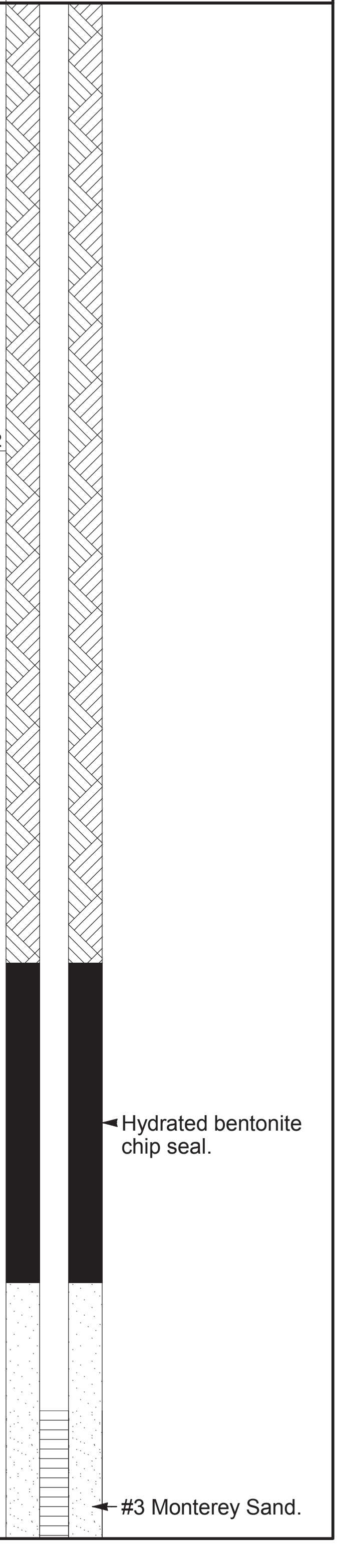
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION	
		(68)				medium dense, moist, well graded. (SM) *(continued)*	
	CC						
25	MC	33-50-36 (86)				Silty SAND with Gravel, light brown (7.5YR 6/3), 20/65/15/0, fine to coarse sand, fine to coarse gravel, medium dense, moist, well graded.	
	CC				28.0	(ML)	1727.2
30	MC	25-70				Sandy SILT, brown (7.5YR 4/4), 0/20/80/0, no to low plasticity, fine to medium sand, hard, moist.	
					▽		
	CC						
35	MC	2-4-6 (10)				Sandy SILT, brown (7.5YR 4/4), 0/20/80/0, no to low plasticity, fine to medium sand, hard, wet.	
	CC						
40	MC	6-6-8 (14)				Sandy SILT, brown (7.5YR 4/4), 0/20/80/0, no to low plasticity, fine to medium sand, hard, moist.	
	NR						
45							

WELL DIAGRAM



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CLIENT Nevada Environmental Response Trust (NERT) **PROJECT NAME** NERT - AP Area Treatability Study

PROJECT NUMBER 194-87600012-M13 **PROJECT LOCATION** Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	14-18-19 (37)			(ML) *(continued)* Sandy SILT, brown (7.5YR 5/4), 5/20/75/0, no plasticity, fine sand, wet, cemented nodules.
	CC				
50	MC	5-7-7 (14)			Sandy SILT, brown (7.5YR 4/3), 0/20/80/0, low to no plasticity, fine sand, medium stiff, wet.
	CC				
55	MC	7-10-12 (22)			Sandy SILT, brown (7.5YR 4/3), 0/20/80/0, low to no plasticity, fine sand, medium stiff to stiff, wet, little fine gravel.
	CC				
60	MC	7-7-13 (20)		61.5	Sandy SILT, light brown (7.5YR 6/4), 15/20/60/0, low to no plasticity, fine sand, medium stiff to stiff, wet. 1693.7

WELL DIAGRAM

2" Schedule 40 PVC 0.020" slotted screen.

Hydrated bentonite chips.

Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

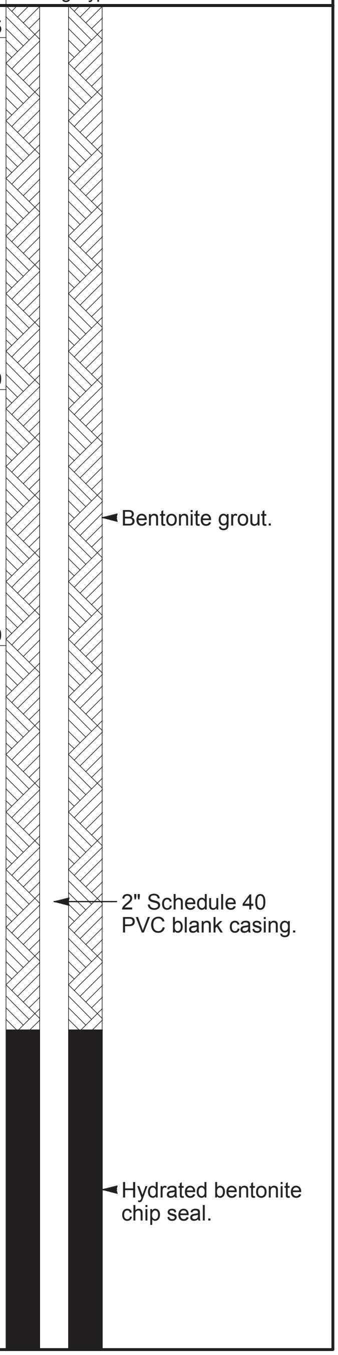
BORING NUMBER UFIW-02S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/8/16 **COMPLETED** 7/20/16
GROUND ELEVATION 1754.97 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING ---
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.20 ft / Elev 1727.77 ft
LOGGED BY Daniel Keady **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION	
0					0.5	Asphalt. (SM) Silty SAND, brown (7.5YR 5/4), 10/70/20/0, fine to medium sand, no plasticity, medium dense to very desne, moist, little fine gravel.	1754.5
5					6.0	Moderate to strong cementation 6' to 10'.	1749.0
10					10.0	(SM) Silty SAND, brown (7.5YR 5/4), 10/70/20/0, fine to medium sand, medium dense to very desne, moist, little fine gravel.	1745.0
15						Silty SAND, brown (7.5YR 5/4), 0/80/20/0, fine to medium sand, medium dense, moist.	
20						Silty SAND, brown (7.5YR 5/4), 10/70/20/0, fine to medium sand, loose to medium dense, moist, little fine	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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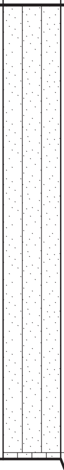
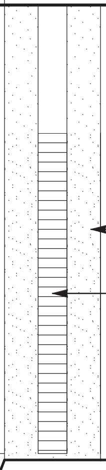
BORING NUMBER UFIW-02S
PAGE 2 OF 2

TETRA TECH, INC.

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
25					gravel. (SM) *(continued)* Silty SAND, brown (7.5YR 5/4), 10/70/20/0, fine to medium sand, medium dense, moist, little fine gravel. ∇	 #3 Monterey Sand. 2" Schedule 40 PVC 0.020" slotted screen.
28.0					1727.0	
28.1					(ML) Sandy SILT, brown (7.5YR 5/4), 0/25/75/0, no to low plasticity, fine sand, moist. 1726.9	

Bottom of borehole at 28.1 feet.

BORING NUMBER UFIW-02I

PAGE 1 OF 2

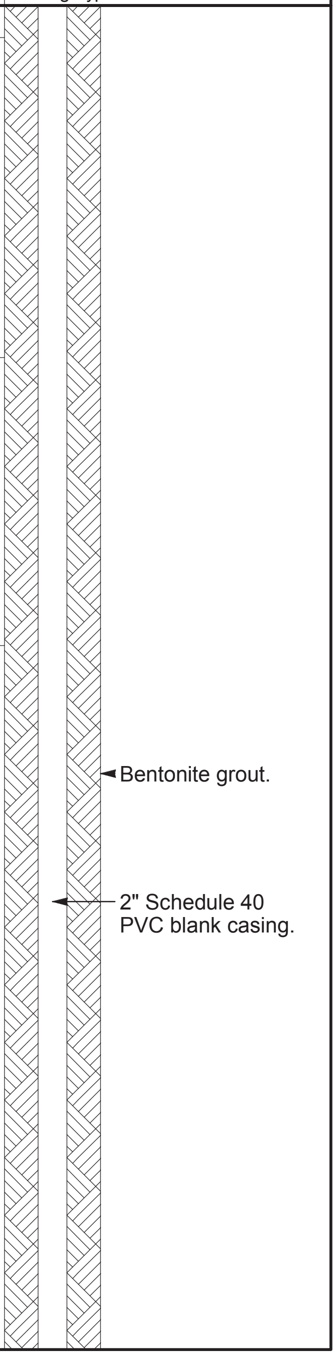
TETRA TECH, INC.

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/11/16 **COMPLETED** 7/21/16
GROUND ELEVATION 1754.85 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 32.00 ft / Elev 1722.85 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.06 ft / Elev 1727.79 ft
LOGGED BY Daniel Keady **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.5					Asphalt.	1754.4
5.5					(SM) Silty SAND, brown (7.5YR 5/4), 10/70/20/0, fine to medium sand, no plasticity, medium dense to very dense, dry, little fine gravel.	1749.4
10.0					Moderate to strong cementation 5.5' to 10'.	1744.9
					(SM) Silty SAND, brown (7.5YR 5/4), 10/70/20/0, fine to medium sand, medium dense to very dense, moist, little fine gravel.	
					Silty SAND, brown (7.5YR 5/4), 0/80/20/0, fine to medium sand, medium dense, moist.	
					Silty SAND, brown (7.5YR 5/4), 10/70/20/0, fine to medium sand, loose to medium dense, moist, little fine	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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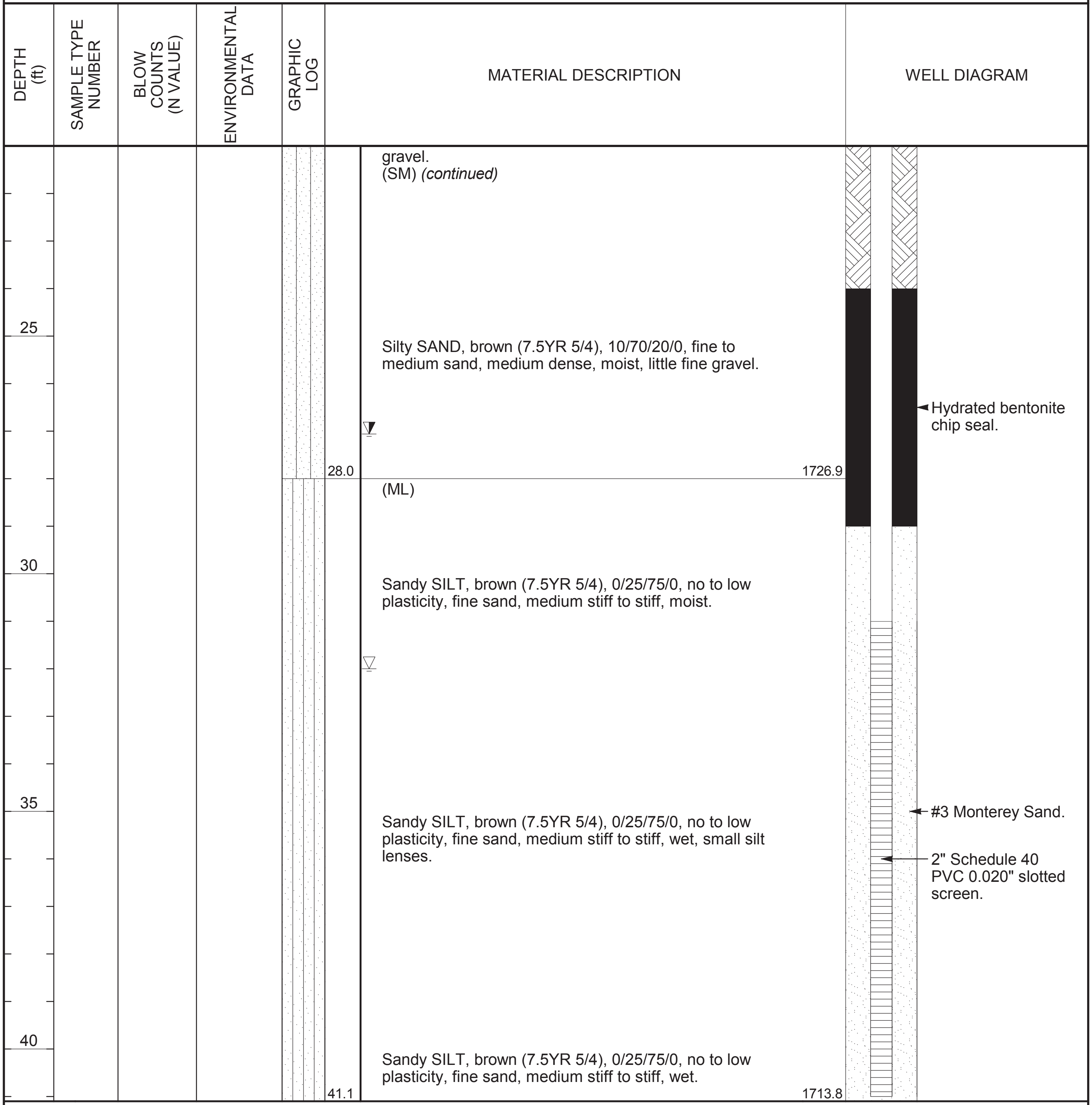
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV



gravel.
(SM) *(continued)*

Silty SAND, brown (7.5YR 5/4), 10/70/20/0, fine to medium sand, medium dense, moist, little fine gravel.

(ML)

Sandy SILT, brown (7.5YR 5/4), 0/25/75/0, no to low plasticity, fine sand, medium stiff to stiff, moist.

Sandy SILT, brown (7.5YR 5/4), 0/25/75/0, no to low plasticity, fine sand, medium stiff to stiff, wet, small silt lenses.

Sandy SILT, brown (7.5YR 5/4), 0/25/75/0, no to low plasticity, fine sand, medium stiff to stiff, wet.

Hydrated bentonite chip seal.

#3 Monterey Sand.

2" Schedule 40 PVC 0.020" slotted screen.

Bottom of borehole at 41.1 feet.

BORING NUMBER UFIW-02D

PAGE 1 OF 3

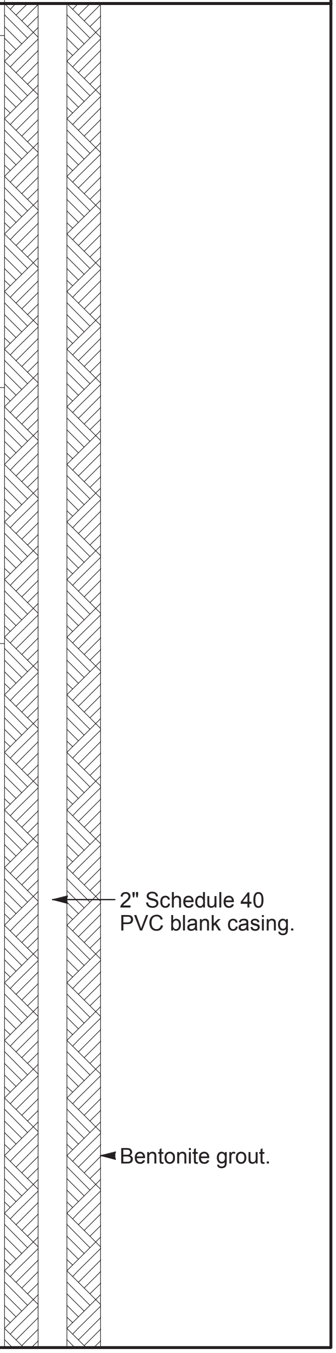
TETRA TECH, INC.

CLIENT	Nevada Environmental Response Trust (NERT)	**PROJECT NAME**	NERT - AP Area Treatability Study
PROJECT NUMBER	194-87600012-M13	**PROJECT LOCATION**	Henderson, NV
DATE STARTED	7/12/16 **COMPLETED** 7/20/16	**GROUND ELEVATION**	1755.01 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR	National EWP	**WATER LEVEL AT TIME OF DRILLING**	32.00 ft / Elev 1723.01 ft
DRILLING METHOD	Hollow Stem Auger	**WATER LEVEL AFTER DRILLING**	27.15 ft / Elev 1727.86 ft
LOGGED BY	Eric Peirce **CHECKED BY** M. Crews		
NOTES	Well completed with an 18" traffic-rated well box.		

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0					Asphalt.	
0.5					(SM) Silty SAND with gravel, yellowish red (5YR 4/6), 15/70/15/0, fine to medium sand, fine gravel, loose to medium dense, moist.	1754.5
6.0					Moderate to strong cementation 6' to 10'.	1749.0
10.0	MC	15-25-30 (55)			(SM) Silty SAND, brown (7.5YR 5/4), 10/70/20/0, fine to medium sand, medium dense to very dense, moist, little fine gravel.	1745.0
	CC					
15	MC	6-6-8 (14)			Silty SAND, brown (7.5YR 5/4), 0/80/20/0, fine to medium sand, medium dense, moist.	
	CC					
20	MC	18-28-40			Silty SAND, brown (7.5YR 5/4), 10/70/20/0, fine to medium sand, loose to medium dense, moist, little fine	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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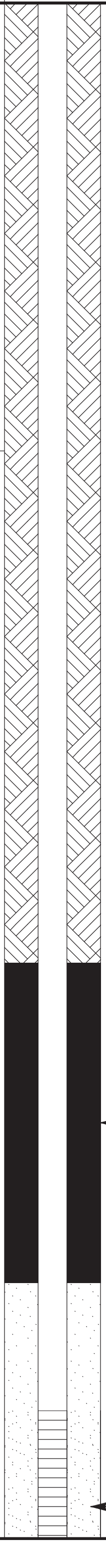
BORING NUMBER UFIW-02D

TETRA TECH, INC.

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV



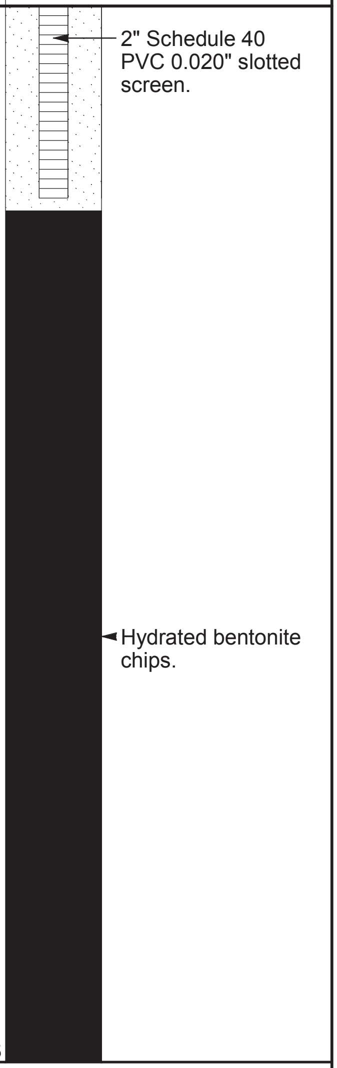
DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
		(68)			gravel. (SM) *(continued)*	
	CC					
25	MC	33-50-36 (86)			Silty SAND, brown (7.5YR 5/4), 10/70/20/0, fine to medium sand, medium dense, moist, little fine gravel.	
					▼	
	CC			28.0	(ML)	1727.0
30	MC	25-70			Sandy SILT, brown (7.5YR 5/4), 0/25/75/0, no to low plasticity, fine sand, medium stiff to stiff, moist.	
					▽	
	CC					
35	MC	2-4-6 (10)			Sandy SILT, brown (7.5YR 5/4), 0/25/75/0, no to low plasticity, fine sand, medium stiff to stiff, wet, little silt lenses.	
	CC					Hydrated bentonite chip seal.
40	MC	6-6-8 (14)			Sandy SILT, brown (7.5YR 5/4), 0/25/75/0, no to low plasticity, fine sand, medium stiff, wet, little silt lenses.	
	CC					#3 Monterey Sand.
45						

(Continued Next Page)

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	14-18-19 (37)			(ML) *(continued)* Sandy SILT, brown (7.5YR 5/4), 0/25/75/0, no to low plasticity, fine sand, medium stiff, wet.
	CC				
50	MC	5-7-7 (14)			Sandy SILT, brown (7.5YR 5/4), 0/25/75/0, no to low plasticity, fine sand, medium stiff to stiff, wet.
	CC				
55	MC	7-10-12 (22)			Sandy SILT, brown (7.5YR 5/4), 0/25/75/0, no to low plasticity, fine sand, medium stiff to stiff, wet.
	CC				
60	MC	7-7-13 (20)			Sandy SILT, brown (7.5YR 5/4), 0/25/75/0, no to low plasticity, fine sand, medium stiff, wet.
				61.5	1693.5

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

BORING NUMBER UFIW-03S

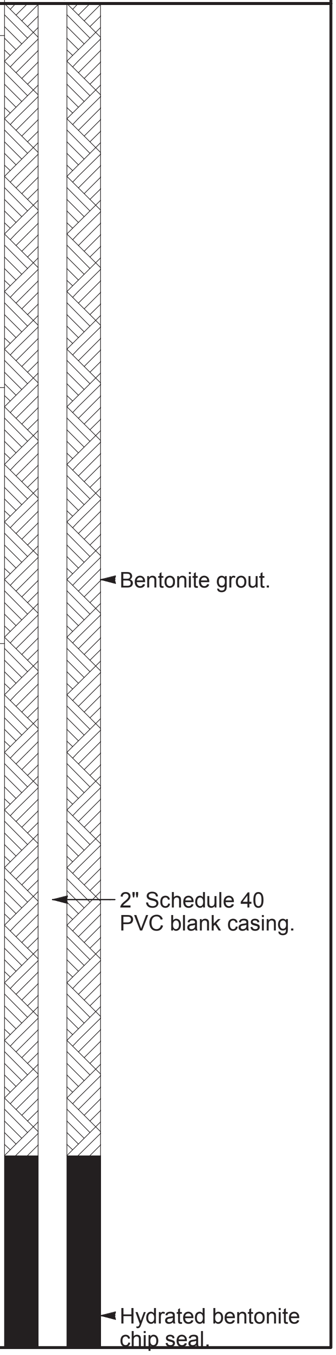
PAGE 1 OF 2

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/11/16 **COMPLETED** 7/14/16
GROUND ELEVATION 1755.22 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 32.00 ft / Elev 1723.22 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.35 ft / Elev 1727.87 ft
LOGGED BY Daniel Keady **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION	
0					0.5	Asphalt.	1754.7
					6.0	(SM) Silty SAND, brown (7.5YR 5/4), 10/70/20/0, fine to medium sand, medium dense to very dense, dry, little fine gravel.	1749.2
5					10.0	Moderate to strong cementation 6' to 10'.	1745.2
10						(SM) Silty SAND, brown (7.5YR 5/4), 15/60/25/0, fine to coarse sand, fine to coarse gravel, moist.	
15						Silty SAND, brown (7.5YR 5/4), 15/60/25/0, fine to coarse sand, fine to coarse gravel, moist, increasing gravel and cemented nodules with depth.	
20						Silty SAND, brown (7.5YR 5/4), 15/60/25/0, fine to coarse sand, fine to coarse gravel, moist, increasing gravel and	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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TETRA TECH, INC.

BORING NUMBER UFIW-03S

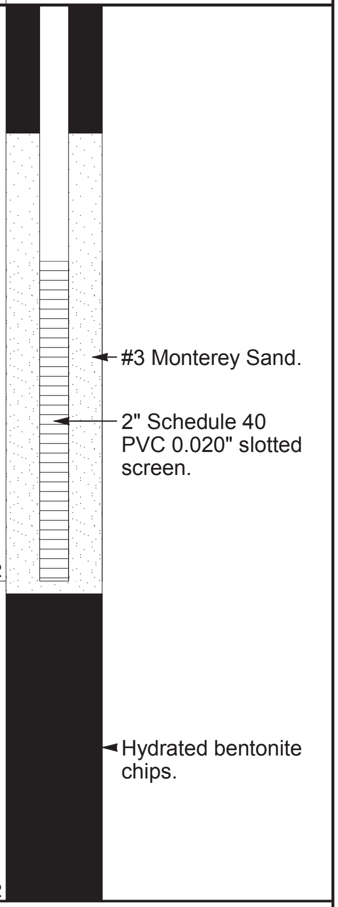
PAGE 2 OF 2

CLIENT Nevada Environmental Response Trust (NERT) **PROJECT NAME** NERT - AP Area Treatability Study

PROJECT NUMBER 194-87600012-M13 **PROJECT LOCATION** Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
					cemented nodules with depth. (SM) *(continued)*
25					Silty SAND, brown (7.5YR 5/4), 15/60/25/0, fine to coarse sand, fine to coarse gravel, moist, increasing gravel and cemented nodules with depth.
					▼
30				30.0	1725.2
					(ML) Sandy SILT, dark yellowish brown (10YR 4/6), 0/15/85/0, low plasticity, fine sand, medium stiff to stiff, moist.
					▽
35				35.0	1720.2

WELL DIAGRAM



Bottom of borehole at 35.0 feet.

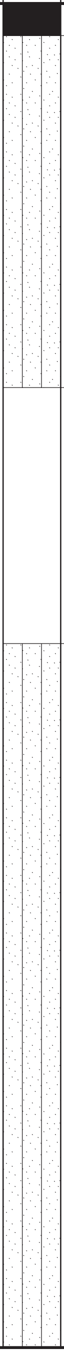
TETRA TECH, INC.

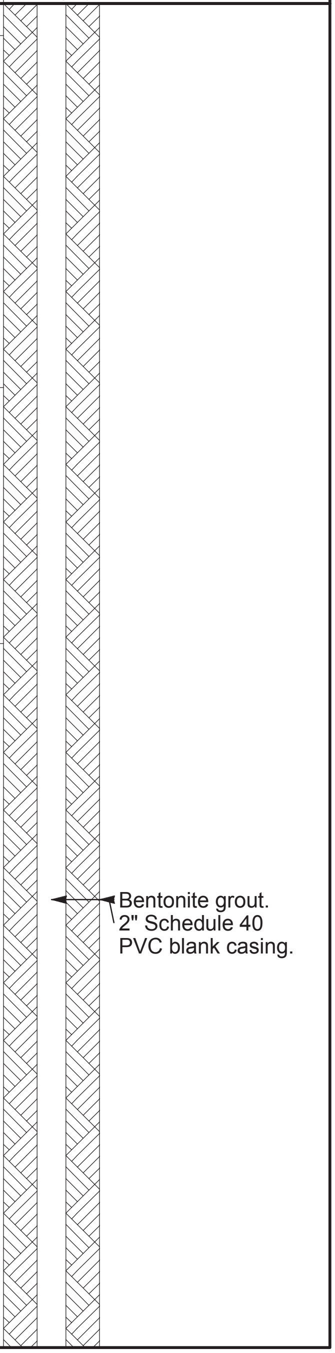
BORING NUMBER UFIW-03I

PAGE 1 OF 2

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/11/16 **COMPLETED** 7/15/16
GROUND ELEVATION 1754.89 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 32.00 ft / Elev 1722.89 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.02 ft / Elev 1727.87 ft
LOGGED BY Daniel Keady **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM Casing Type: Schedule 40 PVC
0				0.5	Asphalt.	1754.4	
				6.0	(SM) Silty SAND, brown (7.5YR 5/4), 10/70/20/0, fine to medium sand, medium dense to very desne, dry, little fine gravel.	1748.9	
5				10.0	Moderate to strong cementation 6' to 10'.	1744.9	
10					(SM) Silty SAND, brown (7.5YR 5/4), 15/60/25/0, fine to coarse sand, moist, little fine gravel.		
15					Silty SAND, brown (7.5YR 5/4), 15/60/25/0, fine to coarse sand, moist, little fine gravel.		
					Silty SAND, brown (7.5YR 5/4), 15/60/25/0, fine to coarse sand, moist.		
					Cemented nodules.		
20					Silty SAND, brown (7.5YR 5/4), 15/70/15/0, fine to coarse sand, fine to coarse gravel, dense to very dense, moist.		





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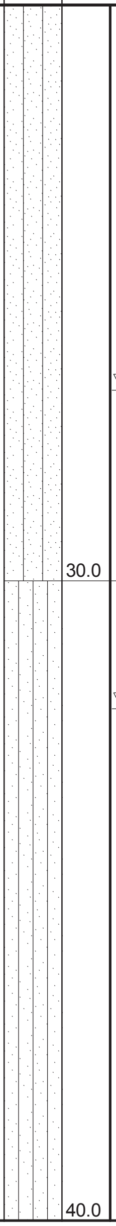
TETRA TECH, INC.

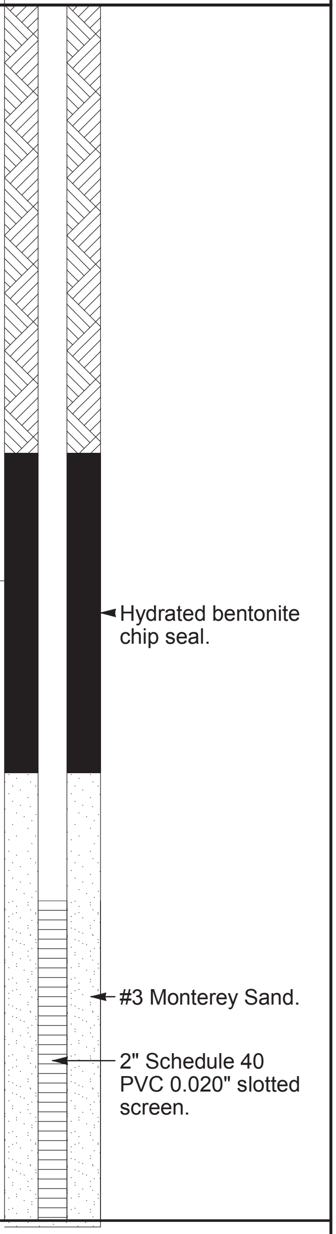
BORING NUMBER UFIW-03I

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
					(SM) *(continued)*	
25					Silty SAND, brown (7.5YR 5/4), 15/70/15/0, fine to coarse sand, fine to coarse gravel, dense to very dense, moist, little small cobbles present. Silty SAND, brownish yellow (10YR 6/6), 5/75/20/0, fine to medium sand, low plasticity (silt), fine to medium gravel, very dense, moist, little cemented nodules.	
					▼	
30				30.0		1724.9
					(ML) Sandy SILT, dark yellowish brown (10YR 4/6), 0/15/85/0, low plasticity, fine sand, medium stiff to stiff, moist.	
					▽	
35					Sandy SILT, yellowish red (5YR 5/6), 0/25/75/0, low plasticity, fine to medium sand, medium stiff to stiff, wet.	
40				40.0		1714.9



WELL DIAGRAM



Bottom of borehole at 40.0 feet.

TETRA TECH, INC.

BORING NUMBER UFIW-03D

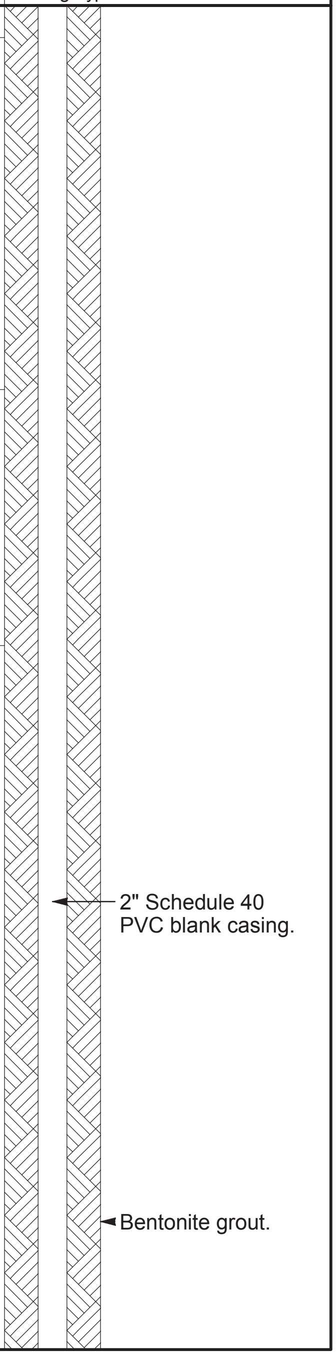
PAGE 1 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/11/16 **COMPLETED** 7/15/16
GROUND ELEVATION 1755.38 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 32.00 ft / Elev 1723.38 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.43 ft / Elev 1727.95 ft
LOGGED BY Eric Peirce **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0				0.5	Asphalt.	1754.9
					(SM) Silty SAND, brown (7.5YR 5/4), 15/70/15/0, fine to medium sand, no plasticit, loose to medium dense, dry.	
5						
				6.0	Moderate to strong cementation 6' to 10'.	1749.4
10				10.0	(SM) Silty SAND, brown (7.5YR 5/4), 10/70/20/0, fine to medium sand, fine gravel, medium dense, dry.	1745.4
	MC	21-24-25 (49)				
	CC					
15	MC	15-15-13 (28)			Silty SAND, brown (7.5YR 5/4), 10/70/20/0, fine to medium sand, fine gravel, medium dense, moist.	
	CC				Silty SAND, brown (7.5YR 5/4), 10/70/20/0, fine to medium sand, medium dense, dry.	
					Cemented nodules.	
20	MC	32-48-57			Silty SAND, brown (7.5YR 5/4), 15/70/15/0, fine to coarse sand, fine to coarse gravel, dense to very dense, moist.	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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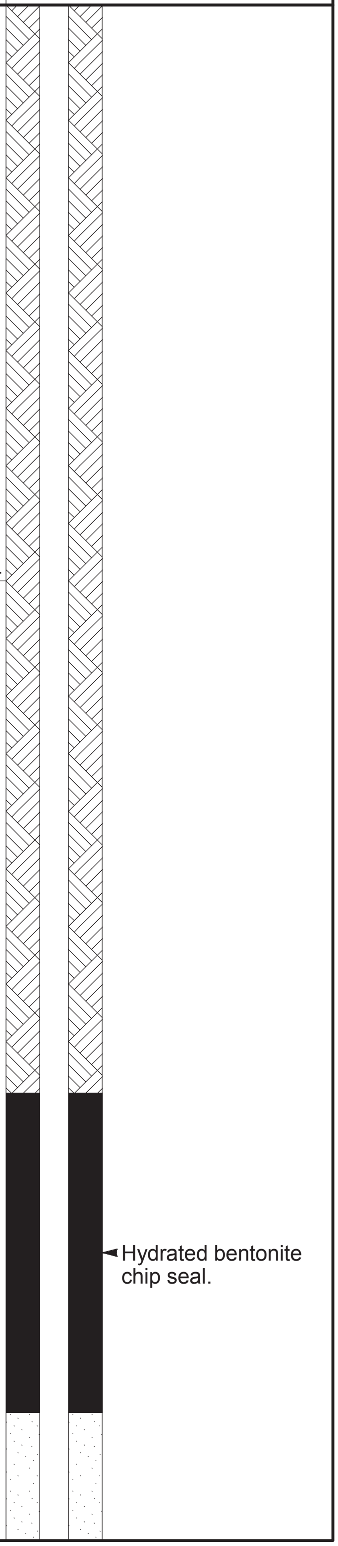
BORING NUMBER UFIW-03D

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
		(105)			(SM) *(continued)*
	CC				
25	MC	60-110			Silty SAND, brownish yellow (10YR 6/6), 5/75/20/0, fine to medium sand, fine to medium gravel, very dense, moist, little cemented nodules.
	CC			▼	
30	MC	3-8-10 (18)		30.0	1725.4 (ML) Sandy SILT, dark yellowish brown (10YR 4/6), 0/15/85/0, low plasticity, fine sand, medium stiff to stiff, moist.
	CC			▽	
35	MC	7-6-9 (15)			Sandy SILT, yellowish red (5YR 5/6), 0/25/75/0, low plasticity, fine to medium sand, medium stiff to stiff, wet.
	CC				
40	MC	5-6-8 (14)			Sandy SILT, reddish brown (5YR 5/4), 0/15/85/0, low plasticity, fine sand, medium stiff, wet.
	CC				
45					

WELL DIAGRAM



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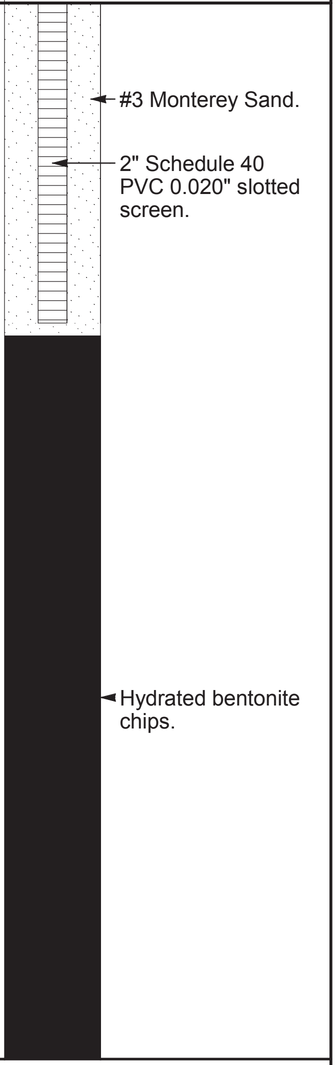
BORING NUMBER UFIW-03D

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	4-4-7 (11)			(ML) *(continued)* Sandy SILT, reddish brown (5YR 5/4), 0/15/85/0, low plasticity, fine sand, medium stiff, wet.
	CC				
50	MC	4-9-12 (21)			Sandy SILT, reddish brown (5YR 5/4), 0/15/85/0, low plasticity, fine sand, medium stiff to stiff, wet, little cemented nodules.
	CC				
55	MC	4-8-9 (17)			Sandy SILT, reddish brown (5YR 5/4), 0/15/85/0, low plasticity, fine sand, medium stiff to stiff, wet, little cemented nodules.
	CC				
60	MC	4-9-10 (19)		61.5	Sandy SILT, reddish brown (5YR 5/4), 0/15/85/0, low plasticity, fine sand, medium stiff to stiff, wet, little cemented nodules. 1693.9

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

BORING NUMBER UFIW-04S

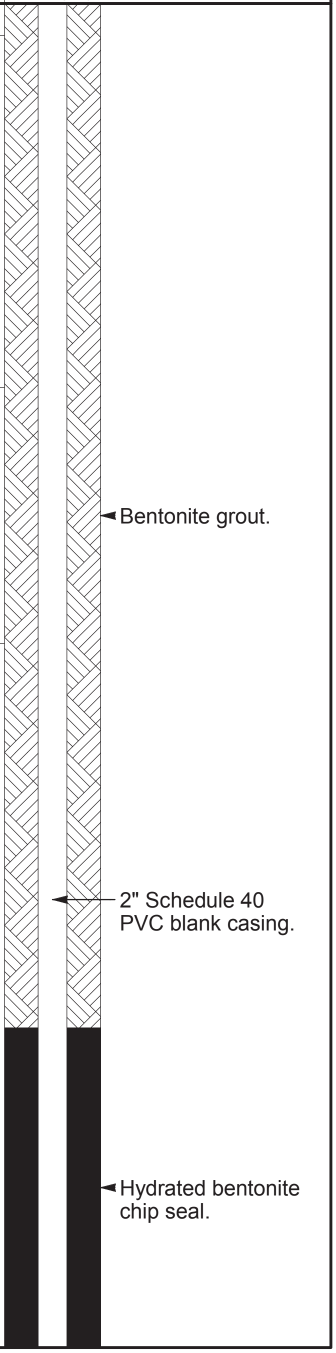
PAGE 1 OF 2

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/11/16 **COMPLETED** 7/18/16
GROUND ELEVATION 1755.28 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING ---
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.31 ft / Elev 1727.97 ft
LOGGED BY Daniel Keady **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0				0.5	Asphalt.	1754.8
				6.0	(SM) Silty SAND, brown (7.5YR 5/3), 15/60/25/0, fine to medium sand, fine gravel, loose to medium dense, dry.	1749.3
5				10.0	Moderate to strong cementation 6' to 10'.	1745.3
10					(SM) Silty SAND with Gravel, brown (7.5YR 5/4), 20/55/25/0, fine to coarse sand, fine to coarse gravel, dry, cemented nodules.	
15					Silty SAND with Gravel, brown (7.5YR 5/4), 20/55/25/0, fine to coarse sand, fine to coarse gravel, moist, cemented nodules.	
20					Silty SAND, brown (7.5YR 5/4), 0/65/35/0, fine to coarse sand, moist, cemented nodules.	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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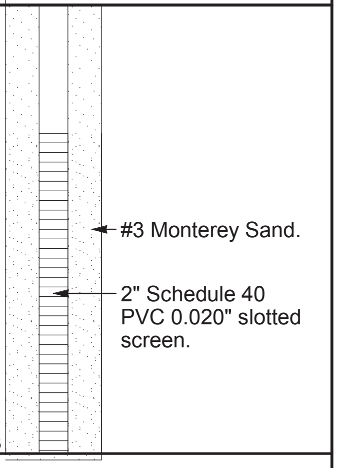
BORING NUMBER UFIW-04S

PAGE 2 OF 2

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
					(SM) *(continued)*
					Silty SAND with Gravel, brown (7.5YR 5/4), 20/55/25/0, fine to coarse sand, fine to coarse gravel, moist, cemented nodules.
25					Silty SAND with Gravel, brown (7.5YR 5/4), 20/55/25/0, fine to coarse sand, fine to coarse gravel, moist, cemented nodules.
				28.0	▼ 1727.3

WELL DIAGRAM



Bottom of borehole at 28.0 feet.

TETRA TECH, INC.

BORING NUMBER UFIW-04I

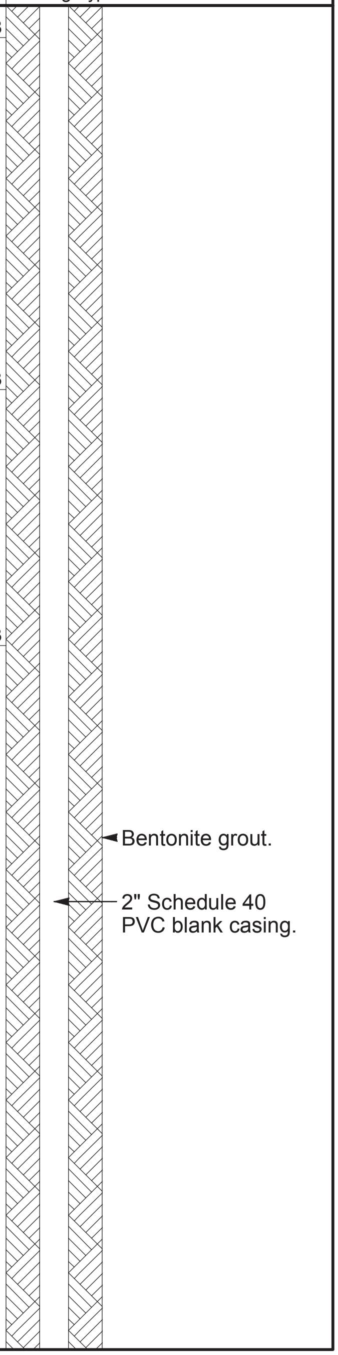
PAGE 1 OF 2

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/11/16 **COMPLETED** 7/21/16
GROUND ELEVATION 1755.33 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 32.00 ft / Elev 1723.33 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.42 ft / Elev 1727.91 ft
LOGGED BY Daniel Keady **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	Elev.
0 – 0.5				■	Asphalt.	1754.8
0.5 – 6.0				⁙	(SM) Silty SAND, brown (7.5YR 5/3), 15/60/25/0, fine to medium sand, fine gravel, loose to medium dense, dry.	1749.3
6.0 – 10.0					Moderate to strong cementation 6' to 10'.	1745.3
10.0				⁙	(SM) Silty SAND with Gravel, brown (7.5YR 5/4), 20/55/25/0, fine to coarse sand, fine to coarse gravel, dry, cemented nodules.	
				⁙	Silty SAND with Gravel, brown (7.5YR 5/4), 20/55/25/0, fine to coarse sand, fine to coarse gravel, moist, cemented nodules.	
				⁙	Silty SAND, brown (7.5YR 5/4), 20/55/25/0, fine to coarse sand, no plasticity, moist, cemented nodules.	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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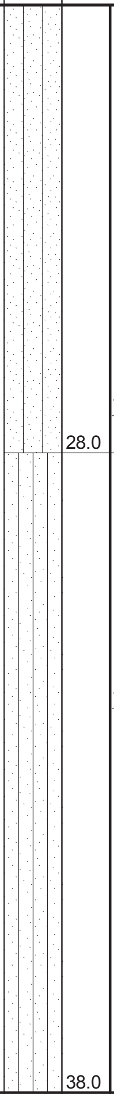
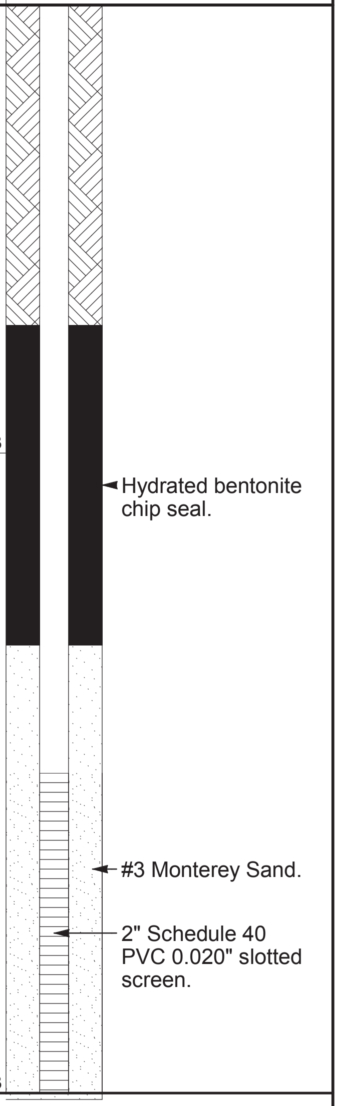
CLIENT Nevada Environmental Response Trust (NERT)	**PROJECT NAME** NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13	**PROJECT LOCATION** Henderson, NV





DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
					(SM) *(continued)*	
					Silty SAND with Gravel, brown (7.5YR 5/4), 20/55/25/0, fine to coarse sand, fine to coarse gravel, moist, cemented nodules.	
25					Silty SAND with Gravel, brown (7.5YR 5/4), 20/55/25/0, fine to coarse sand, fine to coarse gravel, moist, cemented nodules.	
				28.0	(ML)	1727.3
30					Sandy SILT, brown (7.5YR 5/4), 0/15/85/0, no to low plasticity, fine sand, soft to stiff, moist.	Hydrated bentonite chip seal.
35					Sandy SILT, brown (7.5YR 5/4), 0/15/85/0, no to low plasticity, fine sand, soft to stiff, wet.	#3 Monterey Sand. 2" Schedule 40 PVC 0.020" slotted screen.
				38.0		1717.3

Bottom of borehole at 38.0 feet.

TETRA TECH, INC.

BORING NUMBER UFIW-04D

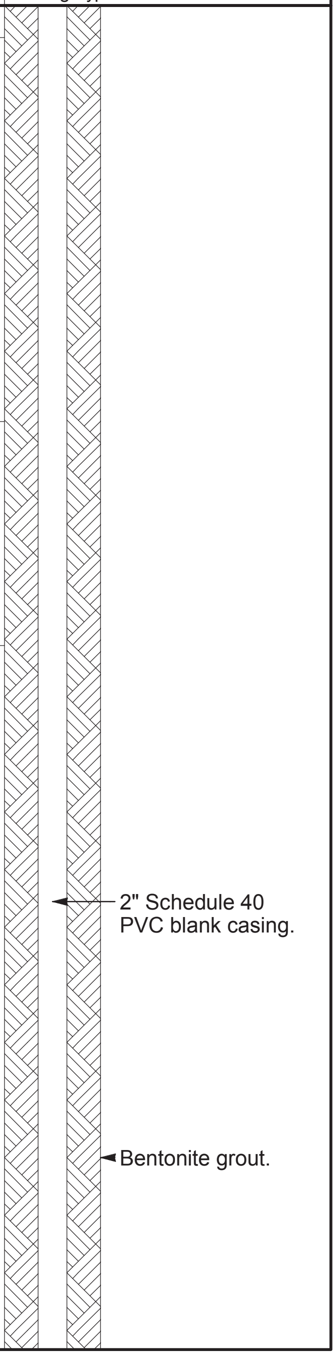
PAGE 1 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/11/16 **COMPLETED** 7/18/16
GROUND ELEVATION 1755.39 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 32.00 ft / Elev 1723.39 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.43 ft / Elev 1727.96 ft
LOGGED BY Daniel Keady **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0				0.5	Asphalt.	1754.9
				6.5	(SM) Silty SAND, brown (7.5YR 5/3), 15/60/25/0, fine to medium sand, fine gravel, loose to medium dense, dry.	1748.9
				10.0	Moderate to strong cementation 6.5' to 10'.	1745.4
10	MC	20-28-40 (68)			(SM) Silty SAND with Gravel, brown (7.5YR 5/4), 20/55/25/0, fine to coarse sand, fine to coarse gravel, dry, cemented nodules.	
	CC					
15	MC	24-21-31 (52)			Silty SAND with Gravel, brown (7.5YR 5/4), 20/55/25/0, fine to coarse sand, fine to coarse gravel, moist, cemented nodules.	
	CC					
20	MC	13-23-43			Silty SAND, brown (7.5YR 5/4), 0/65/35/0, fine to coarse sand, moist, cemented nodules.	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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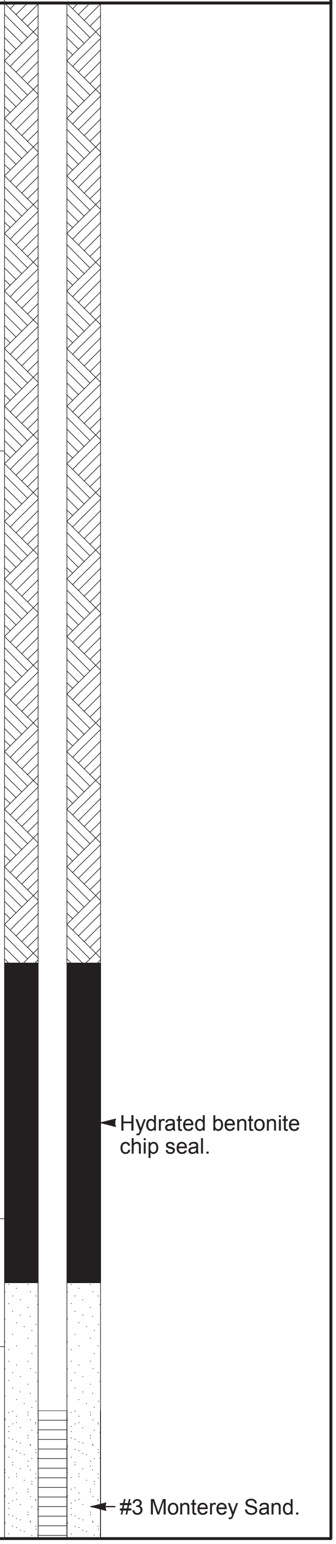
ENVIRONMENTAL BH - GINT STD US.GDT - 11/10/17 12:49 - \\TTS318FS1\CES\PROJECTS\87600014-NERT-M12\WORKING\IN-SITU CR TREATABILITY TEST\FIELD PROGRAM\BORING LOGS\GINT\ALL M13 LOGS.GPJ

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
		(66)			(SM) *(continued)*
	CC				Silty SAND with Gravel, brown (7.5YR 5/4), 20/55/25/0, fine to coarse sand, fine to coarse gravel, moist, cemented nodules.
25	MC	30-31-30 (61)			Silty SAND with Gravel, brown (7.5YR 5/4), 20/55/25/0, fine to coarse sand, fine to coarse gravel, moist, cemented nodules.
	CC				▼
				28.0	1727.4 (ML)
30	MC	3-5-11 (16)			Sandy SILT, brown (7.5YR 5/4), 0/15/85/0, no to low plasticity, fine sand, soft to stiff, moist.
	CC				▽
35	MC	4-5-7 (12)			Sandy SILT, brown (7.5YR 5/4), 0/15/85/0, no to low plasticity, fine sand, soft to stiff, wet.
	CC				
40				40.0	1715.4
	MC	17-14-18 (32)			(SM) Silty SAND with Gravel, pink (7.5YR 8/3), 25/60/15/0, fine to coarse sand, low to no plasticity (silt), fine to coarse gravel, medium dense to dense, wet.
				42.0	1713.4 (ML) Sandy SILT, pink (7.5YR 8/3), 0/20/80/0, no to low plasticity, fine sand, wet.
	CC				
45					

WELL DIAGRAM



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TETRA TECH, INC.

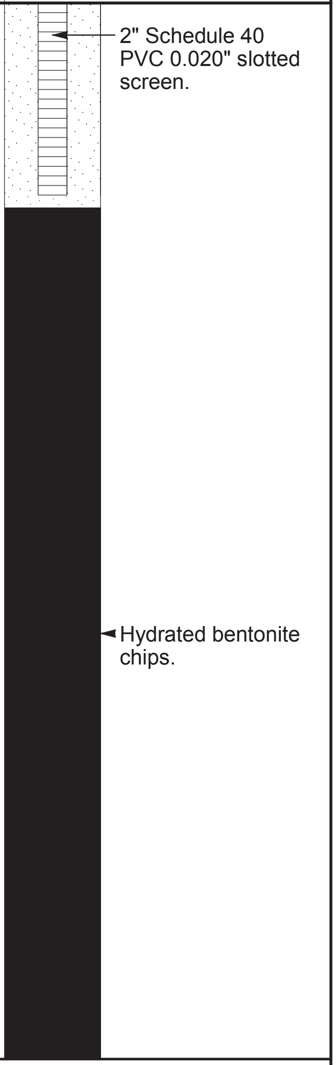
BORING NUMBER UFIW-04D

CLIENT Nevada Environmental Response Trust (NERT) **PROJECT NAME** NERT - AP Area Treatability Study

PROJECT NUMBER 194-87600012-M13 **PROJECT LOCATION** Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	5-15-10 (25)			(ML) *(continued)* Sandy SILT, brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff to stiff, wet.
	CC				
50	MC	5-15-22 (37)			Sandy SILT, brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff to very stiff, wet.
	CC				
55	MC	9-20-25 (45)			Sandy SILT, brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff to very stiff, wet.
	CC				
60	MC	6-7-13 (20)		61.5	Sandy SILT, brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff to stiff, wet. 1693.9

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

BORING NUMBER UFIW-05S

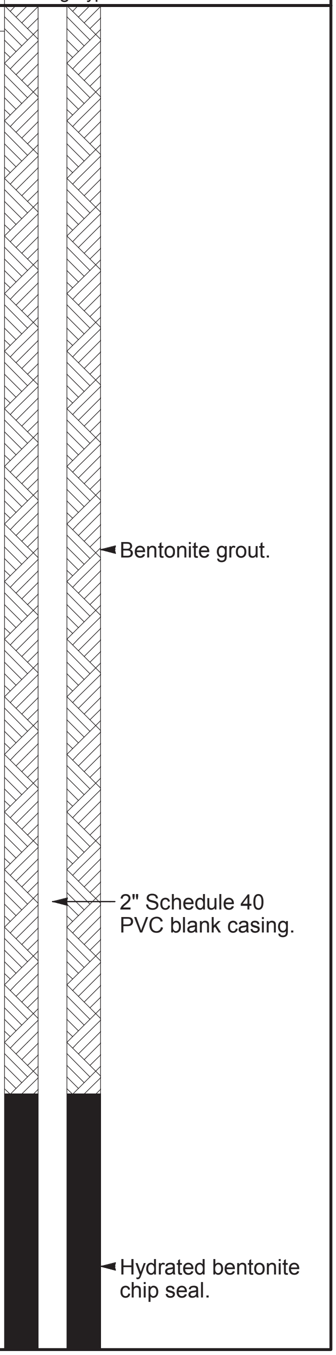
TETRA TECH, INC.

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/15/16 **COMPLETED** 7/27/16
GROUND ELEVATION 1759.63 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING ---
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 28.00 ft / Elev 1731.63 ft
LOGGED BY Joel Lagade **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0				0.4	Asphalt	1759.2
					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	
5					Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel, cemented nodules.	
10					Silty SAND, brown (7.5YR 4/4), 10/70/20/0, fine to medium sand, fine to medium gravel, loose, moist.	
15					Silty SAND, brown (7.5YR 4/4), 10/70/20/0, fine to medium sand, loose, moist, some fine to medium gravel, cemented nodules.	
20					Silty SAND, brown (7.5YR 4/4), 10/70/20/0, fine to medium sand, loose, moist, trace fine to medium gravel,	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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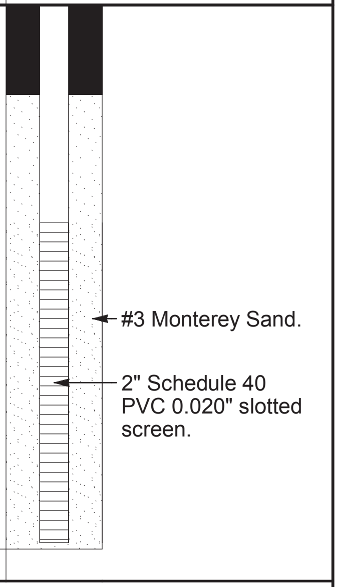
TETRA TECH, INC.

BORING NUMBER UFIW-05S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION	WELL DIAGRAM
						increasing silt content. (SM) *(continued)*	
25						No Recovery	
						▽	
					29.5	1730.1	
30							

Bottom of borehole at 30.0 feet.

TETRA TECH, INC.

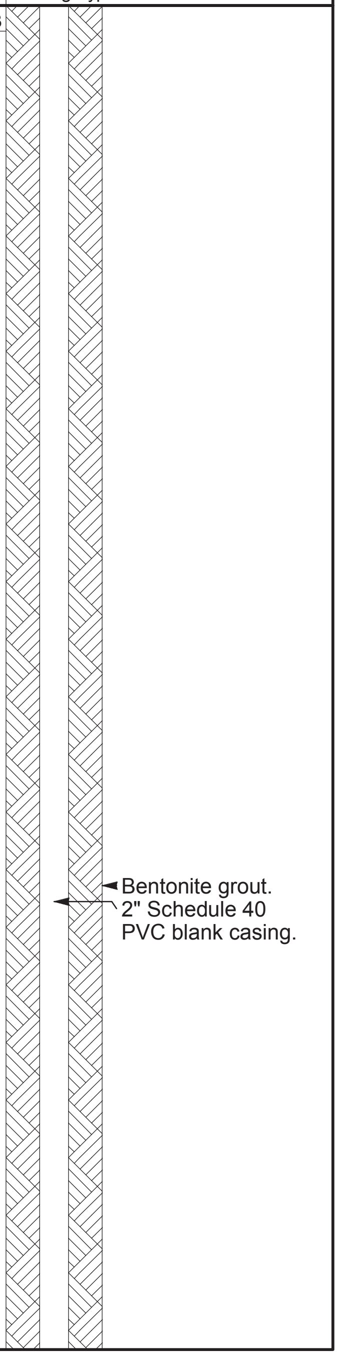
BORING NUMBER UFIW-05I

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/15/16 **COMPLETED** 8/2/16
GROUND ELEVATION 1759.71 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 33.50 ft / Elev 1726.21 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 28.10 ft / Elev 1731.61 ft
LOGGED BY Jon Coen **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
0				0.4	Asphalt 1759.3 (SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.
5					Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel, cemented nodules.
10					Silty SAND, brown (7.5YR 4/4), 10/70/20/0, fine to medium sand, fine to medium gravel, loose, moist.
15					
20					Silty SAND, brown (7.5YR 4/4), 10/70/20/0, fine to medium sand, fine to medium gravel, loose, moist.

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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TETRA TECH, INC.

BORING NUMBER UFIW-05I

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION		WELL DIAGRAM
						(SM) *(continued)*		
25						Silty SAND, brown (7.5YR 4/4), 10/70/20/0, fine to medium sand, loose, moist, trace fine to medium gravel, increasing silt content.		
						▼		
					29.5		1730.2	
30						(ML) Sandy SILT, strong brown (7.5YR 4/6), 0/20/80/0, no to low plasticity, fine sand, very stiff, moist, trace clay.		Hydrated bentonite chip seal.
						▽		
35						Trace cemented nodules. Sandy SILT, strong brown (7.5YR 4/6), 0/20/80/0, low plasticity, fine sand, very stiff, wet, trace clay.		#3 Monterey Sand. 2" Schedule 40 PVC 0.020" slotted screen.
40					40.0		1719.7	

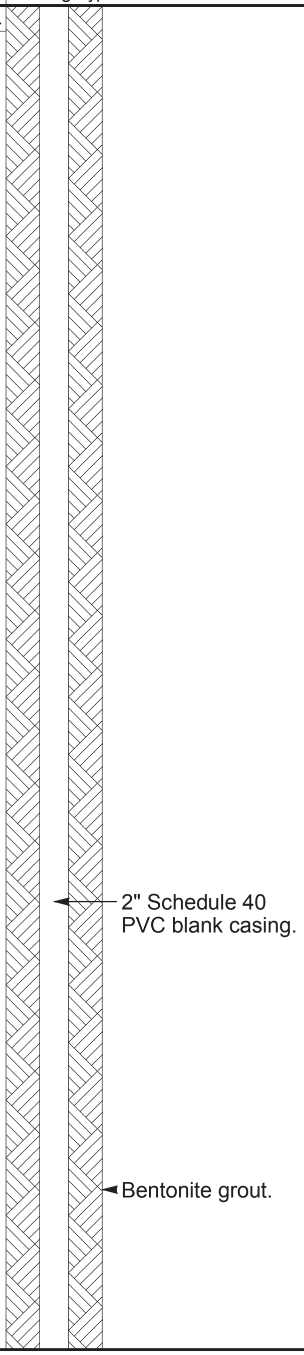
Sandy SILT, strong brown (7.5YR 4/4), 0/20/80/0, low plasticity, fine sand, medium stiff, wet, trace clay.
Bottom of borehole at 40.0 feet.

BORING NUMBER UFIW-05D

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/15/16 **COMPLETED** 7/26/16
GROUND ELEVATION 1759.78 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 33.50 ft / Elev 1726.28 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 28.20 ft / Elev 1731.58 ft
LOGGED BY Joel Lagade **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0				0.4	Asphalt	1759.4
					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	
5					Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel, cemented nodules.	
10	MC	8-16-23 (39)			Silty SAND, brown (7.5YR 4/4), 10/70/20/0, fine to medium sand, fine to medium gravel, loose, moist.	
	CC					
15	MC	15-30-40 (70)			Silty SAND, brown (7.5YR 4/4), 10/70/20/0, fine to medium sand, loose, moist, some fine to medium gravel, cemented nodules.	
	CC					
20	MC	18-27-33			Silty SAND, brown (7.5YR 4/4), 10/70/20/0, fine to medium sand, loose, moist, trace fine to medium gravel,	

Casing Type: Schedule 40 PVC



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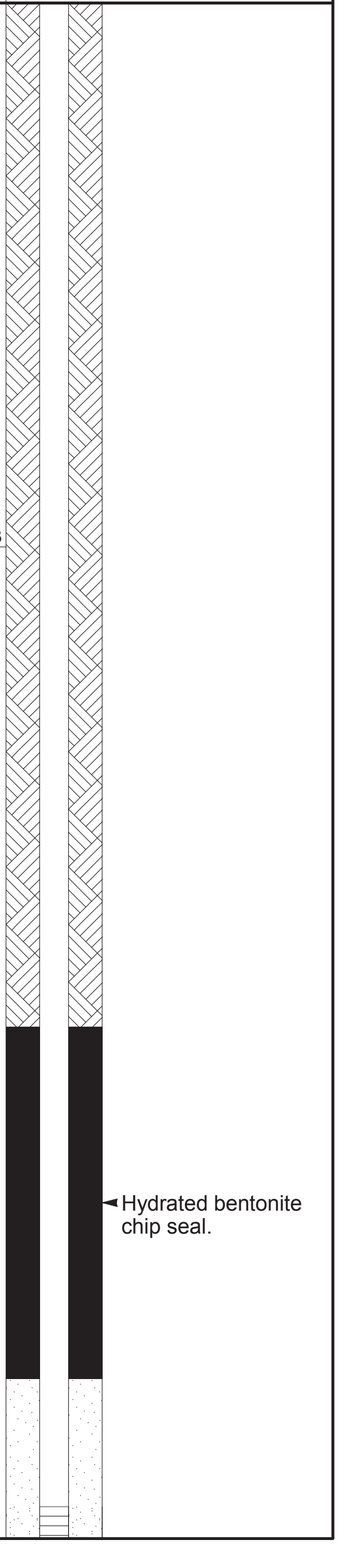
BORING NUMBER UFIW-05D

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
	MC	(60)			increasing silt content. (SM) *(continued)*
	CC				
25	NR	50			No Recovery
	NR				▼
				29.5	1730.3
30	MC	8-12-22 (34)			(ML) Sandy SILT, strong brown (7.5YR 4/6), 0/20/80/0, low plasticity, fine sand, very stiff, moist, trace clay.
	CC				▽
35	MC	23-27-30 (57)			Sandy SILT, strong brown (7.5YR 4/6), 0/20/80/0, low plasticity, fine sand, very stiff, wet, trace clay. Trace cemented nodules.
	CC				
40	MC	4-6-8 (14)			Sandy SILT, strong brown (7.5YR 4/4), 0/20/80/0, low plasticity, fine sand, medium stiff, wet, trace clay.
	CC				
45					

WELL DIAGRAM



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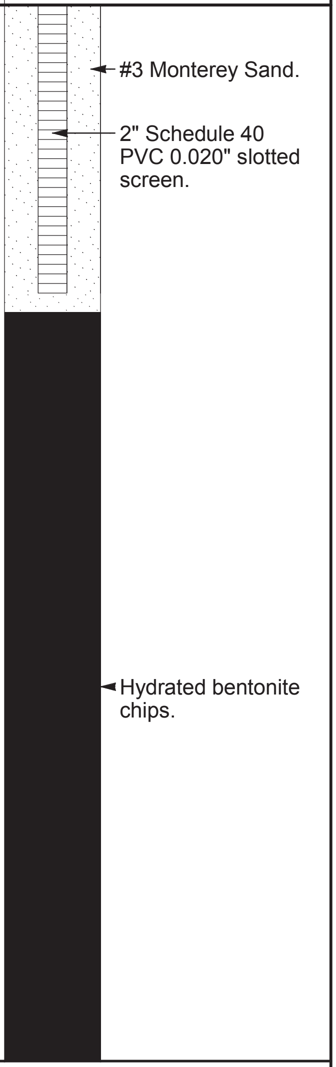
TETRA TECH, INC.

BORING NUMBER UFIW-05D

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	2-4-6 (10)			(ML) *(continued)* SILT with clay, strong brown (7.5YR 4/6), 0/15/70/15, medium plasticity, medium stiff, wet, some fine sand, increasing clay content.
	CC				
50	MC	3-5-6 (11)			SILT, brown (7.5YR 5/4), 1/5/91/3, medium plasticity, wet, trace fine sand and clay, cemented nodules.
	CC				
55	MC	4-3-6 (9)			SILT, strong brown (7.5YR 4/6), 0/15/70/15, low plasticity, medium stiff, wet, some fine sand and clay.
	CC				
60	MC	4-6-8 (14)		61.5	SILT, strong brown (7.5YR 4/6), 0/15/70/15, low plasticity, medium stiff, wet, some fine sand and clay, trace cemented nodules. 1698.3

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

BORING NUMBER UFIW-06S

PAGE 1 OF 2

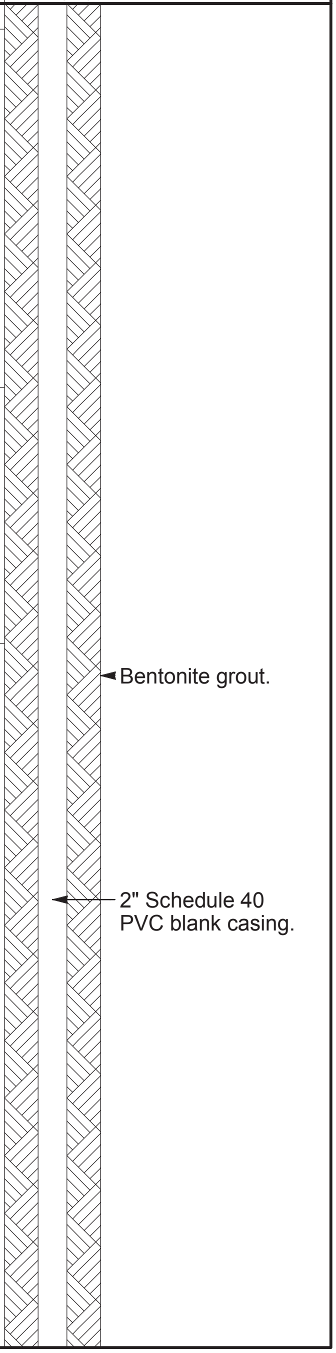
TETRA TECH, INC.

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/15/16 **COMPLETED** 7/29/16
GROUND ELEVATION 1759.76 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING ---
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 28.20 ft / Elev 1731.56 ft
LOGGED BY Joel Lagade **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0				0.4	Asphalt.	1759.4
					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	
5					Little cemented fragments.	
				6.0	Moderate to strong cementation 6' to 10'.	1753.8
10				10.0	(SM) Silty SAND with Gravel, brown (7.5YR 5/4), 17/63/20/<1, fine to coarse sand, fine gravel, hard, moist.	1749.8
15					Silty SAND with Gravel, brown (7.5YR 5/4), 15/63/22/0, fine to coarse sand, fine gravel, hard, moist.	
					Silty SAND with Gravel, white (7.5YR 8/1), 15/63/22/0, fine to coarse sand, fine gravel, hard, moist.	
20					SAND with Silt, strong brown (7.5YR 5/6), 10/80/10/0, fine sand, low plasticity, moist.	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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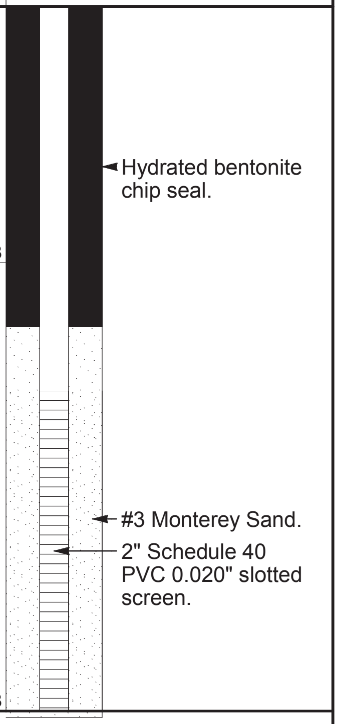
BORING NUMBER UFIW-06S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION	
						(SM) *(continued)*	
25					25.0		1734.8
						(SW-SM) SAND with Silt, brown (7.5YR 4/4), 10/80/10/<1, fine to medium sand, low plasticity (silt), well graded, moist.	
					▽		
30							
						SAND with Gravel and Silt, brown (7.5YR 5/3), 20/70/10/0, medium to coarse sand, very dense, hard (silt), wet, trace cemented nodules, increasing gravel and coarse sand with depth.	
					32.0		1727.8

Bottom of borehole at 32.0 feet.

WELL DIAGRAM



TETRA TECH

BORING NUMBER UFIW-06I

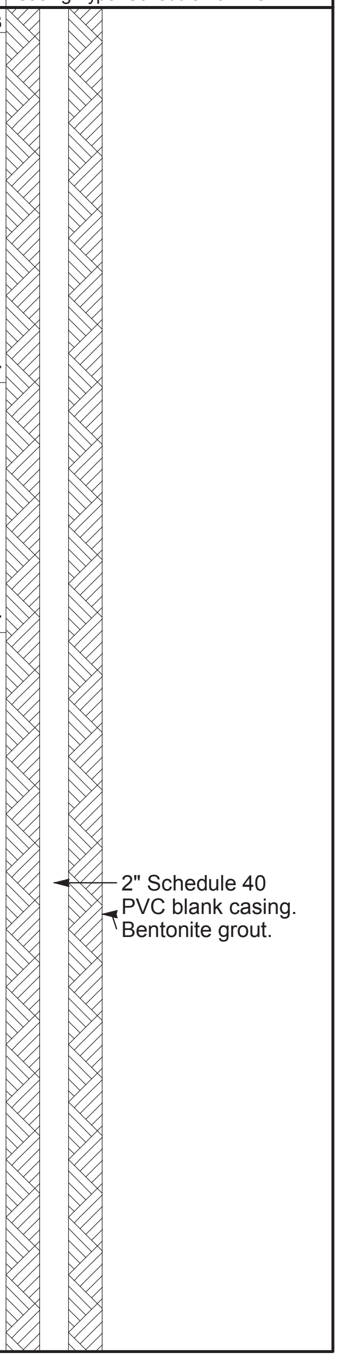
PAGE 1 OF 2

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/15/16 **COMPLETED** 8/1/16
GROUND ELEVATION 1759.71 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 30.00 ft / Elev 1729.71 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 28.17 ft / Elev 1731.54 ft
LOGGED BY Eric Peirce **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.4					Asphalt	1759.3
					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	
6.0						1753.7
					Moderate to strong cementation 6' to 10'.	
10.0						1749.7
					(SM) Silty SAND, light reddish brown (5YR 6/4), 10/70/20/0, fine to coarse sand, dense, moist, few fine to coarse gravel.	
					Silty SAND with Gravel, reddish brown (5YR 4/3), 25/60/15/0, fine to coarse sand, fine to large gravel, medium dense, moist.	
					Silty SAND, reddish brown (5YR 4/3), 5/80/15/0, fine to medium sand, medium dense, moist, little fine gravel.	
					Silty SAND, reddish brown (5YR 4/3), 10/75/15/0, fine to medium sand, medium dense, moist, little fine gravel.	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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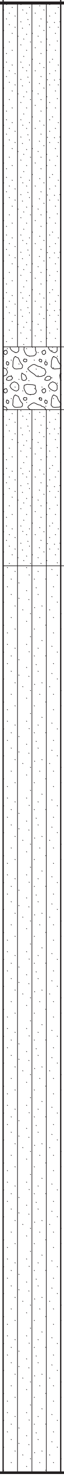
TETRA TECH

BORING NUMBER UFIW-06I

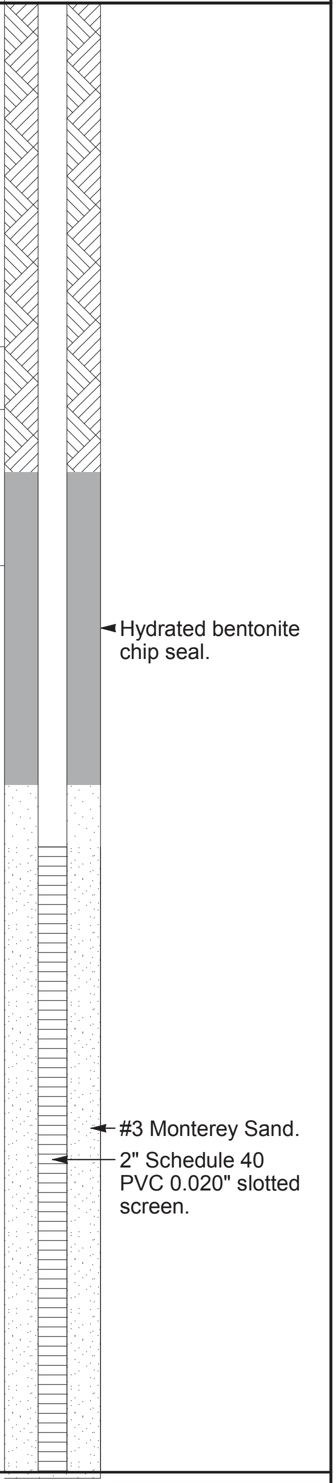
PAGE 2 OF 2

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV



DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
					(SM) *(continued)* Silty SAND with Gravel, reddish brown (5YR 5/3), 20/60/20/0, fine to coarse sand, fine to large gravel, dense, moist.	
25					Silty SAND with Gravel, reddish brown (5YR 5/3), 20/60/20/0, fine to coarse sand, fine to large gravel, dense, moist, trace large gravel. Gravelly SAND with Silt, reddish brown (5YR 5/3), 25/65/10/0, fine to coarse sand, fine to large gravel, medium dense to very dense, moist.	
				27.0	(GP) Sandy GRAVEL, dark reddish brown (5YR 3/3), 70/20/10/0, fine gravel, sub-angular, fine to coarse sand, moist, little silt.	1732.7
				28.0	(SM) Silty SAND with Gravel, reddish brown (5YR 3/3), 15/70/15/0, fine to coarse sand, fine to large gravel, moist, cemented nodules, wet at 30.5'.	1731.7
30				30.5	(ML) Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, low to no plasticity, fine sand, wet.	1729.2
35					Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, low to no plasticity, fine sand, wet.	
40					Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, low to no plasticity, fine sand, wet.	
45				45.0	Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, low to no plasticity, fine sand, wet. Bottom of borehole at 45.0 feet.	1714.7

WELL DIAGRAM



BORING NUMBER UFIW-06D

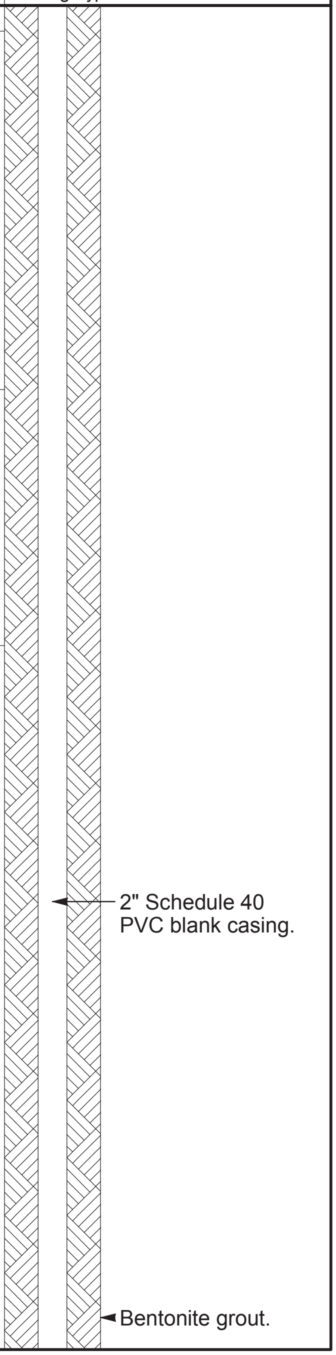
TETRA TECH, INC.

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/15/16 **COMPLETED** 7/29/16
GROUND ELEVATION 1759.85 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 30.00 ft / Elev 1729.85 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 28.38 ft / Elev 1731.47 ft
LOGGED BY Joel Lagade **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0				0.4	Asphalt.	1759.5
					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/<1, fine to medium sand, loose, moist, few fine gravel.	
5					Little cemented fragments.	
				6.0	Moderate to strong cementation 6' to 10'.	1753.9
10	MC	30-50		10.0	(SM) Silty SAND with Gravel, brown (7.5YR 5/4), 17/63/20/0, fine to coarse sand, fine gravel, hard, moist.	1749.9
	CC					
15	MC	18-20-25 (45)			Silty SAND with Gravel, brown (7.5YR 5/4), 15/63/22/0, fine to coarse sand, fine gravel, hard, moist.	
	CC				Silty SAND with Gravel, white (7.5YR 8/1), 15/63/22/0, fine to coarse sand, fine gravel, hard, moist.	
20	MC	12-18-24			SAND with Silt, strong brown (7.5YR 5/6), 10/80/10/0, fine sand, moist.	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



2" Schedule 40 PVC blank casing.

Bentonite grout.

(Continued Next Page)

TETRA TECH, INC.

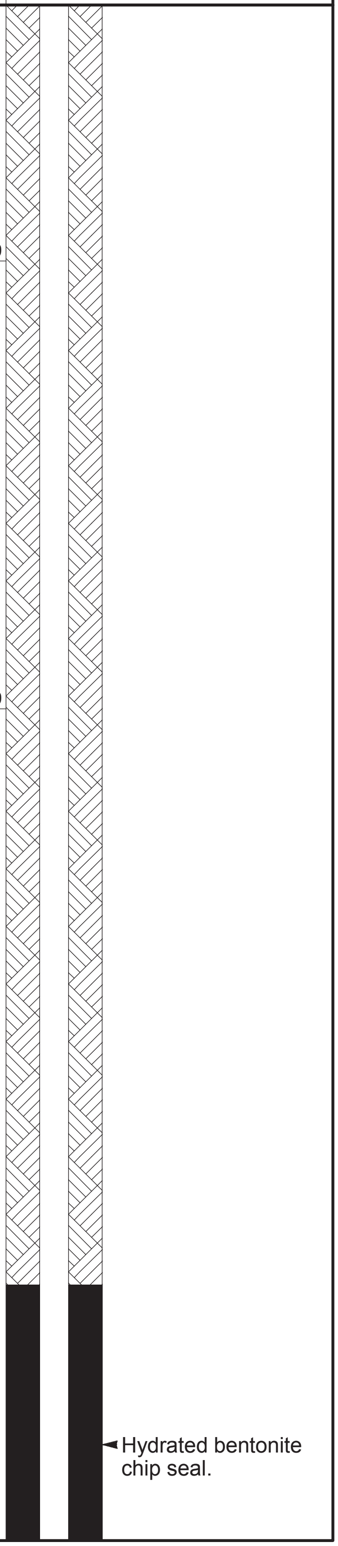
BORING NUMBER UFIW-06D

PAGE 2 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	DEPTH / ELEV.	MATERIAL DESCRIPTION
		(42)			(SM) *(continued)*
	CC				
25	MC	10-50		25.0 / 1734.9	(SW-SM) SAND with Silt, brown (7.5YR 4/4), 10/80/10/<1, fine to medium sand, low plasticity (silt), well graded, moist.
	CC			▼	
30	MC	49-50-10 (60)		▽	SAND with Gravel and Silt, brown (7.5YR 5/3), 20/70/10/0, medium to coarse sand, no plasticity (silt), very dense, hard (silt), wet, trace cemented nodules, increasing gravel and coarse sand with depth.
				32.0 / 1727.9	(ML)
	CC				
35	MC	4-8-16 (24)			Sandy SILT, reddish brown (7.5YR 6/6), 0/40/58/2, low plasticity, very fine sand, stiff, wet.
	CC				
40	MC	9-8-18 (26)			SILT with Sand, strong brown (7.5YR 5/6), 0/20/70/10, low plasticity, very fine sand, stiff, wet.
	CC				
45					

WELL DIAGRAM



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TETRA TECH, INC.

BORING NUMBER UFIW-06D

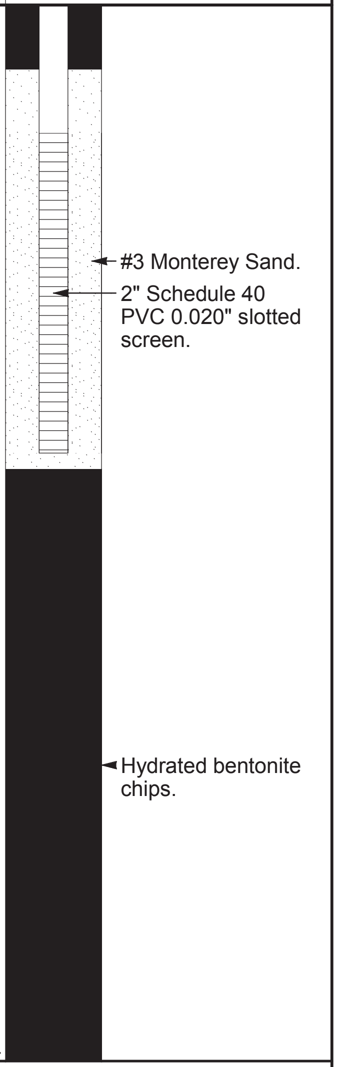
PAGE 3 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	3-5-7 (12)			(ML) *(continued)* SILT with Sand, strong brown (7.5YR 5/6), 0/15/73/12, low plasticity, very fine sand, medium stiff, wet, little clay.
	CC				
50	MC	3-5-7 (12)			SILT with Sand, strong brown (7.5YR 5/6), 0/15/70/15, low plasticity, very fine sand, medium stiff, wet, little clay.
	CC				
55	MC	5-7-11 (18)			SILT with Sand, strong brown (7.5YR 5/6), 0/15/70/15, low plasticity, very fine sand, medium stiff, wet, little clay, trace cemented nodules.
	CC				
60	MC	20-7-9 (16)		61.5	SILT with Sand, strong brown (7.5YR 5/6), 0/10/70/20, low plasticity, very fine sand, medium stiff, wet, little clay, trace cemented nodules. 1698.4

Bottom of borehole at 61.5 feet.

WELL DIAGRAM



TETRA TECH, INC.

BORING NUMBER UFIW-07S

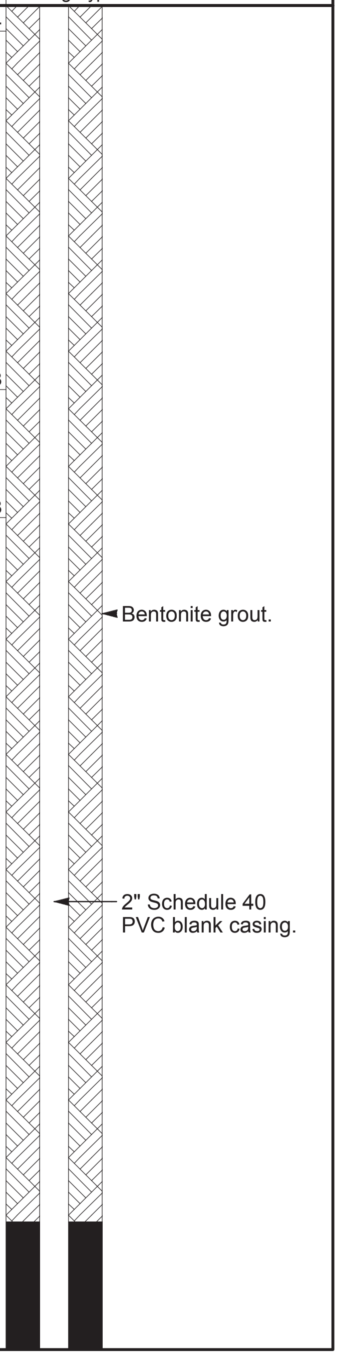
PAGE 1 OF 2

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/14/16 **COMPLETED** 8/1/16
GROUND ELEVATION 1759.76 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING ---
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 28.20 ft / Elev 1731.56 ft
LOGGED BY Eric Peirce **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION	
0					0.4	Asphalt	1759.4
						(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	
5						Little cemented fragments.	
					6.0	Moderate to strong cementation 6' to 8'.	1753.8
					8.0	(SM)	1751.8
10						Silty SAND with Gravel, reddish brown (5YR 5/3), 15/70/15/0, fine to coarse sand, fine gravel, dense, moist, little coarse gravel.	
15							
						Silty SAND, brown (7.5YR 5/4), 5/75/20/0, fine to medium sand, dense, moist.	
20							

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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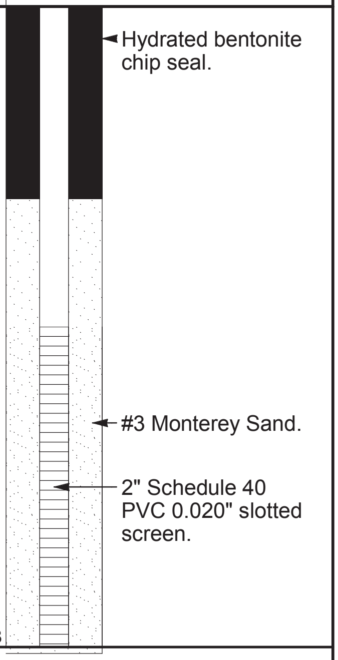
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
					(SM) *(continued)*	
25						
					▼ Silty SAND with Gravel, reddish brown (5YR 5/3), 15/65/20/0, fine to medium sand, fine gravel, dense, moist, little coarse gravel.	
30						
				31.0	1728.8	

Bottom of borehole at 31.0 feet.

TETRA TECH, INC.

BORING NUMBER UFIW-07I

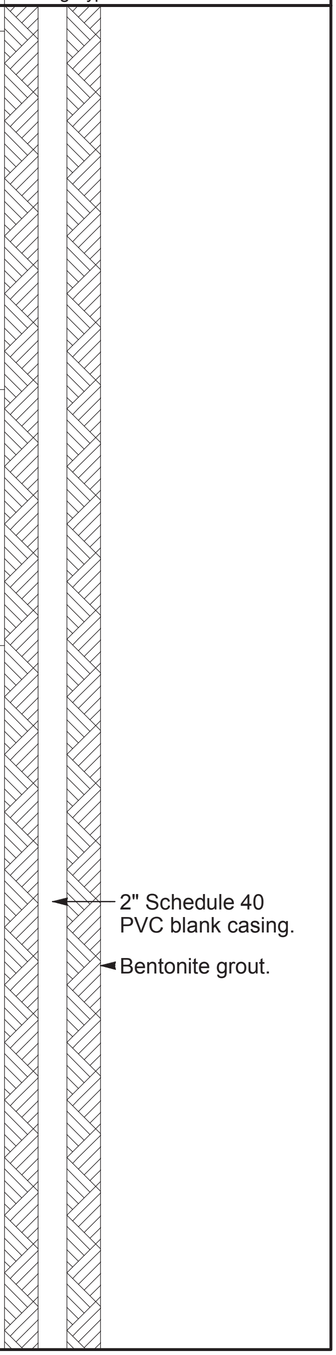
PAGE 1 OF 2

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/14/16 **COMPLETED** 8/5/16
GROUND ELEVATION 1759.63 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 30.00 ft / Elev 1729.63 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 28.10 ft / Elev 1731.53 ft
LOGGED BY Hao Zhang **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	Elev.
0				0.4	Asphalt	1759.2
					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	
5					Little cemented fragments.	
				6.0	Moderate to strong cementation 6' to 10'.	1753.6
10				10.0	(SM) Silty SAND with Gravel, reddish brown (5YR 5/3), 15/70/15/0, fine to medium sand, few coarse gravel, dense, moist.	1749.6
15						
20					Silty SAND with Gravel, reddish brown (5YR 5/3), 6/84/10/0, fine to coarse sand, fine gravel, moist.	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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ENVIRONMENTAL BH - GINT STD US.GDT - 11/10/17 12:49 - \\TTS318FS1\CES\PROJECTS\87600014-NERT-M12\WORKING\IN-SITU CR TREATABILITY TEST\FIELD PROGRAM\BORING LOGS\GINT\ALL M13 LOGS.GPJ

BORING NUMBER UFIW-07I

TETRA TECH, INC.

CLIENT Nevada Environmental Response Trust (NERT)

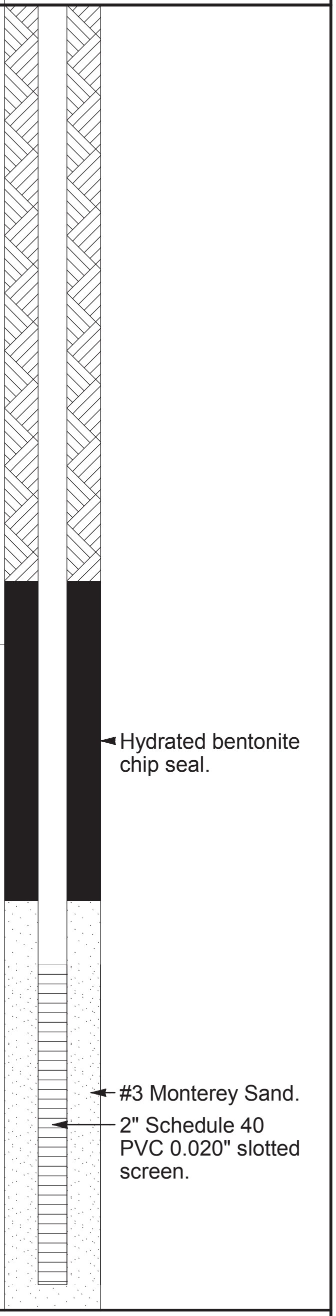
PROJECT NAME NERT - AP Area Treatability Study

PROJECT NUMBER 194-87600012-M13

PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION	
25 30					31.0	(SM) *(continued)* ▼ ▽ Silty SAND with Gravel, reddish brown (5YR 5/3), 6/84/10/0, fine to coarse sand, fine gravel, moist.	1728.6
35 40					41.4	(ML) Sandy SILT, strong brown (7.5YR 5/6), 0/20/80/0, no to low plasticity, fine sand, soft to stiff, wet. SILT with Sand, strong brown (7.5YR 5/6), 0/10/90/0, low plasticity, fine sand, soft to stiff, wet.	1718.2

WELL DIAGRAM



Bottom of borehole at 41.4 feet.

BORING NUMBER UFIW-07D

PAGE 1 OF 3

TETRA TECH, INC.

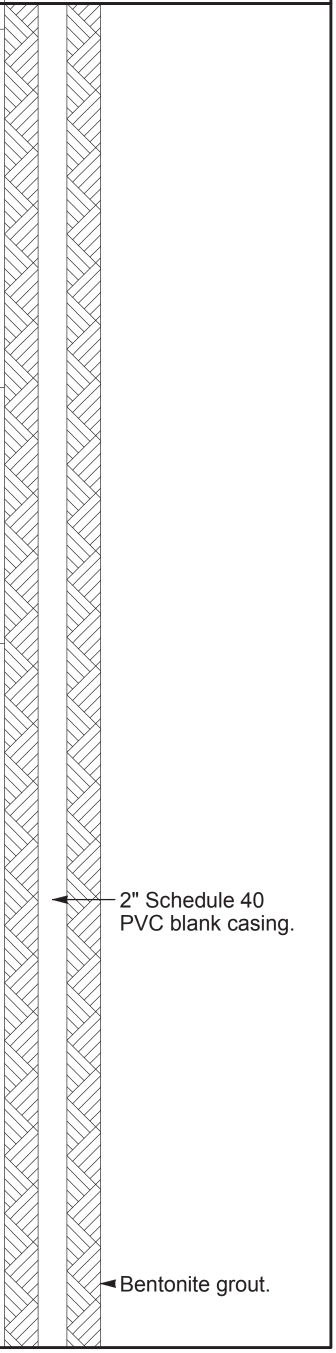
CLIENT Nevada Environmental Response Trust (NERT)	**PROJECT NAME** NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13	**PROJECT LOCATION** Henderson, NV
DATE STARTED 7/15/16 **COMPLETED** 7/27/16	**GROUND ELEVATION** 1759.79 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP	**WATER LEVEL AT TIME OF DRILLING** 30.00 ft / Elev 1729.79 ft
DRILLING METHOD Hollow Stem Auger	**WATER LEVEL AFTER DRILLING** 28.35 ft / Elev 1731.44 ft
LOGGED BY Daniel Keady **CHECKED BY** M. Crews	

NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0				0.4	Asphalt	1759.4
					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	
5					Little cemented fragments.	
				6.0	Moderate to strong cementation 6' to 10'.	1753.8
10	MC	8-30-50 (80)		10.0	(SM) Silty SAND with Gravel, reddish brown (5YR 5/3), 15/70/15/0, fine to medium sand, few coarse gravel, dense, moist.	1749.8
	CC					
15	MC	8-35-50 (85)			Silty SAND with Gravel, white (5YR 8/1), 15/70/15/0, fine to medium sand, dense, moist.	
	CC					
20	MC	27-30-33			Silty SAND, brown (7.5YR 5/4), 5/70/25/0, very fine sand, dense, moist.	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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TETRA TECH, INC.

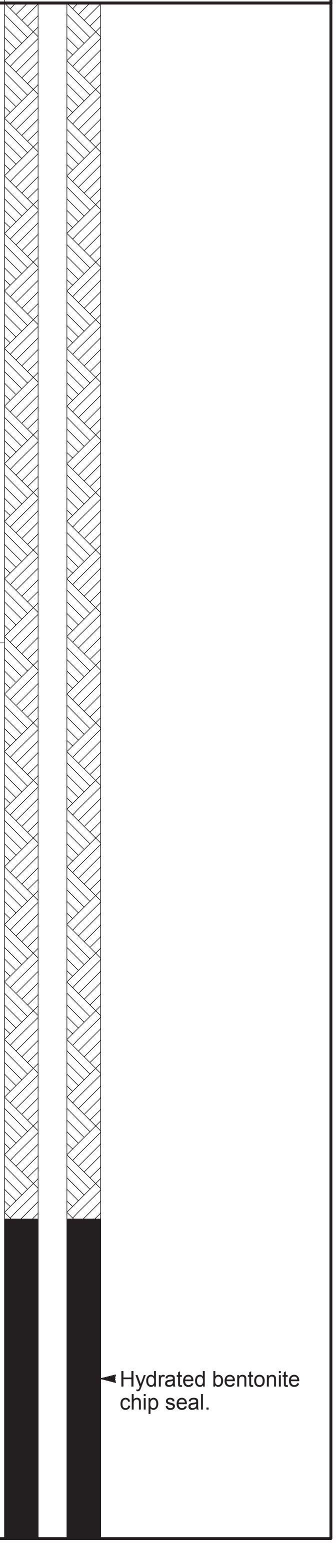
BORING NUMBER UFIW-07D

PAGE 2 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
		(63)			(SM) *(continued)*
	CC				Silty SAND, brown (7.5YR 4/4), 5/70/25/0, fine sand, dense, moist.
25	NR				Silty SAND, brown (7.5YR 4/4), 5/75/20/0, fine sand, dense, moist.
	CC				▼
30	MC	12-14-16 (30)			▽ Silty SAND, strong brown (7.5YR 5/6), 5/75/20/0, fine sand, medium dense, wet.
				31.0	1728.8
	CC				(ML) SILT with Sand, strong brown (7.5YR 5/6), 0/20/70/10, low to medium plasticity, fine sand, soft to stiff, wet.
35	MC	4-7-9 (16)			SILT with Sand, strong brown (7.5YR 5/6), 0/20/70/10, low to medium plasticity, fine sand, medium stiff, wet.
	CC				
40	MC	3-12-27 (39)			SILT with Sand, strong brown (7.5YR 5/6), 0/15/83/2, low to medium plasticity, fine sand, medium stiff, wet.
	CC				
45					

WELL DIAGRAM


Hydrated bentonite chip seal.

(Continued Next Page)

BORING NUMBER UFIW-07D

CLIENT Nevada Environmental Response Trust (NERT)

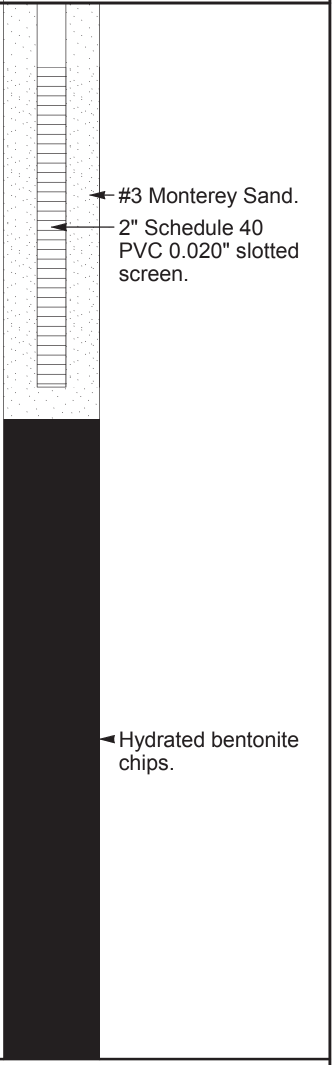
PROJECT NAME NERT - AP Area Treatability Study

PROJECT NUMBER 194-87600012-M13

PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	3-9-12 (21)			(ML) *(continued)* SILT with Sand, strong brown (7.5YR 5/6), 0/15/83/2, low to medium plasticity, fine sand, stiff, wet.
	CC				
50	MC	4-5-7 (12)			SILT with Sand, strong brown (7.5YR 5/6), 0/20/70/10, low plasticity, fine sand, medium stiff, moist to wet, trace cemented nodules.
	CC				
55	MC	3-4-7 (11)			SILT with Sand, strong brown (7.5YR 5/6), 0/20/70/10, very low plasticity, fine sand, medium stiff to stiff, moist.
	CC				
60	MC	5-5-7 (12)		61.5	SILT with Sand, brown (7.5YR 5/4), 0/20/70/10, very low plasticity, fine sand, medium stiff to stiff, moist, trace cemented nodules. 1698.3

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

BORING NUMBER UFIW-08S

PAGE 1 OF 2

CLIENT Nevada Environmental Response Trust (NERT)

PROJECT NAME NERT - AP Area Treatability Study

PROJECT NUMBER 194-87600012-M13

PROJECT LOCATION Henderson, NV

DATE STARTED 7/14/16 **COMPLETED** 7/28/16

GROUND ELEVATION 1759.6 ft **HOLE SIZE** 8 in

DRILLING CONTRACTOR National EWP

WATER LEVEL AT TIME OF DRILLING ---

DRILLING METHOD Hollow Stem Auger

WATER LEVEL AFTER DRILLING 28.02 ft / Elev 1731.58 ft

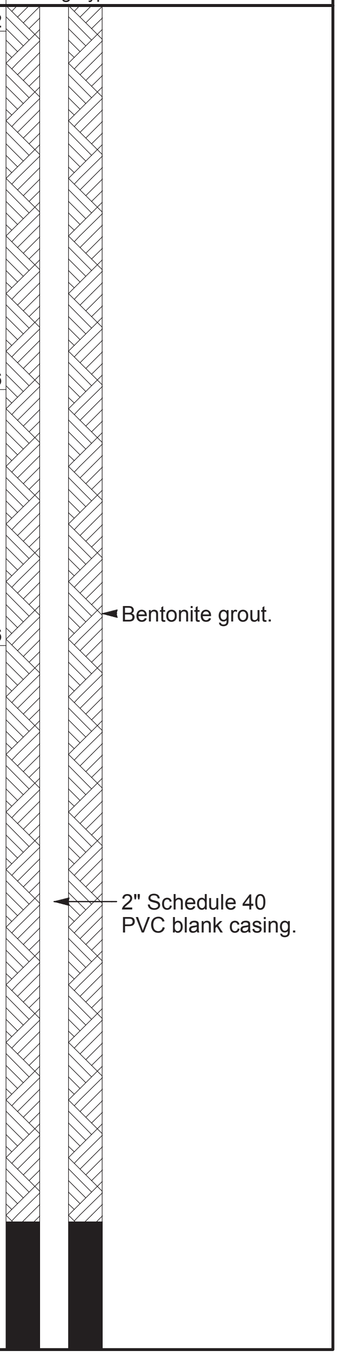
LOGGED BY Daniel Keady **CHECKED BY** M. Crews

NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0					Asphalt	
0.4					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	1759.2
6.0					Moderate to strong cementation 6' to 10'.	1753.6
10.0					(SM) Silty SAND with Gravel, brown (7.5YR 5/4), 15/70/15/0, fine to medium sand, loose, fine to coarse gravel, moist, decreasing gravel content.	1749.6
15					Silty SAND, brown (7.5YR 4/3), 10/70/20/0, fine to medium sand, loose, moist, few fine gravel, trace cobbles.	
20					Silty SAND, brown (7.5YR 4/3), 10/70/20/0, fine to medium sand, loose, moist, few fine gravel, trace cobbles.	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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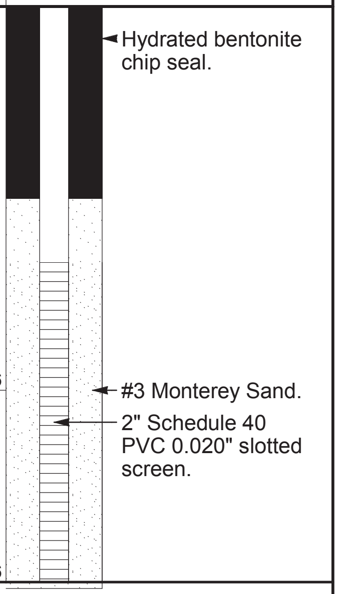
TETRA TECH, INC.

BORING NUMBER UFIW-08S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
25					(SM) *(continued)*		Hydrated bentonite chip seal.
				27.0	(SW-SM) SAND with Silt, brown (7.5YR 5/3), 10/77/10/3, fine to coarse sand, well graded, very dense, moist, some cemented nodules.	1732.6	#3 Monterey Sand. 2" Schedule 40 PVC 0.020" slotted screen.
30				30.0		1729.6	

Bottom of borehole at 30.0 feet.



ENVIRONMENTAL BH - GINT STD US.GDT - 11/10/17 12:49 - \\TTS318FS1\CES\PROJECTS\87600014-NERT-M12\WORKING\IN-SITU CR TREATABILITY TEST\FIELD PROGRAM\BORING LOGS\GINT\ALL M13 LOGS.GPJ

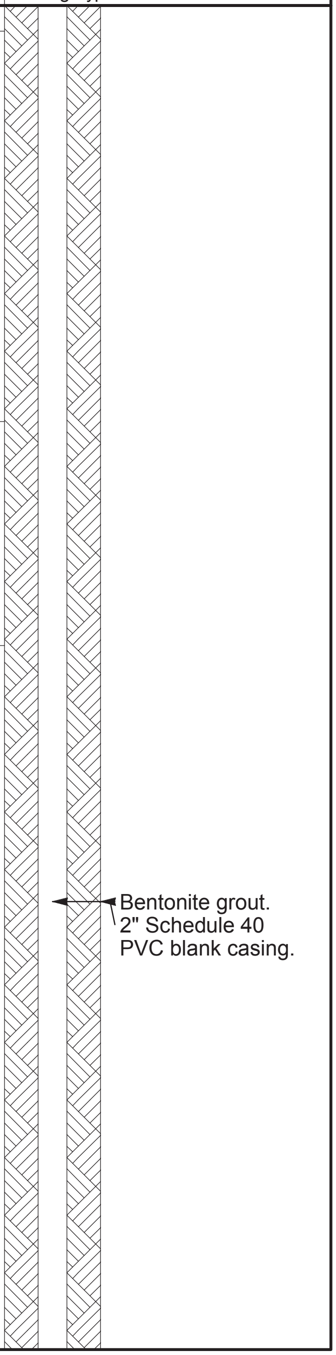
BORING NUMBER UFIW-08I

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/14/16 **COMPLETED** 8/3/16
GROUND ELEVATION 1759.61 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 34.00 ft / Elev 1725.61 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.96 ft / Elev 1731.65 ft
LOGGED BY Jon Coen **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0				0.4	Asphalt	1759.2
					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	
5				6.5	Moderate to strong cementation 6.5' to 10'.	1753.1
10				10.0	(SM) Silty SAND with Gravel, brown (7.5YR 5/4), fine to medium sand, loose, moist, some cobbles.	1749.6
15						
20					Silty SAND with Gravel, brown (7.5YR 5/4), fine to medium sand, loose, moist, some cobbles.	

WELL DIAGRAM

Casing Type: Schedule 40 PVC

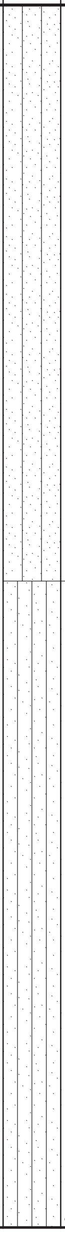
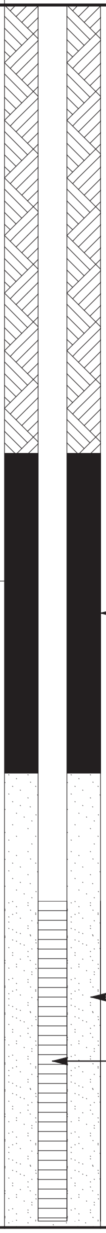


Bentonite grout.
2" Schedule 40 PVC blank casing.

(Continued Next Page)

BORING NUMBER UFIW-08I

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
					(SM) *(continued)*	
25						
30				30.0	1729.6 (ML) SILT with Sand, strong brown (10YR 5/4), 0/20/75/5, low to medium plasticity, fine to medium sand, soft to medium stiff, moist.	Hydrated bentonite chip seal.
35					SILT with Sand, strong brown (7.5YR 5/6), 0/20/75/5, low to medium plasticity, fine sand, soft to medium stiff, wet.	#3 Monterey Sand. 2" Schedule 40 PVC 0.020" slotted screen.
40				40.1	1719.5 SILT with Sand, strong brown (7.5YR 5/6), 0/20/75/5, low to medium plasticity, fine sand, soft to very stiff, wet.	

Bottom of borehole at 40.1 feet.

TETRA TECH, INC.

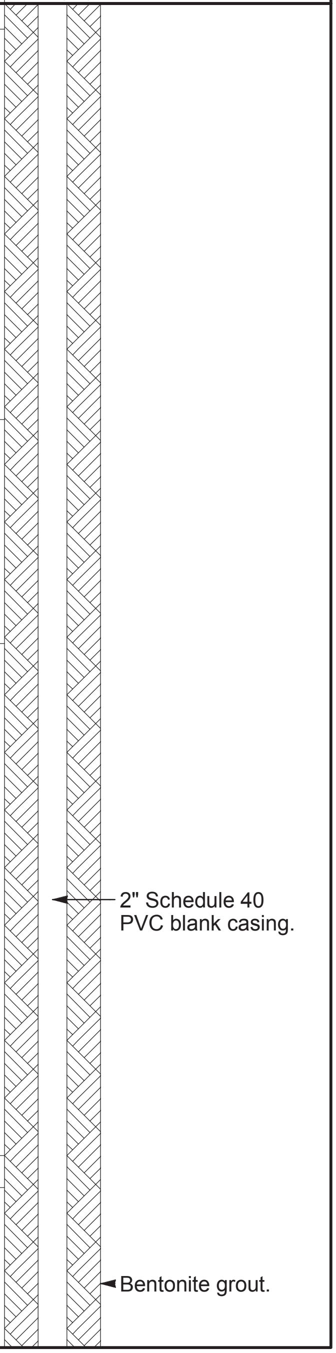
BORING NUMBER UFIW-08D

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/14/16 **COMPLETED** 7/28/16
GROUND ELEVATION 1759.77 ft **HOLE SIZE** 8 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 34.00 ft / Elev 1725.77 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 28.14 ft / Elev 1731.63 ft
LOGGED BY Daniel Keady **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic-rated well box.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0				0.4	Asphalt	1759.4
					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	
5					Cemented fragments.	
				6.5	Moderate to strong cementation 6.5' to 10'.	1753.3
10				10.0		1749.8
	MC	14-22-27 (49)			(SM) Silty SAND with Gravel, brown (7.5YR 5/4), 15/70/15/0, fine to medium sand, loose, fine to coarse gravel, moist, decreasing gravel content.	
	CC					
15	MC	10-45-50 (95)			Silty SAND, brown (7.5YR 4/3), 10/70/20/0, fine to medium sand, loose, moist, few fine gravel, trace cobbles.	
	CC			18.0	(SP) SAND, pink (5YR 8/3), 10/80/10/0, fine to medium sand, loose, moist, few fine gravel.	1741.8
				18.5	(SM)	1741.3
20	MC	10-17-35			Silty SAND, brown (7.5YR 4/3), 10/70/20/0, fine to medium sand, loose, moist, few fine gravel, trace cobbles.	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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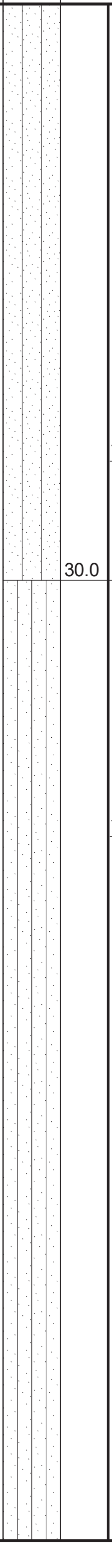
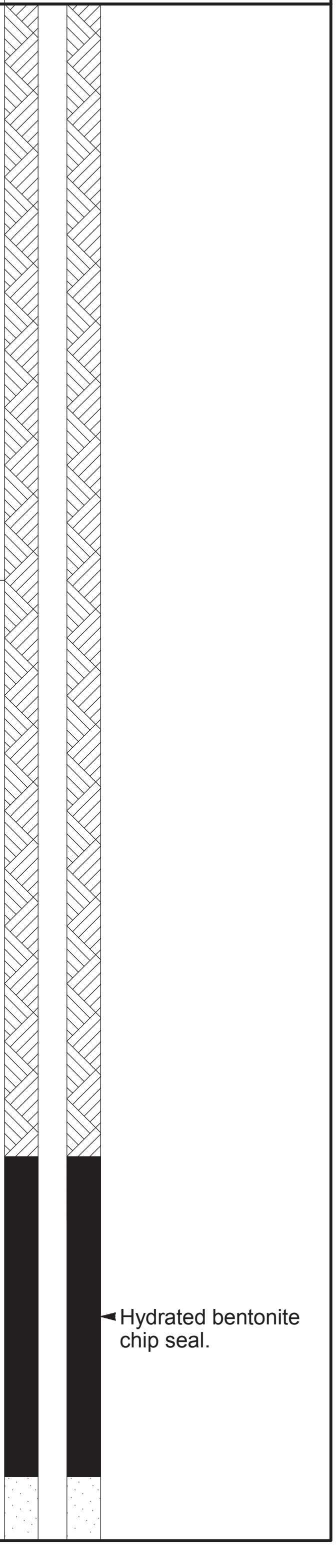
BORING NUMBER UFIW-08D

TETRA TECH, INC.

CLIENT Nevada Environmental Response Trust (NERT) **PROJECT NAME** NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13 **PROJECT LOCATION** Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	MATERIAL DESCRIPTION	WELL DIAGRAM
	MC	(52)		(SM) *(continued)*	
	CC				
25	MC	48-50		Silty SAND, brown (7.5YR 4/3), 10/70/20/0, fine to medium sand, loose, moist, few fine gravel, trace cobbles.	
	CC			▼	
30	MC	13-16-19 (35)		30.0 (ML) SILT with Sand, strong brown (7.5YR 5/6), 0/20/75/5, low to medium plasticity, fine sand, soft to medium stiff, moist.	1729.8
	CC			▽	
35	MC	4-2-7 (9)		SILT with Sand, strong brown (7.5YR 5/6), 0/20/75/5, low to medium plasticity, fine sand, soft to medium stiff, wet.	
	CC				
40	MC	4-8-12 (20)		SILT with Sand, strong brown (7.5YR 5/6), 0/20/75/5, low to medium plasticity, fine sand, soft to very stiff, wet.	◄Hydrated bentonite chip seal.
	CC				
45					





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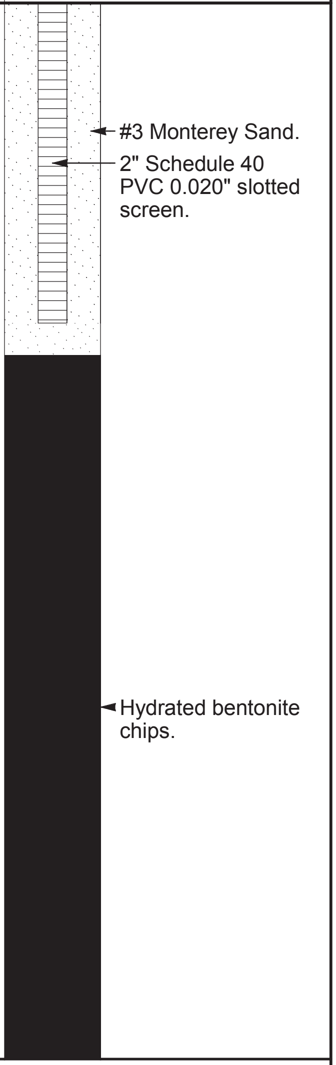
TETRA TECH, INC.

BORING NUMBER UFIW-08D

PAGE 3 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
45	MC	3-3-12 (15)			(ML) *(continued)* SILT with Sand, strong brown (7.5YR 5/6), 0/20/75/5, low to medium plasticity, fine sand, soft to very stiff, wet, cemented nodules.	
	CC					
50	MC	4-4-8 (12)			SILT, brown (7.5YR 5/4), 1/5/86/8, low to medium plasticity, medium stiff to stiff, wet, trace fine sand and gravel, cemented nodules.	
	CC					
55	MC	5-7-9 (16)			SILT, brown (7.5YR 5/4), 1/3/86/10, low to medium plasticity, medium stiff to stiff, wet, trace fine sand and gravel, trace cemented nodules.	
	CC					
60	MC	3-4-5 (9)		61.5	SILT, brown (7.5YR 5/4), 1/3/86/10, low to medium plasticity, medium stiff to stiff, wet, trace fine sand and gravel, trace cemented nodules. 1698.3	



Bottom of borehole at 61.5 feet.

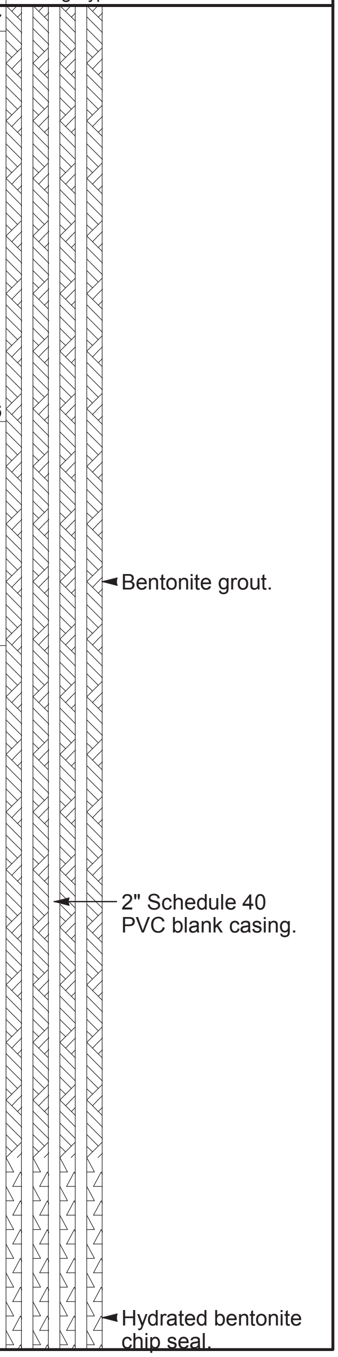
TETRA TECH, INC.

BORING NUMBER UFMW-01S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/14/16 **COMPLETED** 7/22/16
GROUND ELEVATION 1755.07 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 33.00 ft / Elev 1722.07 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.90 ft / Elev 1727.17 ft
LOGGED BY Daniel Keady **CHECKED BY** M. Crews
NOTES Well completed with a 24" x 24" traffic-rated well vault. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0				0.4	Asphalt	1754.7
					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	
5						
				6.5	Moderate to strong cementation 6.5' to 10'.	1748.6
10	MC	14-30-50 (80)		10.0	(SM) Silty SAND, reddish brown (5YR 6/4), 10/60/30/0, fine to coarse sand, fine gravel, dense, moist, cemented nodules.	1745.1
	CC					
15	MC	10-11-12 (23)			Silty SAND, reddish brown (5YR 5/4), 10/60/30/0, fine to coarse sand, fine gravel, medium dense to dense, moist.	
	CC					
20	MC	20-20-30			Silty SAND, reddish brown (5YR 5/4), 10/60/30/0, fine to coarse sand, fine gravel, medium dense to dense, moist.	

Casing Type: Schedule 40 PVC



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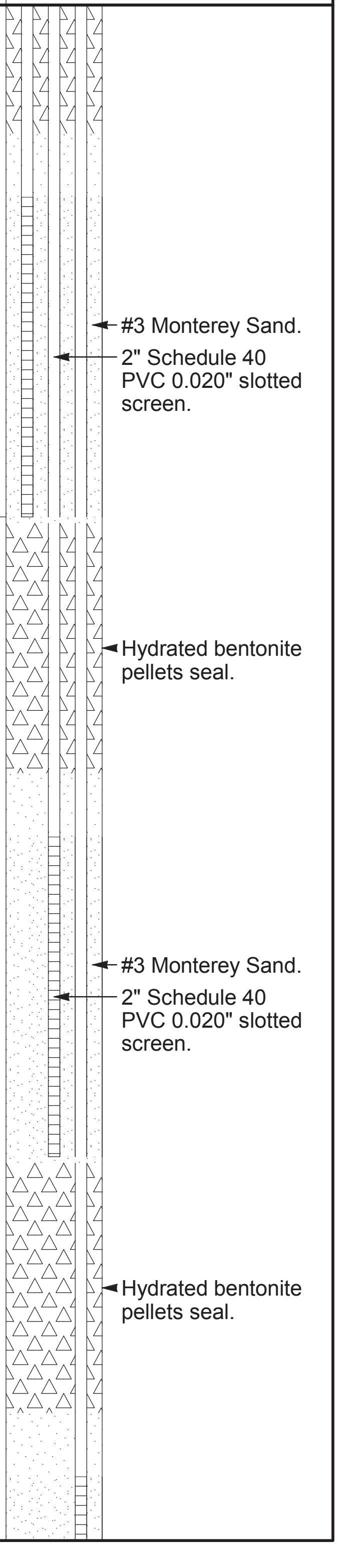
TETRA TECH, INC.

BORING NUMBER UFMW-01S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
		(50)			(SM) *(continued)* Silty SAND, white (10YR 8/1), 0/80/20/0, fine sand, no plasticity, medium dense, moist.
	CC				
25	MC	50-50-50 (100)			Silty SAND, reddish brown (5YR 5/4), 10/70/20/0, fine to coarse sand, fine gravel, medium dense to dense, moist.
	CC				▼
29.0					1726.1
					(ML)
30	MC	3-5-4 (9)			Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist.
	CC				▽
35	MC	4-7-9 (16)			Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist.
	CC				
40	MC	4-5-7 (12)			Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist.
	CC				
45					

WELL DIAGRAM



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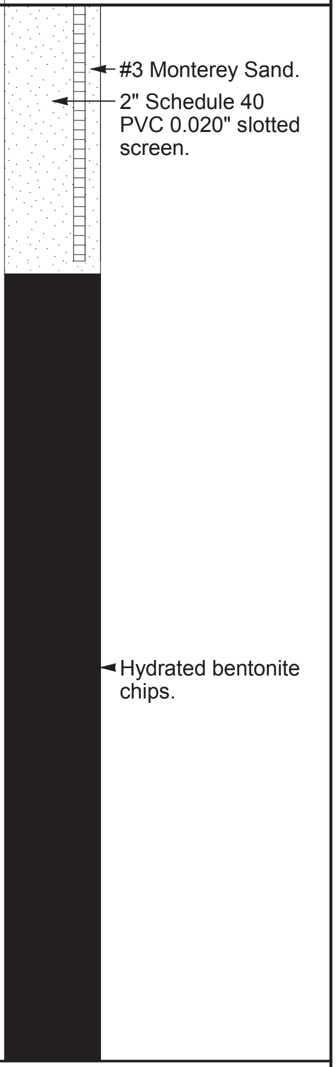
TETRA TECH, INC.

BORING NUMBER UFMW-01S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	4-7-8 (15)			(ML) *(continued)* Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist.
	CC				
50	MC	4-6-8 (14)			Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist.
	CC				
55	MC	5-5-7 (12)			Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist.
	CC				
60	MC	6-6-6 (12)			Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist.
				61.5	1693.6

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

BORING NUMBER UFMW-01I

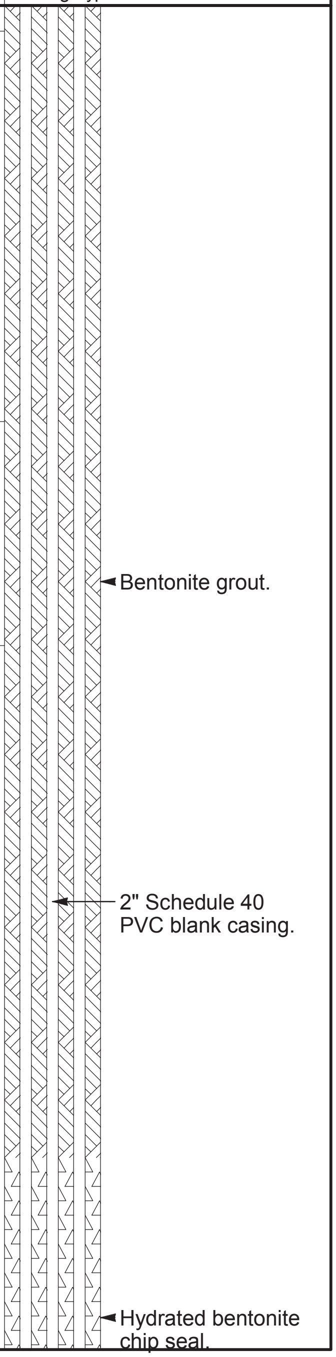
TETRA TECH, INC.

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/14/16 **COMPLETED** 7/22/16
GROUND ELEVATION 1755.03 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 33.00 ft / Elev 1722.03 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.79 ft / Elev 1727.24 ft
LOGGED BY Daniel Keady **CHECKED BY** M. Crews
NOTES Well completed with a 24" x 24" traffic-rated well vault. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0				0.4	Asphalt	1754.6
					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	
5						
				6.5	Moderate to strong cementation 6.5' to 10'.	1748.5
10				10.0	(SM) Silty SAND, reddish brown (5YR 6/4), 10/60/30/0, fine to coarse sand, fine gravel, dense, moist, cemented nodules.	1745.0
	MC	14-30-50 (80)				
	CC					
15	MC	10-11-12 (23)			Silty SAND, reddish brown (5YR 5/4), 10/60/30/0, fine to coarse sand, fine gravel, medium dense to dense, moist.	
	CC					
20	MC	20-20-30			Silty SAND, reddish brown (5YR 5/4), 10/60/30/0, fine to coarse sand, fine gravel, medium dense to dense, moist.	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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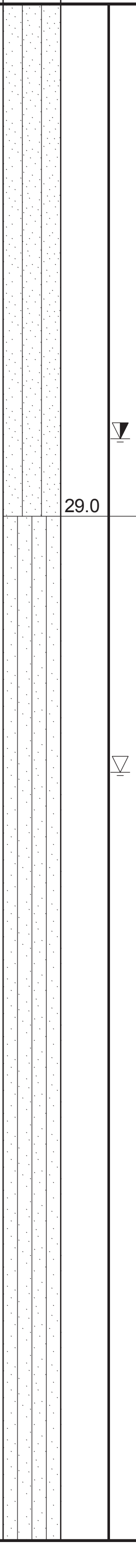
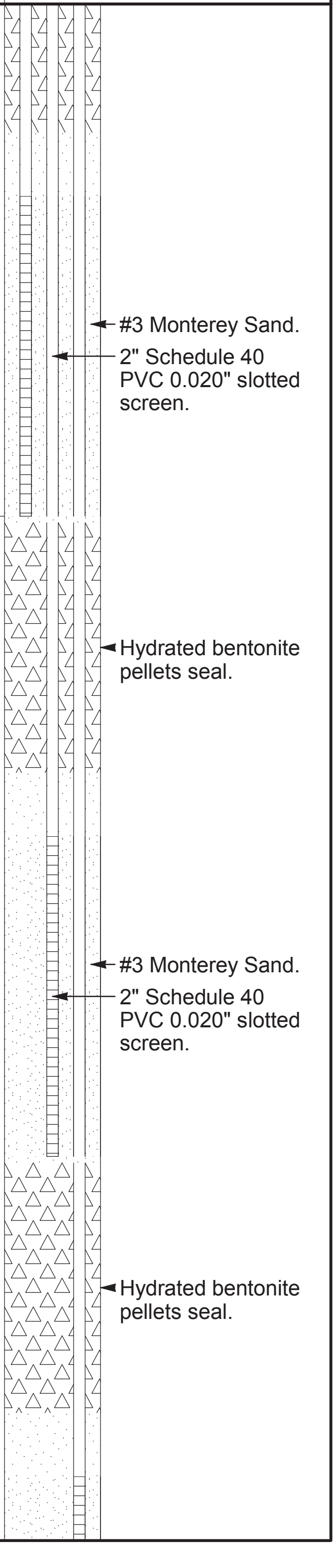
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
		(50)			(SM) *(continued)* Silty SAND, white (10YR 8/1), 0/80/20/0, fine sand, no plasticity, medium dense, moist.
	CC				
25	MC	50-50-50 (100)			Silty SAND, reddish brown (5YR 5/4), 10/70/20/0, fine to coarse sand, fine gravel, medium dense to dense, moist.
	CC			29.0	1726.0
30	MC	3-5-4 (9)			(ML) Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist.
	CC				
35	MC	4-7-9 (16)			Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist.
	CC				
40	MC	4-5-7 (12)			Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist.
	CC				
45					



WELL DIAGRAM



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TETRA TECH, INC.

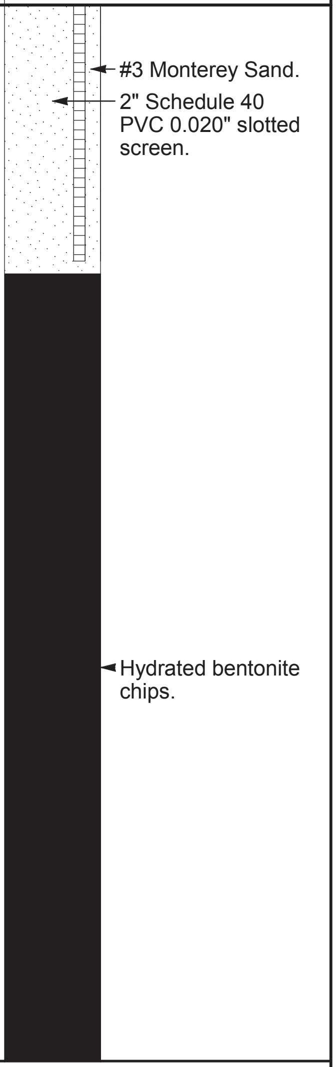
BORING NUMBER UFMW-01I

PAGE 3 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	4-7-8 (15)			(ML) *(continued)* Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist.
	CC				
50	MC	4-6-8 (14)			Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist.
	CC				
55	MC	5-5-7 (12)			Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist.
	CC				
60	MC	6-6-6 (12)			Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist.
61.5					1693.5

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

BORING NUMBER UFMW-01D

PAGE 1 OF 3

CLIENT Nevada Environmental Response Trust (NERT)

PROJECT NAME NERT - AP Area Treatability Study

PROJECT NUMBER 194-87600012-M13

PROJECT LOCATION Henderson, NV

DATE STARTED 7/14/16 **COMPLETED** 7/22/16

GROUND ELEVATION 1755.12 ft **HOLE SIZE** 12 in

DRILLING CONTRACTOR National EWP

WATER LEVEL AT TIME OF DRILLING 33.00 ft / Elev 1722.12 ft

DRILLING METHOD Hollow Stem Auger

WATER LEVEL AFTER DRILLING 27.89 ft / Elev 1727.23 ft

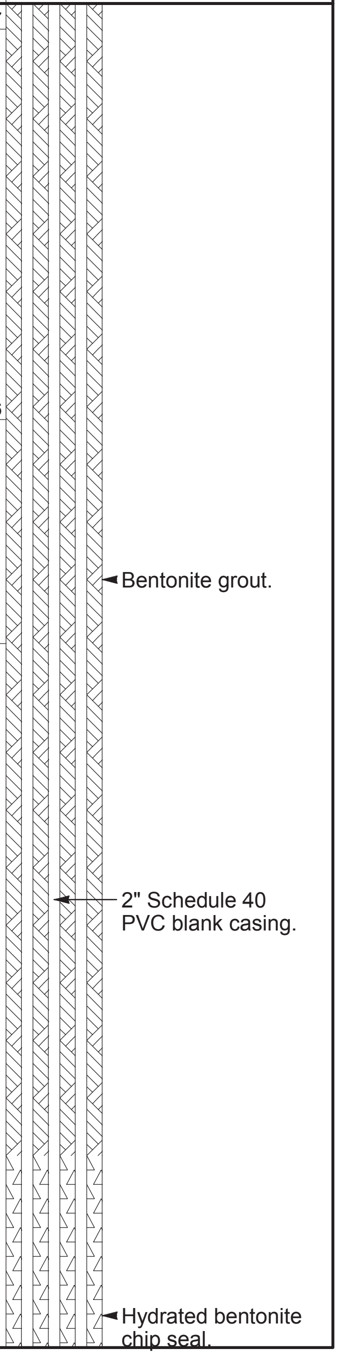
LOGGED BY Daniel Keady **CHECKED BY** M. Crews

NOTES Well completed with a 24" x 24" traffic-rated well vault. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0				0.4	Asphalt	1754.7
					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	
5				6.5		1748.6
					Moderate to strong cementation 6.5' to 10'.	
10				10.0		1745.1
	MC	14-30-50 (80)			(SM) Silty SAND, reddish brown (5YR 6/4), 10/60/30/0, fine to coarse sand, fine gravel, dense, moist, cemented nodules.	
	CC					
15	MC	10-11-12 (23)			Silty SAND, reddish brown (5YR 5/4), 10/60/30/0, fine to coarse sand, fine gravel, medium dense to dense, moist.	
	CC					
20	MC	20-20-30			Silty SAND, reddish brown (5YR 5/4), 10/60/30/0, fine to coarse sand, fine gravel, medium dense to dense, moist.	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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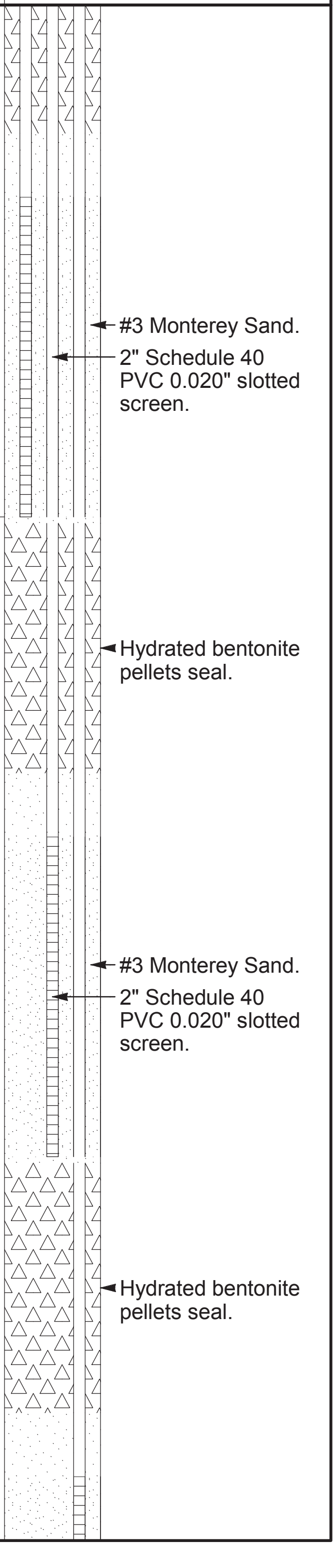
BORING NUMBER UFMW-01D

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
		(50)			(SM) *(continued)* Silty SAND, white (10YR 8/1), 0/80/20/0, fine sand, no plasticity, medium dense, moist.
	CC				
25	MC	50-50-50 (100)			Silty SAND, reddish brown (5YR 5/4), 10/70/20/0, fine to coarse sand, fine gravel, medium dense to dense, moist.
	CC				▼ 29.0 1726.1
30	MC	3-5-4 (9)			(ML) Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist.
	CC				▽
35	MC	4-7-9 (16)			Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist.
	CC				
40	MC	4-5-7 (12)			Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist.
	CC				
45					

WELL DIAGRAM



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BORING NUMBER UFMW-01D

PAGE 3 OF 3

CLIENT Nevada Environmental Response Trust (NERT)

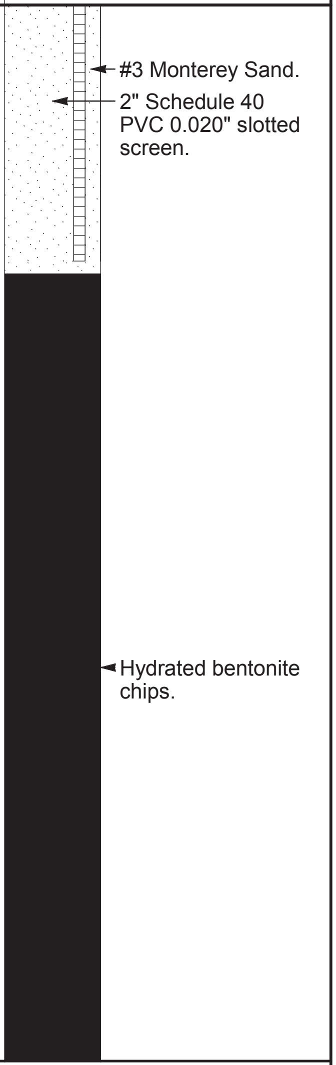
PROJECT NAME NERT - AP Area Treatability Study

PROJECT NUMBER 194-87600012-M13

PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	4-7-8 (15)			(ML) *(continued)* Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist.
	CC				
50	MC	4-6-8 (14)			Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist.
	CC				
55	MC	5-5-7 (12)			Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist.
	CC				
60	MC	6-6-6 (12)		61.5	Sandy SILT, strong brown (7.5YR 5/4), 0/20/80/0, no to low plasticity, fine sand, medium stiff, moist. 1693.6

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

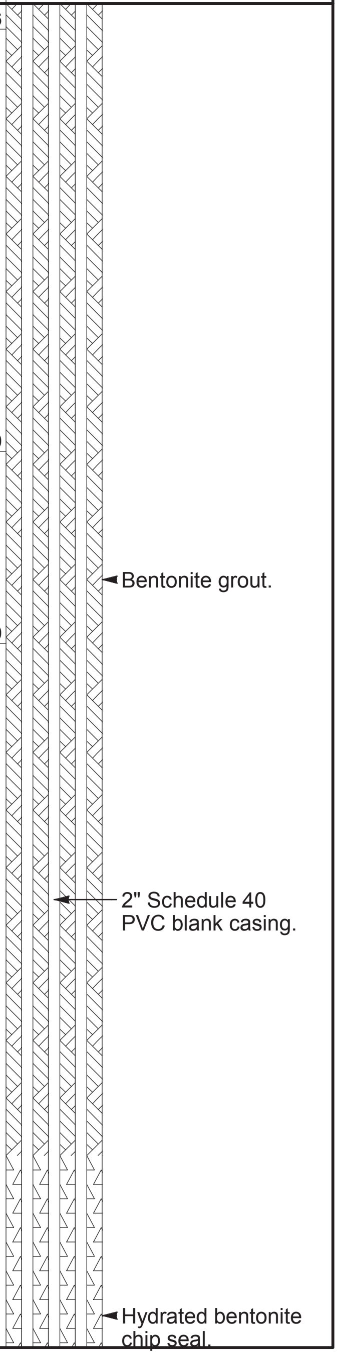
BORING NUMBER UFMW-02S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/14/16 **COMPLETED** 7/25/16
GROUND ELEVATION 1755.02 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 33.00 ft / Elev 1722.02 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.59 ft / Elev 1727.43 ft
LOGGED BY Daniel Keady **CHECKED BY** M. Crews
NOTES Well completed with a 24" x 24" traffic-rated well vault. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0				0.4	Asphalt.	1754.6
					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	
5					Cemented fragments.	
				7.0	Moderate to strong cementation 7' to 10'.	1748.0
10				10.0	(SM) Silty SAND, yellowish red (5YR 5/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	1745.0
	MC	10-15-16 (31)				
	CC					
15	MC	13-27-30 (57)			Silty SAND, yellowish red (5YR 5/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	
	CC					
20	MC	20-50-50			Silty SAND, yellowish red (5YR 5/6), 0/80/20/0, fine to medium sand, loose, moist.	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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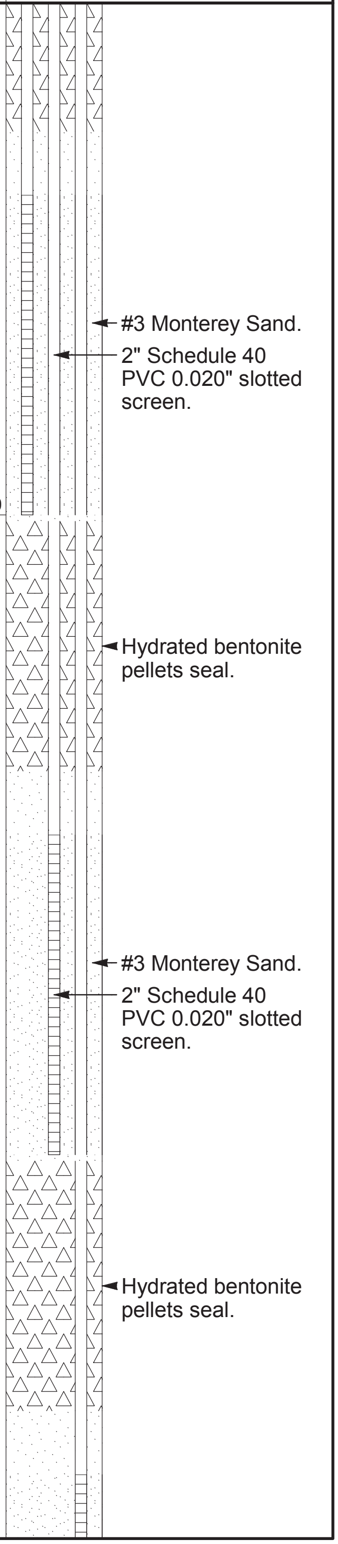
TETRA TECH, INC.

BORING NUMBER UFMW-02S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	MATERIAL DESCRIPTION
		(100)		(SM) *(continued)*
	CC			
25	MC	50-50		Silty SAND, yellowish red (5YR 5/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.
	CC			▼
29.0				1726.0
				(ML)
30	MC	4-7-9 (16)		Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, no to low plasticity, fine sand, medium stiff to stiff, moist.
	CC			▽
35	MC	10-10-12 (22)		Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/<1, no to low plasticity, fine sand, stiff, wet, trace clay.
	CC			
40	MC	3-5-6 (11)		Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/<1, no to low plasticity, fine sand, medium stiff to stiff, wet, trace clay, cemented nodules.
	CC			
45				

WELL DIAGRAM



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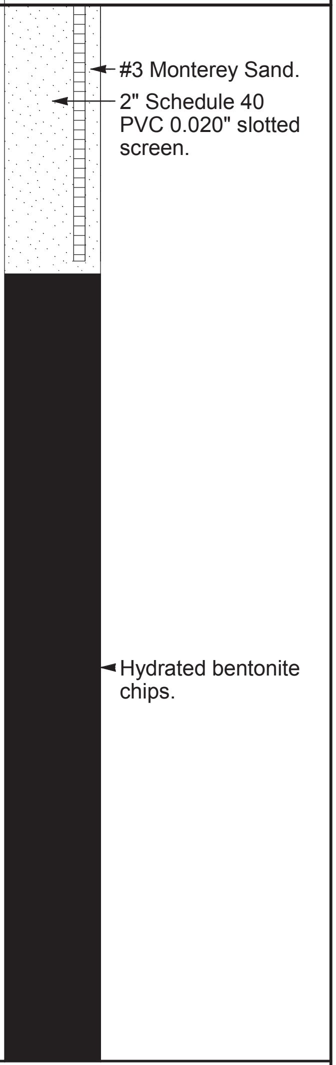
CLIENT Nevada Environmental Response Trust (NERT) **PROJECT NAME** NERT - AP Area Treatability Study

PROJECT NUMBER 194-87600012-M13 **PROJECT LOCATION** Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	4-6-8 (14)			(ML) *(continued)* Sandy SILT, brown (7.5YR 5/4), 0/15/85/<1 no to low plasticity, fine sand, medium stiff to stiff, wet, trace clay.
	CC				
50	MC	2-5-7 (12)			Sandy SILT, brown (7.5YR 5/4), 0/15/85/<1, no to low plasticity, fine sand, medium stiff to stiff, wet, trace clay, cemented nodules.
	CC				
55	MC				Sandy SILT, brown (7.5YR 5/4), 0/15/85/<1, no to low plasticity, fine sand, medium stiff to stiff, wet, trace clay, cemented nodules.
	CC				
60	MC	4-4-8 (12)			Sandy SILT, brown (7.5YR 5/4), 0/15/85/<1, no to low plasticity, fine sand, medium stiff to stiff, wet, trace clay, cemented nodules.
				61.5	1693.5

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

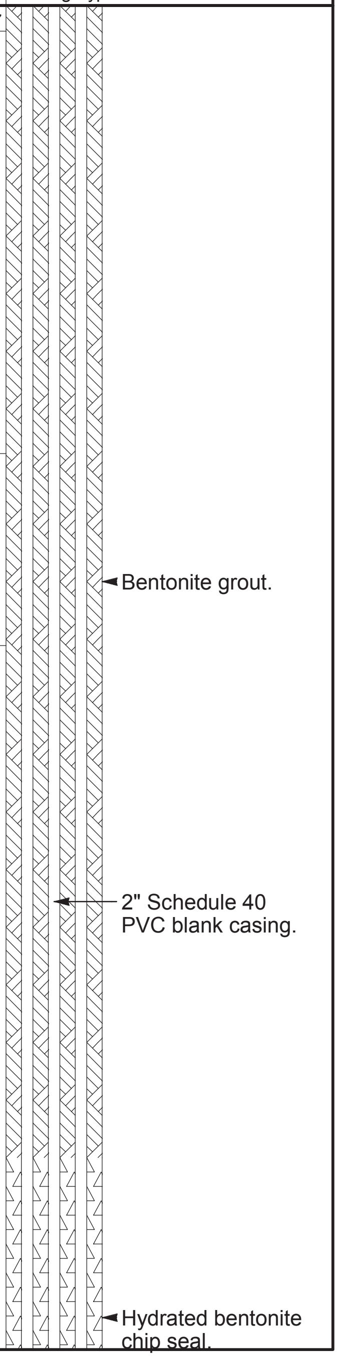
BORING NUMBER UFMW-02I

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/14/16 **COMPLETED** 7/25/16
GROUND ELEVATION 1755.05 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 33.00 ft / Elev 1722.05 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.68 ft / Elev 1727.37 ft
LOGGED BY Daniel Keady **CHECKED BY** M. Crews
NOTES Well completed with a 24" x 24" traffic-rated well vault. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
0				0.4	Asphalt. 1754.7
					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.
5					Cemented fragments.
				7.0	Moderate to strong cementation 7' to 10'. 1748.1
10	MC	10-15-16 (31)		10.0	(SM) Silty SAND, yellowish red (5YR 5/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel. 1745.1
	CC				
15	MC	13-27-30 (57)			Silty SAND, yellowish red (5YR 5/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.
	CC				
20	MC	20-50-50			Silty SAND, yellowish red (5YR 5/6), 0/80/20/0, fine to medium sand, loose, moist.

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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TETRA TECH, INC.

BORING NUMBER UFMW-02I

CLIENT Nevada Environmental Response Trust (NERT)

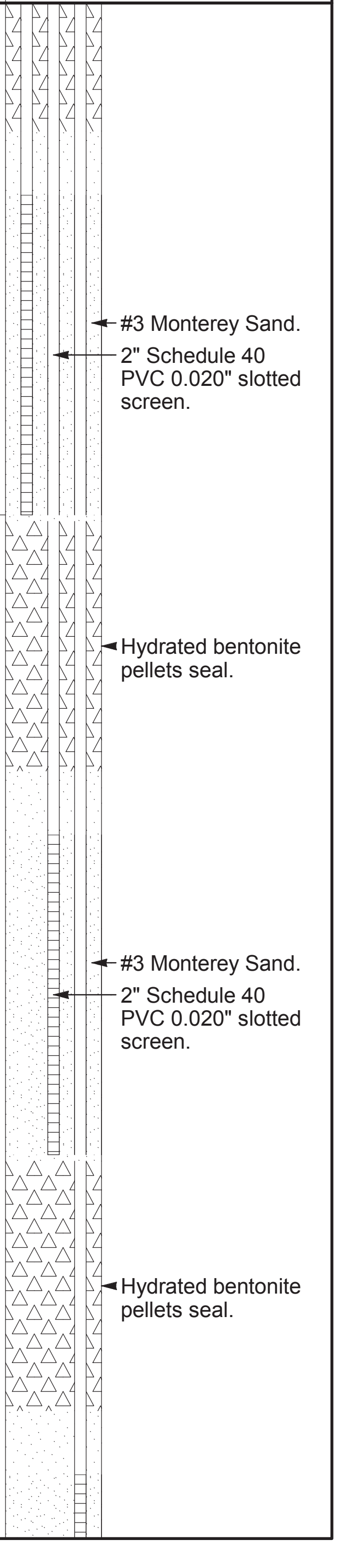
PROJECT NAME NERT - AP Area Treatability Study

PROJECT NUMBER 194-87600012-M13

PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
		(100)			(SM) *(continued)*
	CC				
25	MC	50-50			Silty SAND, yellowish red (5YR 5/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.
	CC			▼	
29.0					1726.1
					(ML)
30	MC	4-7-9 (16)			Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, no to low plasticity, fine sand, medium stiff to stiff, moist.
	CC			▽	
35	MC	10-10-12 (22)			Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/<1, no to low plasticity, fine sand, stiff, wet, trace clay.
	CC				
40	MC	3-5-6 (11)			Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/<1, no to low plasticity, fine sand, medium stiff to stiff, wet, trace clay, cemented nodules.
	CC				
45					

WELL DIAGRAM



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TETRA TECH, INC.

BORING NUMBER UFMW-02I

PAGE 3 OF 3

CLIENT Nevada Environmental Response Trust (NERT)

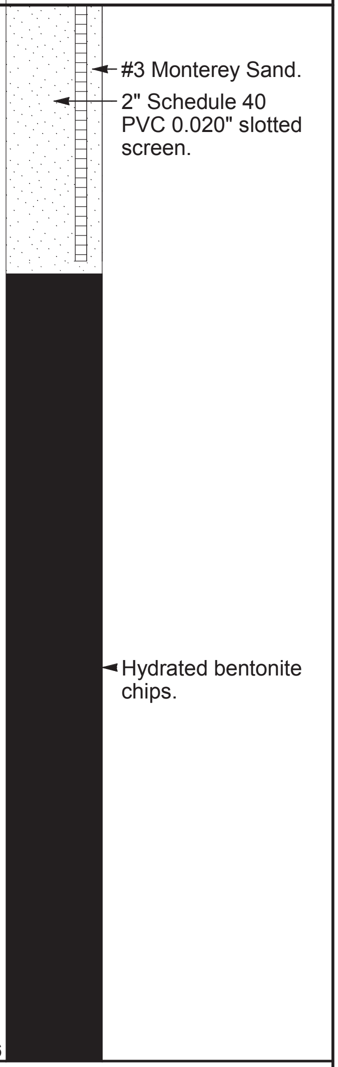
PROJECT NAME NERT - AP Area Treatability Study

PROJECT NUMBER 194-87600012-M13

PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	4-6-8 (14)			(ML) *(continued)* Sandy SILT, brown (7.5YR 5/4), 0/15/85/<1 no to low plasticity, fine sand, medium stiff to stiff, wet, trace clay.
	CC				
50	MC	2-5-7 (12)			Sandy SILT, brown (7.5YR 5/4), 0/15/85/<1, no to low plasticity, fine sand, medium stiff to stiff, wet, trace clay, cemented nodules.
	CC				
55	MC				Sandy SILT, brown (7.5YR 5/4), 0/15/85/<1, no to low plasticity, fine sand, medium stiff to stiff, wet, trace clay, cemented nodules.
	CC				
60	MC	4-4-8 (12)		61.5	Sandy SILT, brown (7.5YR 5/4), 0/15/85/<1, no to low plasticity, fine sand, medium stiff to stiff, wet, trace clay, cemented nodules. 1693.6

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

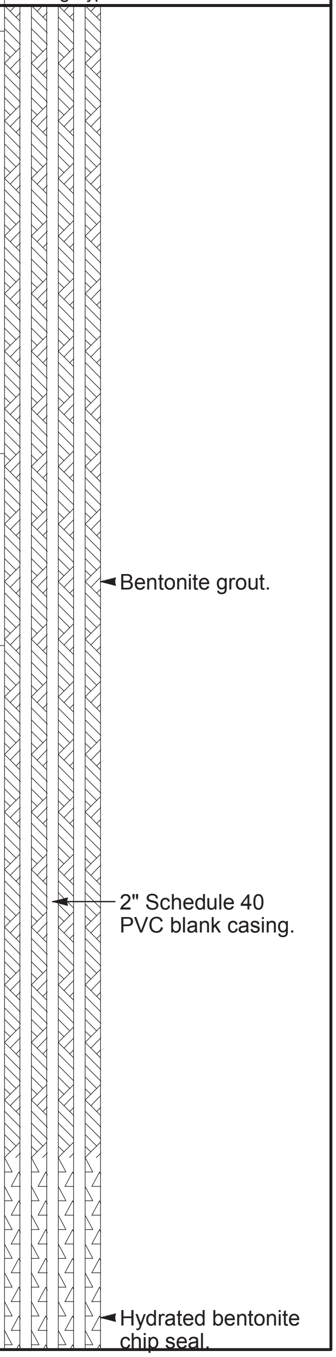
BORING NUMBER UFMW-02D

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/14/16 **COMPLETED** 7/25/16
GROUND ELEVATION 1755.02 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 33.00 ft / Elev 1722.02 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.74 ft / Elev 1727.28 ft
LOGGED BY Daniel Keady **CHECKED BY** M. Crews
NOTES Well completed with a 24" x 24" traffic-rated well vault. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	Elev.
0				0.4	Asphalt.	1754.6
					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	
5					Cemented fragments.	
				7.0	Moderate to strong cementation 7' to 10'.	1748.0
10				10.0	(SM) Silty SAND, yellowish red (5YR 5/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	1745.0
	MC	10-15-16 (31)				
	CC					
15	MC	13-27-30 (57)			Silty SAND, yellowish red (5YR 5/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	
	CC					
20	MC	20-50-50			Silty SAND, yellowish red (5YR 5/6), 0/80/20/0, fine to medium sand, loose, moist.	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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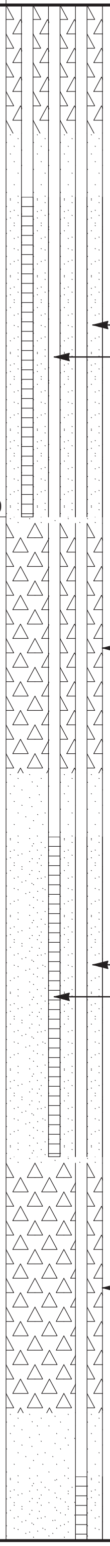
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
		(100)			(SM) *(continued)*	
	CC					
25	MC	50-50			Silty SAND, yellowish red (5YR 5/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	#3 Monterey Sand. 2" Schedule 40 PVC 0.020" slotted screen.
	CC			▼		
				29.0	1726.0	
					(ML)	
30	MC	4-7-9 (16)			Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, no to low plasticity, fine sand, medium stiff to stiff, moist.	Hydrated bentonite pellets seal.
	CC			▽		
35	MC	10-10-12 (22)			Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/<1, no to low plasticity, fine sand, stiff, wet, trace clay.	#3 Monterey Sand. 2" Schedule 40 PVC 0.020" slotted screen.
	CC					
40	MC	3-5-6 (11)			Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/<1, no to low plasticity, fine sand, medium stiff to stiff, wet, trace clay, cemented nodules.	Hydrated bentonite pellets seal.
	CC					
45						



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TETRA TECH, INC.

BORING NUMBER UFMW-02D

PAGE 3 OF 3

CLIENT Nevada Environmental Response Trust (NERT)

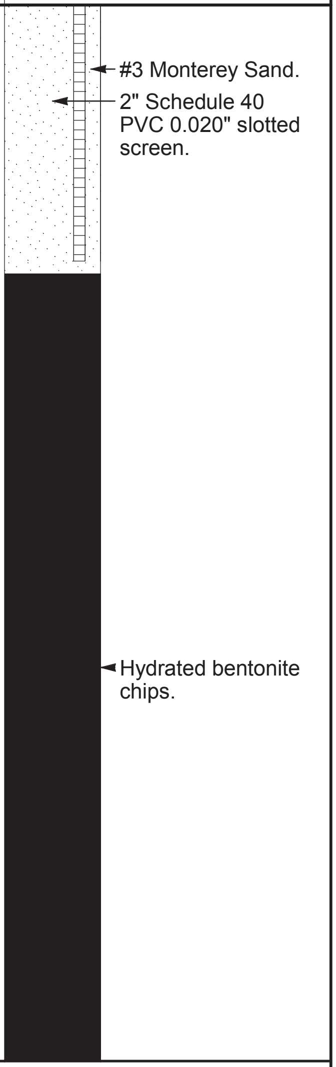
PROJECT NAME NERT - AP Area Treatability Study

PROJECT NUMBER 194-87600012-M13

PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	4-6-8 (14)			(ML) *(continued)* Sandy SILT, brown (7.5YR 5/4), 0/15/85/<1 no to low plasticity, fine sand, medium stiff to stiff, wet, trace clay.
	CC				
50	MC	2-5-7 (12)			Sandy SILT, brown (7.5YR 5/4), 0/15/85/<1, no to low plasticity, fine sand, medium stiff to stiff, wet, trace clay, cemented nodules.
	CC				
55	MC				Sandy SILT, brown (7.5YR 5/4), 0/15/85/<1, no to low plasticity, fine sand, medium stiff to stiff, wet, trace clay, cemented nodules.
	CC				
60	MC	4-4-8 (12)		61.5	Sandy SILT, brown (7.5YR 5/4), 0/15/85/<1, no to low plasticity, fine sand, medium stiff to stiff, wet, trace clay, cemented nodules. 1693.5

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

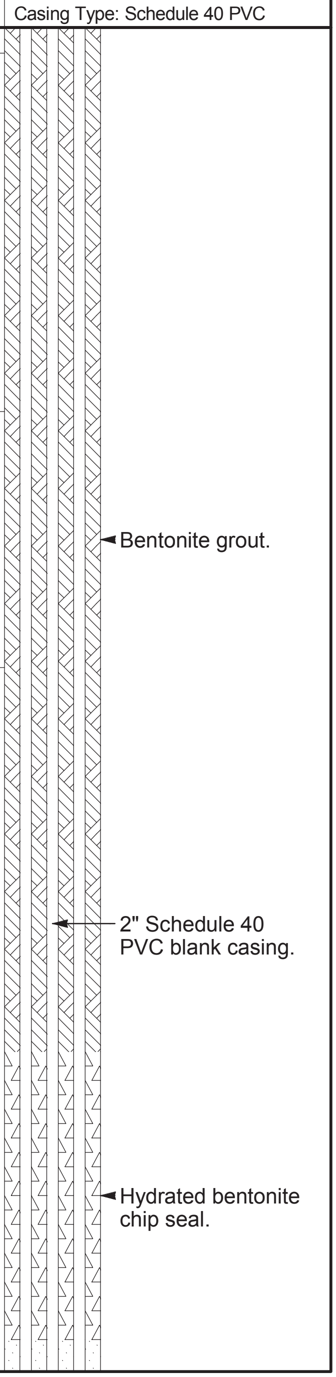
BORING NUMBER UFMW-03S

PAGE 1 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/13/16 **COMPLETED** 7/19/13
GROUND ELEVATION 1754.68 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 30.00 ft / Elev 1724.68 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING --- Dry
LOGGED BY Eric Peirce **CHECKED BY** M. Crews
NOTES Well completed with a 24" x 24" traffic-rated well vault. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	Elev.
0				0.4	Asphalt	1754.3
				6.0	(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	1748.7
5						
				10.0	Moderate to strong cementation 6' to 10'.	1744.7
10	MC	40-38-30 (68)			(SM) Silty SAND, reddish brown (5YR 5/4), 10/70/20/0, fine to coarse sand, fine gravel, dense, moist, cemented nodules.	
	CC					
15	MC	17-20-25 (45)			Silty SAND, brown (7.5YR 5/3), 15/70/15/0, fine to coarse sand, fine gravel, medium dense to dense, moist.	
	CC					
20	MC	18-17-19			Silty SAND, brown (7.5YR 5/3), 15/70/15/0, fine to coarse sand, fine gravel, medium dense to dense, moist.	

WELL DIAGRAM



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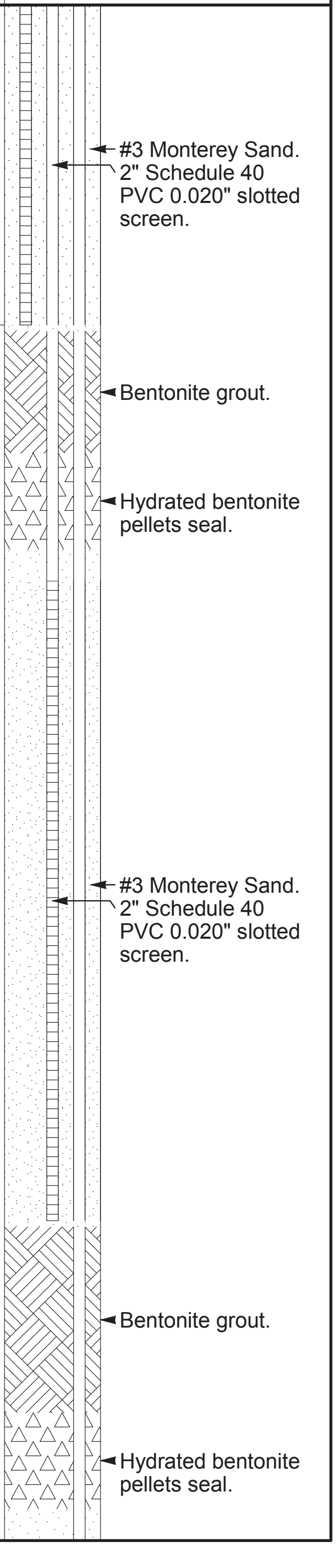
BORING NUMBER UFMW-03S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
		(36)			(SM) *(continued)*
	CC				
25	MC	13-14-24 (38)			Silty SAND, brown (7.5YR 5/3), 15/70/15/0, fine to coarse sand, fine gravel, medium dense to dense, moist.
	CC			26.0	(ML) Sandy SILT, strong brown (7.5YR 5/6), 0/20/80/0, low to no plasticity, fine sand, very stiff, moist. 1728.7
30	MC	3-7-14 (21)		▽	Sandy SILT, strong brown (7.5YR 5/6), 0/20/80/0, low to no plasticity, fine sand, medium stiff to stiff, wet.
	CC				
35	MC	5-5-7 (12)			Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, low plasticity, fine sand, medium stiff, wet to saturated.
	CC				
40	MC	5-60			Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, low plasticity, fine sand, hard, wet to saturated.
	CC				
45					

WELL DIAGRAM



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BORING NUMBER UFMW-03S

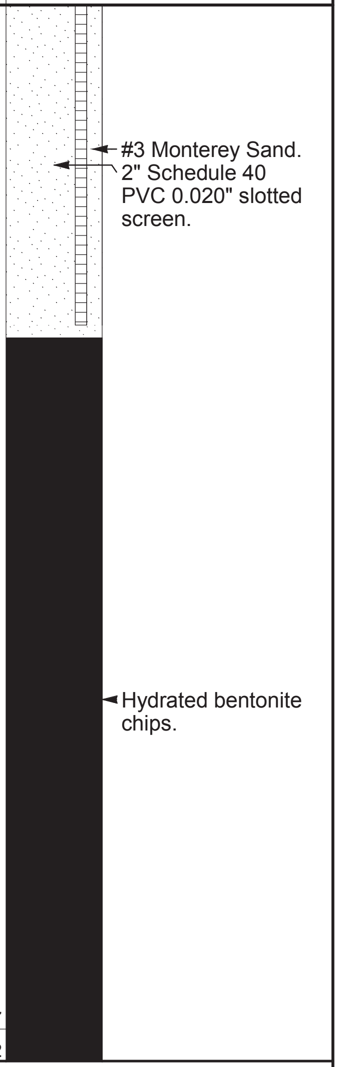
CLIENT Nevada Environmental Response Trust (NERT) **PROJECT NAME** NERT - AP Area Treatability Study

PROJECT NUMBER 194-87600012-M13 **PROJECT LOCATION** Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	4-6-8 (14)			(ML) *(continued)* Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, low plasticity, fine sand, medium stiff to stiff, wet to saturated.
	CC				
50	MC	5-8-4 (12)			Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, low plasticity, fine sand, medium stiff to stiff, wet to saturated.
	CC				
55	MC	8-10-13 (23)			Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, low plasticity, fine sand, stiff, wet to saturated.
	CC				
60	MC	6-7-10 (17)		61.0	Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, low plasticity, fine sand, medium stiff to stiff, wet to saturated. 1693.7
				61.5	(SM) Silty SAND, white (10YR 8/1), 0/80/20/0, fine sand, medium dense, wet. 1693.2

Bottom of borehole at 61.5 feet.

WELL DIAGRAM



TETRA TECH, INC.

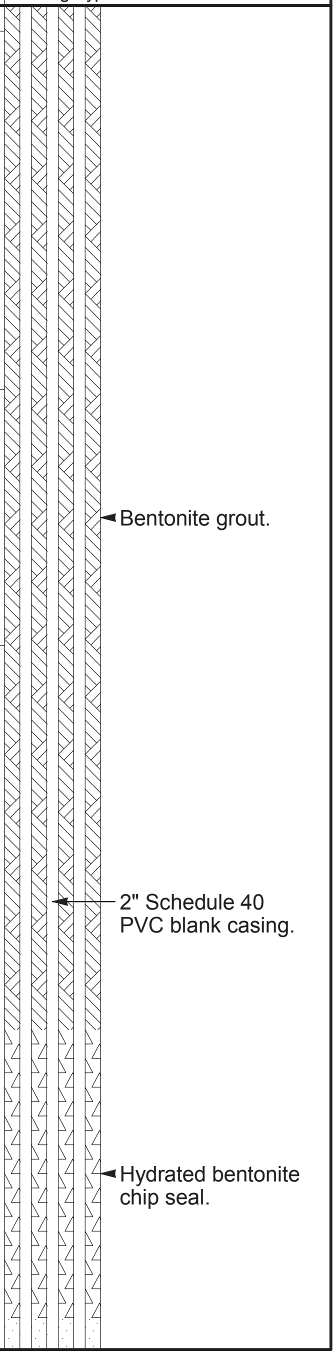
BORING NUMBER UFMW-03I

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/13/16 **COMPLETED** 7/19/13
GROUND ELEVATION 1754.7 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 30.00 ft / Elev 1724.70 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.04 ft / Elev 1727.66 ft
LOGGED BY Eric Peirce **CHECKED BY** M. Crews
NOTES Well completed with a 24" x 24" traffic-rated well vault. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0				0.4	Asphalt	1754.3
					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	
5				6.0	Moderate to strong cementation 6' to 10'.	1748.7
10				10.0	(SM) Silty SAND, reddish brown (5YR 5/4), 10/70/20/0, fine to coarse sand, fine gravel, dense, moist, cemented nodules.	1744.7
	MC	40-38-30 (68)				
	CC					
15	MC	17-20-25 (45)			Silty SAND, brown (7.5YR 5/3), 15/70/15/0, fine to coarse sand, fine gravel, medium dense to dense, moist.	
	CC					
20	MC	18-17-19			Silty SAND, brown (7.5YR 5/3), 15/70/15/0, fine to coarse sand, fine gravel, medium dense to dense, moist.	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



Bentonite grout.

2" Schedule 40 PVC blank casing.

Hydrated bentonite chip seal.

(Continued Next Page)

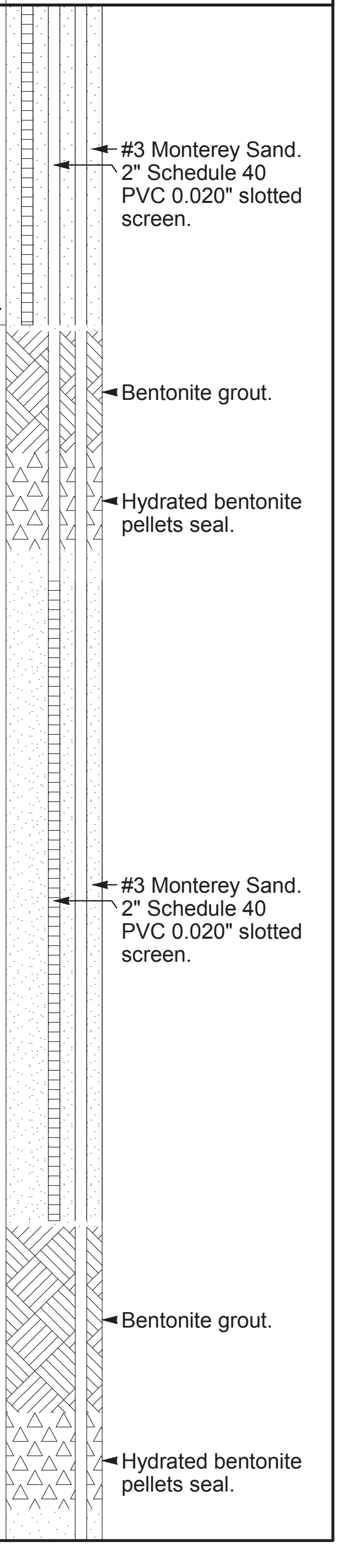
TETRA TECH, INC.

BORING NUMBER UFMW-03I

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	MATERIAL DESCRIPTION
		(36)		(SM) *(continued)*
	CC			
25	MC	13-14-24 (38)		Silty SAND, brown (7.5YR 5/3), 15/70/15/0, fine to coarse sand, fine gravel, medium dense to dense, moist.
26.0				1728.7
				(ML) Sandy SILT, strong brown (7.5YR 5/6), 0/20/80/0, low to no plasticity, fine sand, very stiff, moist.
	CC			
30	MC	3-7-14 (21)		Sandy SILT, strong brown (7.5YR 5/6), 0/20/80/0, low to no plasticity, fine sand, medium stiff to stiff, wet.
	CC			
35	MC	5-5-7 (12)		Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, low plasticity, fine sand, medium stiff, wet to saturated.
	CC			
40	MC	5-60		Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, low plasticity, fine sand, hard, wet to saturated.
	CC			
45				

WELL DIAGRAM



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BORING NUMBER UFMW-03I

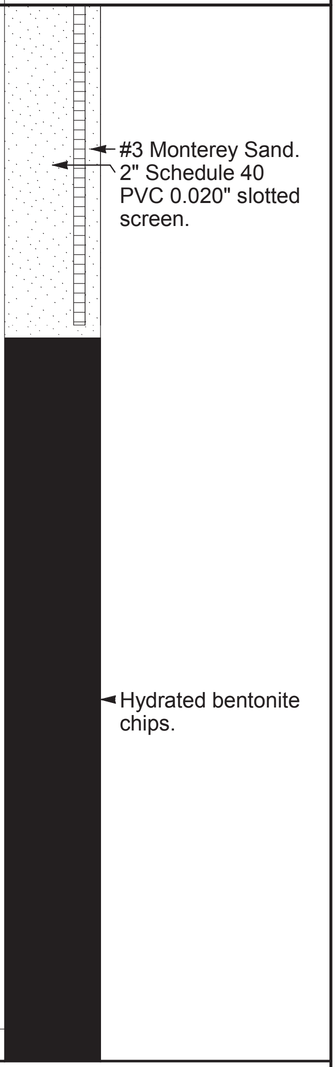
PAGE 3 OF 3

CLIENT Nevada Environmental Response Trust (NERT)

PROJECT NAME NERT - AP Area Treatability Study

PROJECT NUMBER 194-87600012-M13

PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION		WELL DIAGRAM
45	MC	4-6-8 (14)				(ML) *(continued)* Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, low plasticity, fine sand, medium stiff to stiff, wet to saturated.		
	CC							
50	MC	5-8-4 (12)				Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, low plasticity, fine sand, medium stiff to stiff, wet to saturated.		
	CC							
55	MC	8-10-13 (23)				Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, low plasticity, fine sand, stiff, wet to saturated.		
	CC							
60	MC	6-7-10 (17)			61.0	Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, low plasticity, fine sand, medium stiff to stiff, wet to saturated.	1693.7	
					61.5	(SM) Silty SAND, white (10YR 8/1), 0/80/20/0, fine sand, medium dense, wet.	1693.2	

Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

BORING NUMBER UFMW-03D

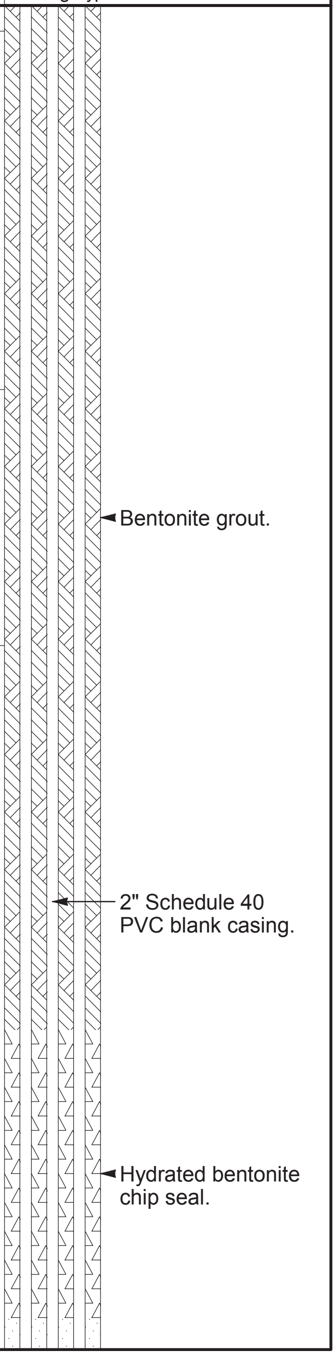
PAGE 1 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/13/16 **COMPLETED** 7/19/13
GROUND ELEVATION 1754.77 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 30.00 ft / Elev 1724.77 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.09 ft / Elev 1727.68 ft
LOGGED BY Eric Peirce **CHECKED BY** M. Crews
NOTES Well completed with a 24" x 24" traffic-rated well vault. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0				0.4	Asphalt	1754.4
				6.0	(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	1748.8
5				10.0	Moderate to strong cementation 6' to 10'.	1744.8
10	MC	40-38-30 (68)			(SM) Silty SAND, reddish brown (5YR 5/4), 10/70/20/0, fine to coarse sand, fine gravel, dense, moist, cemented nodules.	
	CC					
15	MC	17-20-25 (45)			Silty SAND, brown (7.5YR 5/3), 15/70/15/0, fine to coarse sand, fine gravel, medium dense to dense, moist.	
	CC					
20	MC	18-17-19			Silty SAND, brown (7.5YR 5/3), 15/70/15/0, fine to coarse sand, fine gravel, medium dense to dense, moist.	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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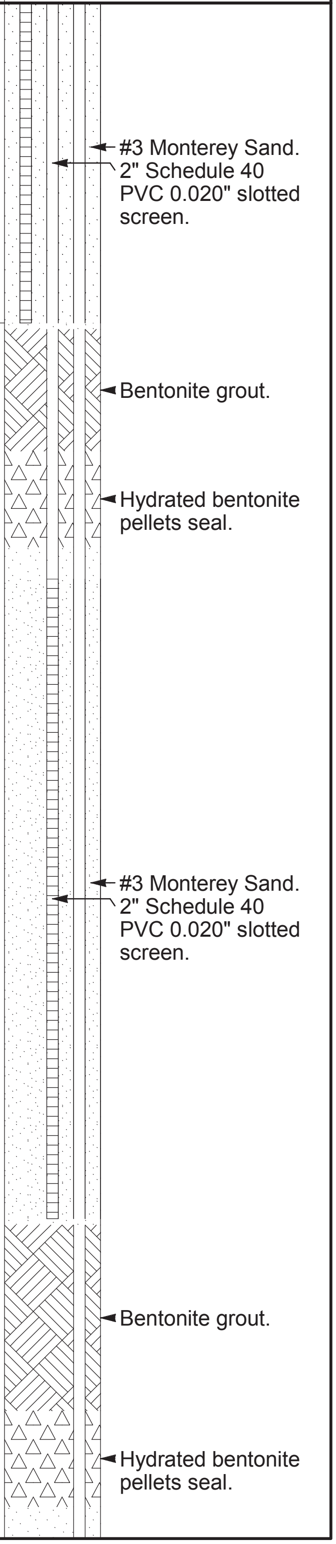
ENVIRONMENTAL BH - GINT STD US.GDT - 11/10/17 12:49 - \\TTS318FS1\CES\PROJECTS\87600014-NERT-M12\WORKING\IN-SITU CR TREATABILITY TEST\FIELD PROGRAM\BORING LOGS\GINT\ALL M13 LOGS.GPJ

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
		(36)			(SM) *(continued)*
	CC				
25	MC	13-14-24 (38)			Silty SAND, brown (7.5YR 5/3), 15/70/15/0, fine to coarse sand, fine gravel, medium dense to dense, moist.
26.0					1728.8
					(ML) Sandy SILT, strong brown (7.5YR 5/6), 0/20/80/0, low to ▼ no plasticity, fine sand, very stiff, moist.
	CC				
30	MC	3-7-14 (21)			▽ Sandy SILT, strong brown (7.5YR 5/6), 0/20/80/0, low to no plasticity, fine sand, medium stiff to stiff, wet.
	CC				
35	MC	5-5-7 (12)			Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, low plasticity, fine sand, medium stiff, wet to saturated.
	CC				
40	MC	5-60			Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, low plasticity, fine sand, hard, wet to saturated.
	CC				
45					

WELL DIAGRAM



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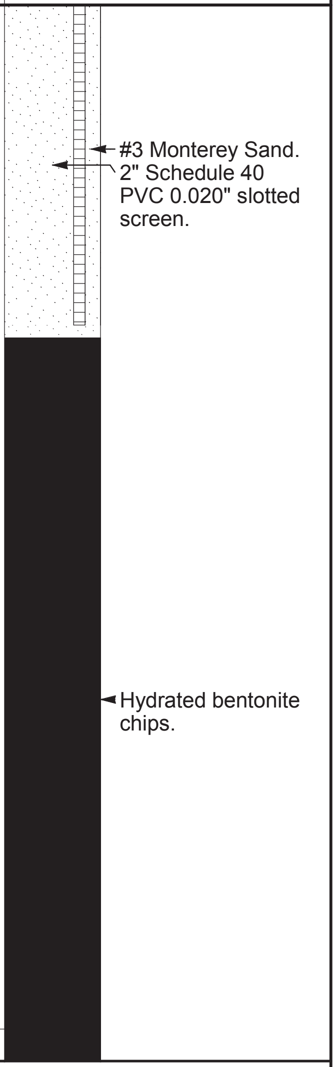
BORING NUMBER UFMW-03D

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION	
45	MC	4-6-8 (14)				(ML) *(continued)* Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, low plasticity, fine sand, medium stiff to stiff, wet to saturated.	
	CC						
50	MC	5-8-4 (12)				Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, low plasticity, fine sand, medium stiff to stiff, wet to saturated.	
	CC						
55	MC	8-10-13 (23)				Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, low plasticity, fine sand, stiff, wet to saturated.	
	CC						
60	MC	6-7-10 (17)			61.0	Sandy SILT, strong brown (7.5YR 4/6), 0/15/85/0, low plasticity, fine sand, medium stiff to stiff, wet to saturated.	1693.8
					61.5	(SM) Silty SAND, white (10YR 8/1), 0/80/20/0, fine sand, medium dense, wet.	1693.3

Bottom of borehole at 61.5 feet.

WELL DIAGRAM



BORING NUMBER UFMW-04S

TETRA TECH, INC.

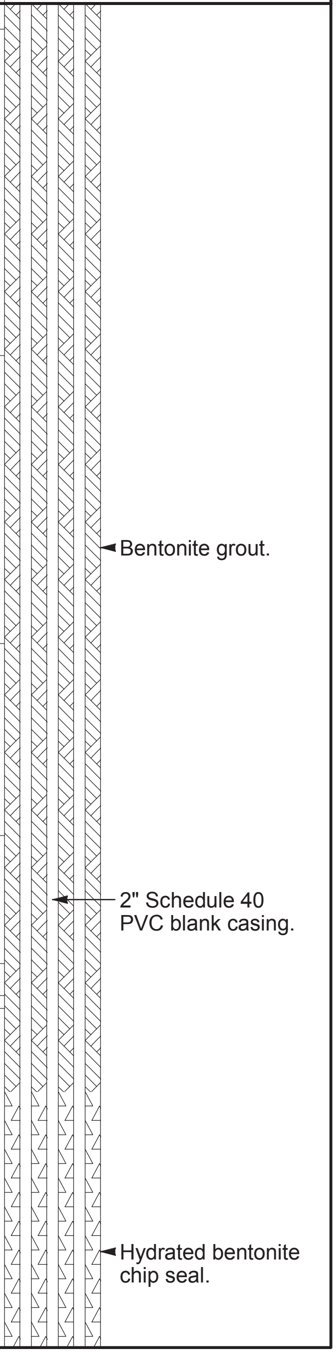
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/25/16 **COMPLETED** 8/4/16
GROUND ELEVATION 1758.79 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 31.00 ft / Elev 1727.79 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.75 ft / Elev 1731.04 ft
LOGGED BY Eric Peirce **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.

DEPTH (ft)	MATERIAL DESCRIPTION	Elevation (ft)
0.4	Asphalt	1758.4
5.5	(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	1753.3
10.0	Moderate to strong cementation 5.5' to 10'.	1748.8
13.0	(SM) Silty Sand, reddish brown (5YR 5/3), 10/70/20/0, fine to medium sand, medium dense, moist, little fine gravel. Silty Sand, reddish brown (5YR 5/3), 10/70/20/0, fine to coarse sand, medium dense to dense, moist, little fine gravel.	1745.8
15.0	(SW) Gravelly SAND, reddish brown (5YR 5/3), 30/60/10/0, fine to coarse sand, fine gravel, medium dense, moist.	1743.8
15.5	(SM) Silty SAND with Gravel, reddish brown (5YR 5/3), 15/65/20/0, fine to coarse sand, fine gravel, medium dense, moist.	1743.3
15.7	3" gypsum lense with moderate to strong cementation, white (5YR 8/1), trace small gravel.	1743.1
	(SM) Silty SAND, reddish brown, (5YR 5/3), 5/70/25/0, fine sand, medium dense, moist, trace fine gravel. Silty SAND, reddish brown, (5YR 5/3), 5/75/20/0, fine sand, medium dense, moist, trace fine gravel.	

SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)
MC	4-18-20 (38)
MC	18-27-39 (66)
MC	23-25-30 (55)
MC	15-20-25 (45)
MC	10-12-14 (26)
MC	11-15-17 (32)
MC	12-16-18 (34)

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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ENVIRONMENTAL BH - GINT STD US.GDT - 11/10/17 12:49 - \\TTS318FS1\CES\PROJECTS\87600014-NERT-M12\WORKING\IN-SITU CR TREATABILITY TEST\FIELD PROGRAM\BORING LOGS\GINT\ALL M13 LOGS.GPJ

BORING NUMBER UFMW-04S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA
	MC	7-14-35 (49)	
	MC	8-18-35 (53)	
25	MC	34-50	
	MC	25-50	
	MC	7-14-28 (42)	
	MC	7-9-11 (20)	
30	MC	40-10-10 (20)	
35	CC		
	MC	4-5-10 (15)	
40	CC		
	MC	3-8-6 (14)	
45	CC		

MATERIAL DESCRIPTION

(SM) *(continued)*

SIlty SAND with Gravel, reddish brown (5YR 4/3), 15/60/25/0, fine to coarse sand, fine gravel, dense, moist.

SIlty SAND with Gravel, reddish brown (5YR 4/3), 20/60/20/0, fine to coarse sand, fine gravel, medium dense to dense, moist.

▼

29.0 — 1729.8

(ML)
Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no plasticity, fine sand, medium stiff to stiff, moist.

▽

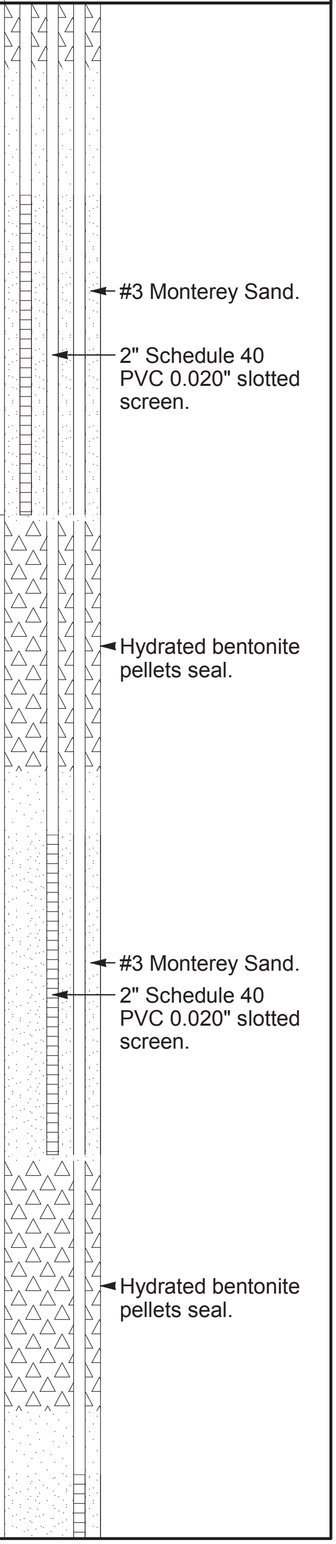
Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no to low plasticity, fine sand, medium stiff to stiff, moist.
Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no to low plasticity, fine sand, medium stiff to stiff, wet.
Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no to low plasticity, fine sand, medium stiff to stiff, wet, trace cemented nodules.

Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no plasticity, fine sand, soft to medium dense, wet, trace cemented nodules.

Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no plasticity, fine sand, soft to medium dense, wet.

Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no plasticity, fine sand, soft to medium dense, wet, trace

WELL DIAGRAM



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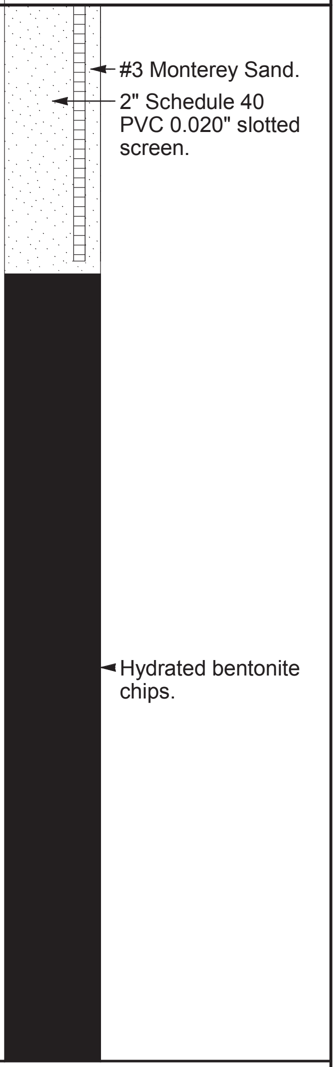
TETRA TECH, INC.

BORING NUMBER UFMW-04S

CLIENT	Nevada Environmental Response Trust (NERT)	**PROJECT NAME**	NERT - AP Area Treatability Study
PROJECT NUMBER	194-87600012-M13	**PROJECT LOCATION**	Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	5-7-9 (16)			cemented nodules. (ML) *(continued)*
	CC				
50	MC	6-7-12 (19)			Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no plasticity, fine sand, soft to medium dense, wet, trace cemented nodules.
	CC				
55	MC	3-4-6 (10)			Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no to low plasticity, fine sand, soft to medium dense, wet, trace cemented nodules.
	CC				
60	MC	4-4-6 (10)			Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no to low plasticity, fine sand, soft to medium dense, wet, trace cemented nodules.
				61.5	1697.3

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

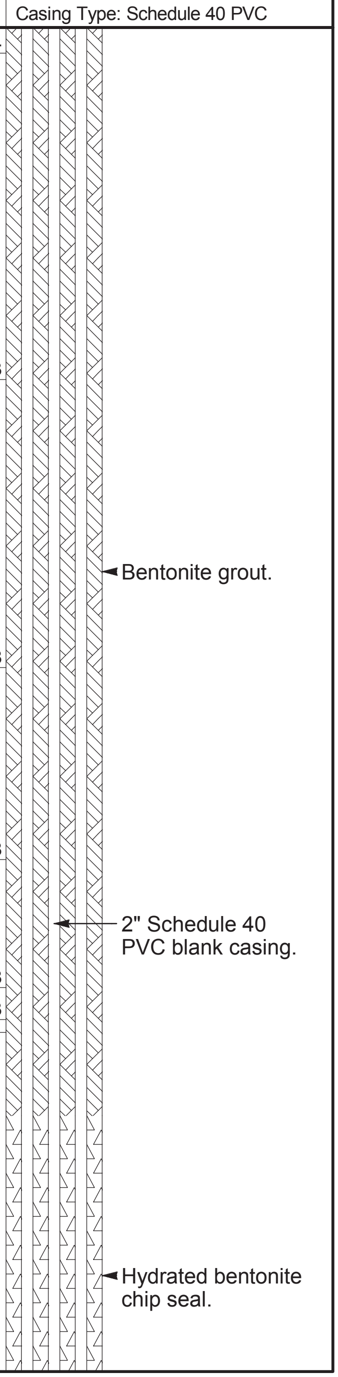
BORING NUMBER UFMW-04I

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/25/16 **COMPLETED** 8/4/16
GROUND ELEVATION 1758.84 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 31.00 ft / Elev 1727.84 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.76 ft / Elev 1731.08 ft
LOGGED BY Eric Peirce **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.

DEPTH (ft)	MATERIAL DESCRIPTION	Elevation
0.4	Asphalt	1758.4
	(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	
5.5		1753.3
	Moderate to strong cementation 5.5' to 10'.	
10.0		1748.8
	(SM) Silty Sand, reddish brown (5YR 5/3), 10/70/20/0, fine to medium sand, medium dense, moist, little fine gravel. Silty Sand, reddish brown (5YR 5/3), 10/70/20/0, fine to coarse sand, medium dense to dense, moist, little fine gravel.	
13.0		1745.8
	(SW) Gravelly SAND, reddish brown (5YR 5/3), 30/60/10/0, fine to coarse sand, fine gravel, medium dense, moist.	
15.0		1743.8
	(SM) Silty SAND with Gravel, reddish brown (5YR 5/3), 15/65/20/0, fine to coarse sand, fine gravel, medium dense, moist.	
15.5		1743.3
	3" gypsum lense with moderate to strong cementation, white (5YR 8/1), trace small gravel.	
15.7		1743.1
	(SM) Silty SAND, reddish brown, (5YR 5/3), 5/70/25/0, fine sand, medium dense, moist, trace fine gravel. Silty SAND, reddish brown, (5YR 5/3), 5/75/20/0, fine sand, medium dense, moist, trace fine gravel.	

SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA
MC	4-18-20 (38)	
MC	18-27-39 (66)	
MC	23-25-30 (55)	
MC	15-20-25 (45)	
MC	10-12-14 (26)	
MC	11-15-17 (32)	
MC	12-16-18 (34)	

WELL DIAGRAM



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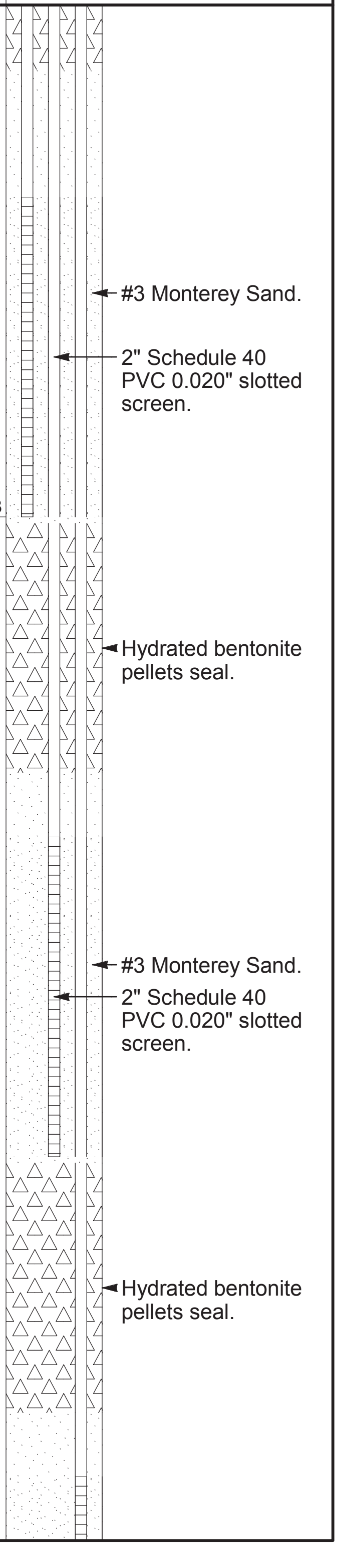
CLIENT Nevada Environmental Response Trust (NERT) **PROJECT NAME** NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13 **PROJECT LOCATION** Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	MATERIAL DESCRIPTION
	MC	7-14-35 (49)		(SM) *(continued)*
	MC	8-18-35 (53)		SIlty SAND with Gravel, reddish brown (5YR 4/3), 15/60/25/0, fine to coarse sand, fine gravel, dense, moist.
	MC	34-50		
25	MC	25-50		SIlty SAND with Gravel, reddish brown (5YR 4/3), 20/60/20/0, fine to coarse sand, fine gravel, medium dense to dense, moist.
	MC	7-14-28 (42)		▼
	MC	7-9-11 (20)		29.0 — 1729.8 (ML) Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no plasticity, fine sand, medium stiff to stiff, moist.
30	MC	40-10-10 (20)		▽ Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no to low plasticity, fine sand, medium stiff to stiff, moist.
	CC			Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no to low plasticity, fine sand, medium stiff to stiff, wet. Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no to low plasticity, fine sand, medium stiff to stiff, wet, trace cemented nodules.
35	MC	4-5-10 (15)		Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no plasticity, fine sand, soft to medium dense, wet, trace cemented nodules.
	CC			
40	MC	3-8-6 (14)		Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no plasticity, fine sand, soft to medium dense, wet.
45	CC			Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no plasticity, fine sand, soft to medium dense, wet, trace

WELL DIAGRAM



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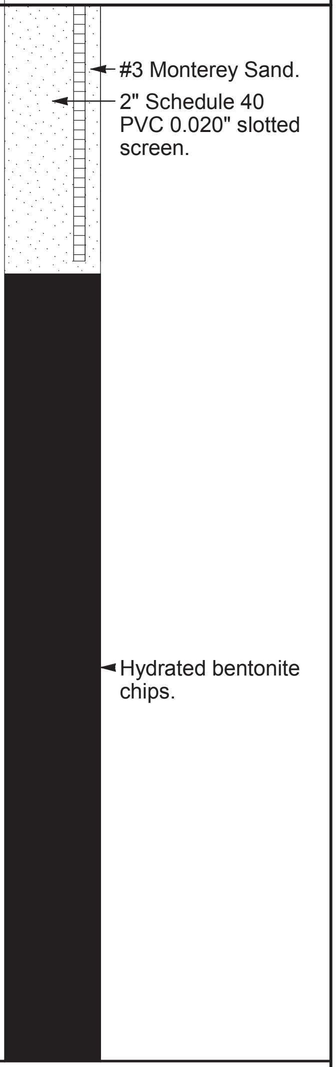
BORING NUMBER UFMW-04I

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION	
45	MC	5-7-9 (16)				cemented nodules. (ML) *(continued)*	
	CC						
50	MC	6-7-12 (19)				Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no plasticity, fine sand, soft to medium dense, wet, trace cemented nodules.	
	CC						
55	MC	3-4-6 (10)				Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no to low plasticity, fine sand, soft to medium dense, wet, trace cemented nodules.	
	CC						
60	MC	4-4-6 (10)			61.5	Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no to low plasticity, fine sand, soft to medium dense, wet, trace cemented nodules.	1697.3

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

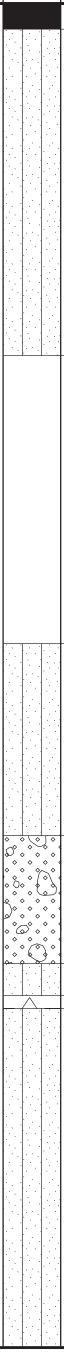
BORING NUMBER UFMW-04D

PAGE 1 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/25/16 **COMPLETED** 8/4/16
GROUND ELEVATION 1758.83 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 31.00 ft / Elev 1727.83 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.73 ft / Elev 1731.10 ft
LOGGED BY Eric Peirce **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.

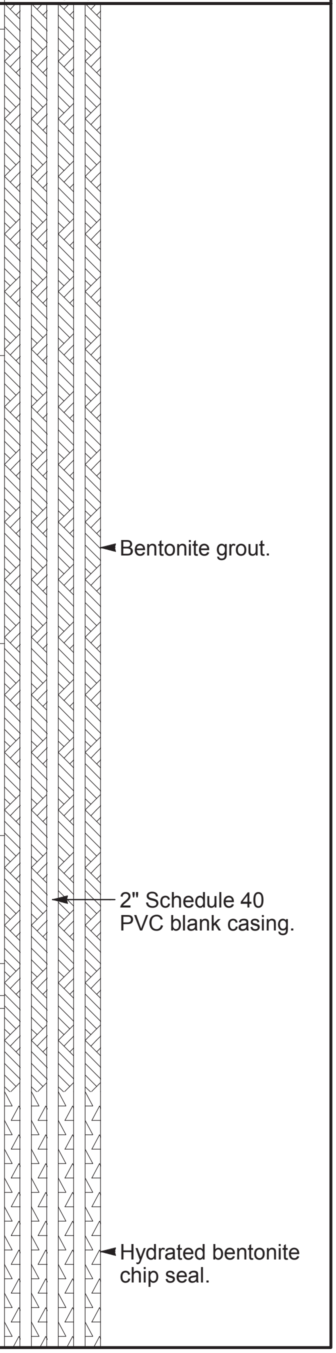
DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	Layer depth	MATERIAL DESCRIPTION	Elev.
0				0.4	Asphalt	1758.4
				5.5	(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	1753.3
5				10.0	Moderate to strong cementation 5.5' to 10'.	1748.8
10	MC	4-18-20 (38)			(SM) Silty Sand, reddish brown (5YR 5/3), 10/70/20/0, fine to medium sand, medium dense, moist, little fine gravel.	
	MC	18-27-39 (66)		13.0	Silty Sand, reddish brown (5YR 5/3), 10/70/20/0, fine to coarse sand, medium dense to dense, moist, little fine gravel.	1745.8
	MC	23-25-30 (55)		15.0	(SW) Gravelly SAND, reddish brown (5YR 5/3), 30/60/10/0, fine to coarse sand, fine gravel, medium dense, moist.	1743.8
15	MC	15-20-25 (45)		15.5	(SM) Silty SAND with Gravel, reddish brown (5YR 5/3), 15/65/20/0, fine to coarse sand, fine gravel, medium dense, moist.	1743.3
				15.7	3" gypsum lense with moderate to strong cementation, white (5YR 8/1), trace small gravel.	1743.1
	MC	10-12-14 (26)			(SM) Silty SAND, reddish brown, (5YR 5/3), 5/70/25/0, fine sand, medium dense, moist, trace fine gravel.	
	MC	11-15-17 (32)				
20	MC	12-16-18 (34)			Silty SAND, reddish brown, (5YR 5/3), 5/75/20/0, fine sand, medium dense, moist, trace fine gravel.	

GRAPHIC LOG



WELL DIAGRAM

Casing Type: Schedule 40 PVC



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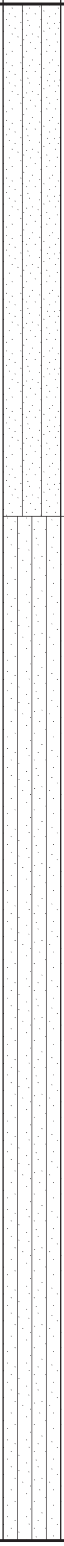
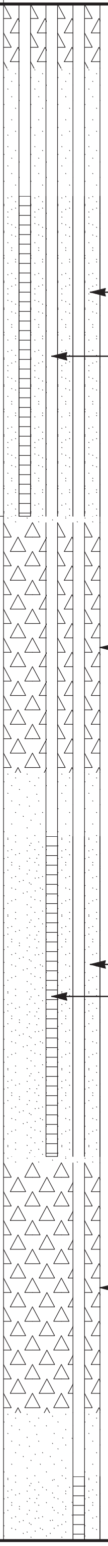
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	MC	7-14-35 (49)			(SM) *(continued)*	
	MC	8-18-35 (53)			SIlty SAND with Gravel, reddish brown (5YR 4/3), 15/60/25/0, fine to coarse sand, fine gravel, dense, moist.	
	MC	34-50				
25	MC	25-50			SIlty SAND with Gravel, reddish brown (5YR 4/3), 20/60/20/0, fine to coarse sand, fine gravel, medium dense to dense, moist.	#3 Monterey Sand.
	MC	7-14-28 (42)			▼	2" Schedule 40 PVC 0.020" slotted screen.
	MC	7-9-11 (20)		29.0		1729.8
30	MC	40-10-10 (20)			(ML) Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no plasticity, fine sand, medium stiff to stiff, moist.	
	CC				▽ Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no to low plasticity, fine sand, medium stiff to stiff, moist. Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no to low plasticity, fine sand, medium stiff to stiff, wet. Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no to low plasticity, fine sand, medium stiff to stiff, wet, trace cemented nodules.	Hydrated bentonite pellets seal.
35	MC	4-5-10 (15)			Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no plasticity, fine sand, soft to medium dense, wet, trace cemented nodules.	#3 Monterey Sand.
	CC					2" Schedule 40 PVC 0.020" slotted screen.
40	MC	3-8-6 (14)			Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no plasticity, fine sand, soft to medium dense, wet.	Hydrated bentonite pellets seal.
45	CC				Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no plasticity, fine sand, soft to medium dense, wet, trace	





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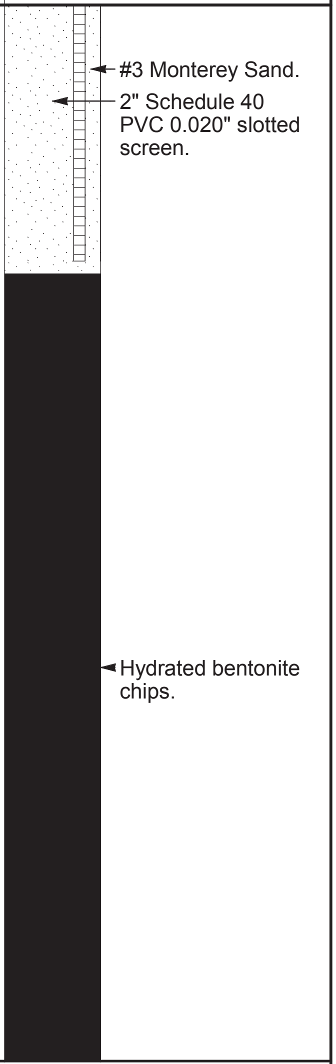
BORING NUMBER UFMW-04D

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	5-7-9 (16)			cemented nodules. (ML) *(continued)*
	CC				
50	MC	6-7-12 (19)			Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no plasticity, fine sand, soft to medium dense, wet, trace cemented nodules.
	CC				
55	MC	3-4-6 (10)			Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no to low plasticity, fine sand, soft to medium dense, wet, trace cemented nodules.
	CC				
60	MC	4-4-6 (10)			Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, no to low plasticity, fine sand, soft to medium dense, wet, trace cemented nodules.
61.5					1697.3

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

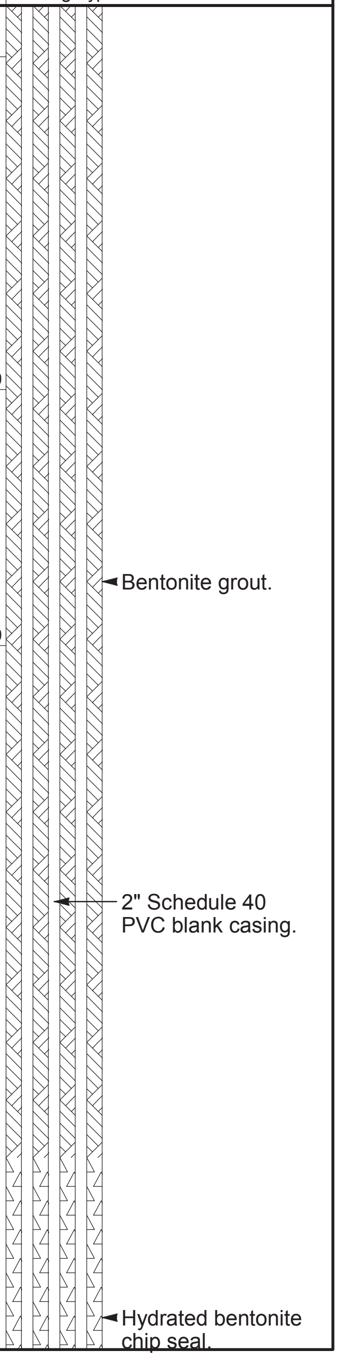
BORING NUMBER UFMW-05S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/22/16 **COMPLETED** 8/3/16
GROUND ELEVATION 1758.94 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 30.00 ft / Elev 1728.94 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.90 ft / Elev 1731.04 ft
LOGGED BY Eric Peirce **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	Elevation
0					Compacted base material.	
0.8					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	1758.1
6.0					Moderate to strong cementation 6' to 10'.	1752.9
10.0	MC	20-20-25 (45)			(SM) Silty SAND, light reddish brown (5YR 6/3), 5/75/20/0, fine to coarse sand, medium dense, moist.	1748.9
	CC					
15	MC	20-27-27 (54)			Silty SAND with Gravel, reddish brown (5YR 4/4), 20/55/25/0, fine to coarse sand, fine gravel, medium dense, moist.	
	CC				Silty SAND, reddish brown (5YR 4/4), 5/70/25/0, fine sand, moist, trace fine gravel.	
20	MC	12-18-27			Silty SAND with Gravel, reddish brown (5YR 4/4), 20/55/25/0, fine to coarse sand, no plasticity, fine gravel,	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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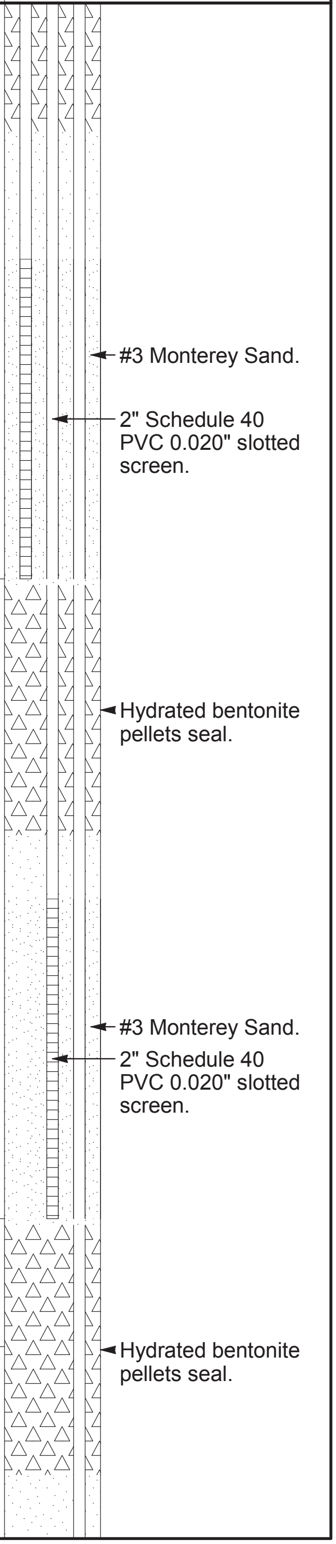
TETRA TECH, INC.

BORING NUMBER UFMW-05S

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
		(45)			medium dense, moist. (SM) *(continued)*
	CC				
25	MC	40-50			Silty SAND, reddish brown (5YR 5/3), 10/70/20/0, fine to coarse sand, dense, moist, little fine gravel, layer with moderate to strong cementation.
	CC				▼
30				30.0	▽ Silty SAND, pinkish gray (5YR 6/2), 10/75/15/0, fine to coarse sand, no to low plasticity (silt), moist, little fine gravel. 1728.9
	MC	5-10-14 (24)			(ML) Sandy SILT, yellowish red (5YR 4/6), 0/25/75/0, no to low plasticity, fine sand, medium stiff to stiff, wet, cemented nodules.
	CC				Sandy SILT with Gravel, yellowish red (5YR 5/6), 25/25/50/0, no plasticity, fine sand, fine gravel, wet. Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low plasticity, fine sand, stiff to very stiff, wet, little cemented nodules.
35	MC	14-17-17 (34)			Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low plasticity, fine sand, stiff to very stiff, wet, little cemented nodules.
	CC				
40				40.0	1718.9
	MC	3-6-9 (15)			(ML) SILT, yellowish red (5YR 4/6), 0/5/95/0, no plasticity, soft to medium stiff, wet, trace fine sand.
				42.0	1716.9
	CC				(ML) Sandy SILT, yellowish red (5YR 4/6), 0/20/80/0, no plasticity, fine sand, wet.
45					

WELL DIAGRAM



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BORING NUMBER UFMW-05S

CLIENT Nevada Environmental Response Trust (NERT)

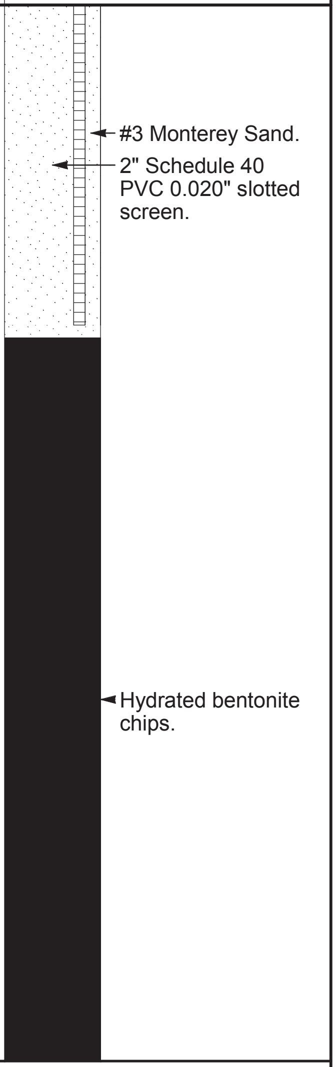
PROJECT NAME NERT - AP Area Treatability Study

PROJECT NUMBER 194-87600012-M13

PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	4-10-12 (22)			(ML) *(continued)* Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low plasticity, fine sand, medium stiff to stiff, wet, trace cemented nodules.
	CC				Large cemented nodules, pink (5YR 7/3).
50	MC	5-7-11 (18)			Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, no to low plasticity, fine sand, medium stiff to stiff, wet.
	CC				
55	MC	5-7-11 (18)			Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, no to low plasticity, fine sand, medium stiff to stiff, wet.
	CC				Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, no to low plasticity, fine sand, medium stiff to stiff, wet, trace cemented nodules.
60	MC	3-5-7 (12)		61.5	Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, no to low plasticity, fine sand, medium stiff to stiff, wet, trace cemented nodules. 1697.4

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

BORING NUMBER UFMW-05I

PAGE 1 OF 3

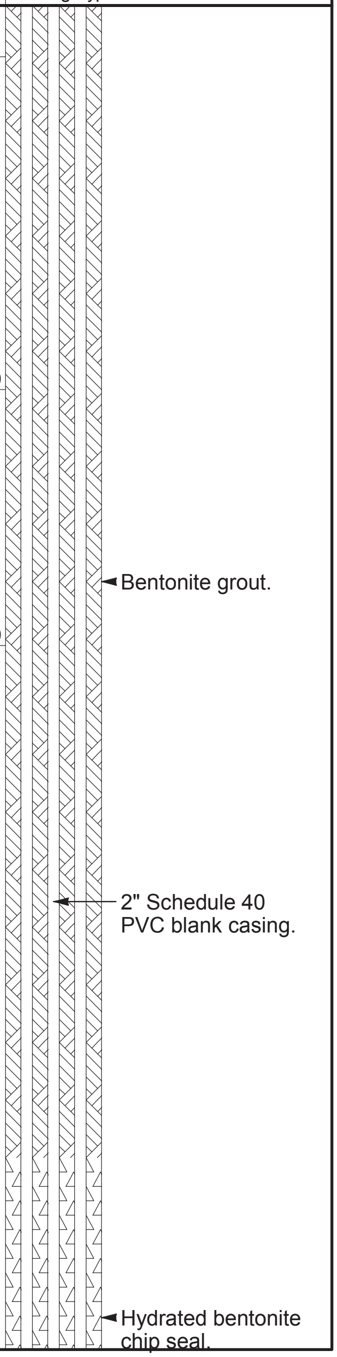
TETRA TECH, INC.

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/22/16 **COMPLETED** 8/3/16
GROUND ELEVATION 1758.92 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 30.00 ft / Elev 1728.92 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.82 ft / Elev 1731.10 ft
LOGGED BY Eric Peirce **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
0					Compacted base material.
				0.8	1758.1
					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.
5					
				6.0	1752.9
					Moderate to strong cementation 6' to 10'.
10				10.0	1748.9
	MC	20-20-25 (45)			(SM) Silty SAND, light reddish brown (5YR 6/3), 5/75/20/0, fine to coarse sand, medium dense, moist.
	CC				
15	MC	20-27-27 (54)			Silty SAND with Gravel, reddish brown (5YR 4/4), 20/55/25/0, fine to coarse sand, fine gravel, medium dense, moist.
	CC				Silty SAND, reddish brown (5YR 4/4), 5/70/25/0, fine sand, moist, trace fine gravel.
20	MC	12-18-27			Silty SAND with Gravel, reddish brown (5YR 4/4), 20/55/25/0, fine to coarse sand, no plasticity, fine gravel,

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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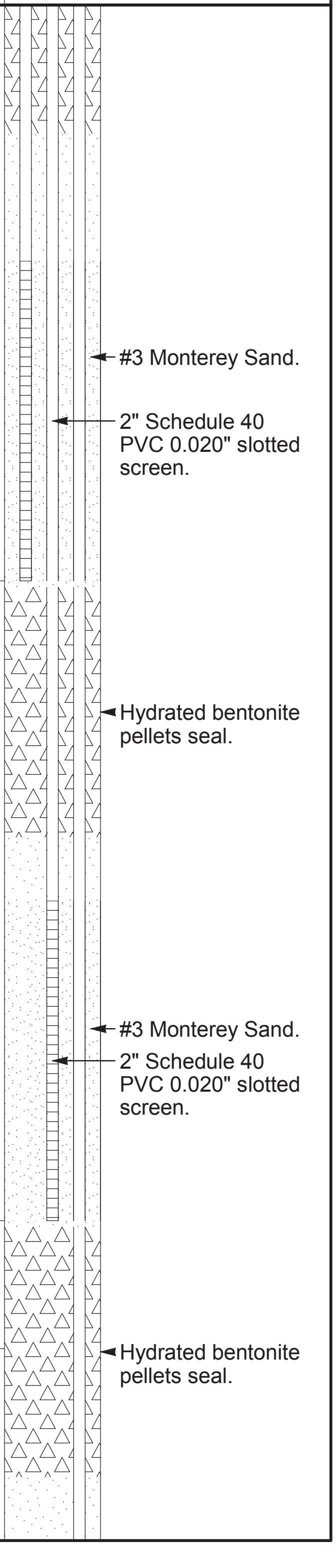
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	MATERIAL DESCRIPTION
		(45)		medium dense, moist. (SM) *(continued)*
	CC			
25	MC	40-50		Silty SAND, reddish brown (5YR 5/3), 10/70/20/0, fine to coarse sand, dense, moist, little fine gravel, layer with moderate to strong cementation.
	CC			▼
30				Silty SAND, pinkish gray (5YR 6/2), 10/75/15/0, fine to coarse sand, no to low plasticity (silt), moist, little fine gravel. 30.0 ▽ 1728.9
	MC	5-10-14 (24)		(ML) Sandy SILT, yellowish red (5YR 4/6), 0/25/75/0, no to low plasticity, fine sand, medium stiff to stiff, wet, cemented nodules.
	CC			Sandy SILT with Gravel, yellowish red (5YR 5/6), 25/25/50/0, no plasticity, fine sand, fine gravel, wet. Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low plasticity, fine sand, stiff to very stiff, wet, little cemented nodules.
35	MC	14-17-17 (34)		Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low plasticity, fine sand, stiff to very stiff, wet, little cemented nodules.
	CC			
40				40.0 1718.9
	MC	3-6-9 (15)		(ML) SILT, yellowish red (5YR 4/6), 0/5/95/0, no plasticity, soft to medium stiff, wet, trace fine sand.
				42.0 1716.9
	CC			(ML) Sandy SILT, yellowish red (5YR 4/6), 0/20/80/0, no plasticity, fine sand, wet.
45				



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TETRA TECH, INC.

BORING NUMBER UFMW-05I

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	4-10-12 (22)			(ML) *(continued)* Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low plasticity, fine sand, medium stiff to stiff, wet, trace cemented nodules.
	CC				Large cemented nodules, pink (5YR 7/3).
50	MC	5-7-11 (18)			Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, no to low plasticity, fine sand, medium stiff to stiff, wet.
	CC				
55	MC	5-7-11 (18)			Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, no to low plasticity, fine sand, medium stiff to stiff, wet.
	CC				Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, no to low plasticity, fine sand, medium stiff to stiff, wet, trace cemented nodules.
60	MC	3-5-7 (12)		61.5	Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, no to low plasticity, fine sand, medium stiff to stiff, wet, trace cemented nodules. 1697.4

WELL DIAGRAM

Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

BORING NUMBER UFMW-05D

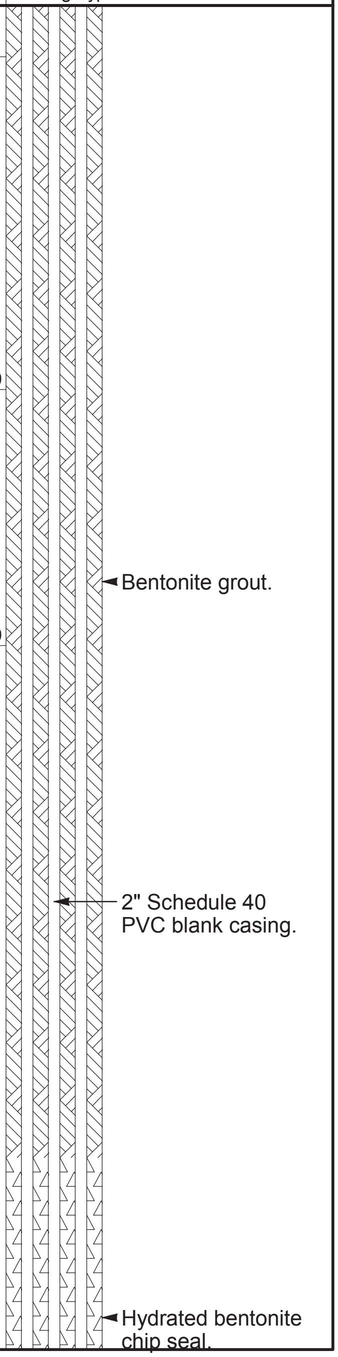
CLIENT Nevada Environmental Response Trust (NERT)		**PROJECT NAME** NERT - AP Area Treatability Study	
PROJECT NUMBER 194-87600012-M13		**PROJECT LOCATION** Henderson, NV	
DATE STARTED 7/22/16	**COMPLETED** 8/3/16	**GROUND ELEVATION** 1758.91 ft	**HOLE SIZE** 12 in
DRILLING CONTRACTOR National EWP		**WATER LEVEL AT TIME OF DRILLING** 30.00 ft / Elev 1728.91 ft	
DRILLING METHOD Hollow Stem Auger		**WATER LEVEL AFTER DRILLING** 27.72 ft / Elev 1731.19 ft	
LOGGED BY Eric Peirce	**CHECKED BY** M. Crews		

NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0				0.8	Compacted base material.	1758.1
				6.0	(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	1752.9
5						
				10.0	Moderate to strong cementation 6' to 10'.	1748.9
10	MC	20-20-25 (45)			(SM) Silty SAND, light reddish brown (5YR 6/3), 5/75/20/0, fine to coarse sand, medium dense, moist.	
	CC					
15	MC	20-27-27 (54)			Silty SAND with Gravel, reddish brown (5YR 4/4), 20/55/25/0, fine to coarse sand, fine gravel, medium dense, moist.	
	CC				Silty SAND, reddish brown (5YR 4/4), 5/70/25/0, fine sand, moist, trace fine gravel.	
20	MC	12-18-27			Silty SAND with Gravel, reddish brown (5YR 4/4), 20/55/25/0, fine to coarse sand, no plasticity, fine gravel,	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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CLIENT Nevada Environmental Response Trust (NERT)

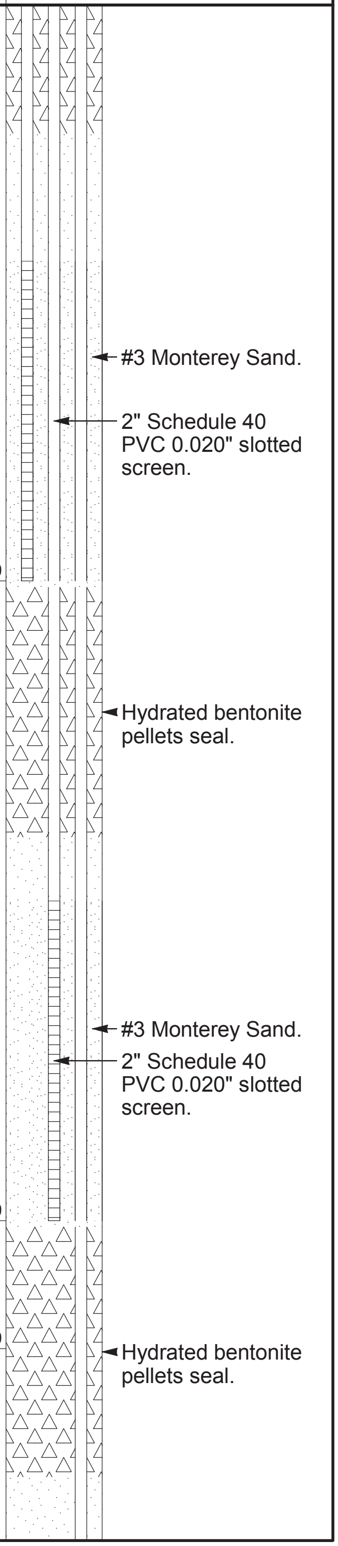
PROJECT NAME NERT - AP Area Treatability Study

PROJECT NUMBER 194-87600012-M13

PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION	
		(45)				medium dense, moist. (SM) *(continued)*	
	CC						
25	MC	40-50				Silty SAND, reddish brown (5YR 5/3), 10/70/20/0, fine to coarse sand, dense, moist, little fine gravel, layer with moderate to strong cementation.	
	CC				▼	Silty SAND, pinkish gray (5YR 6/2), 10/75/15/0, fine to coarse sand, no to low plasticity (silt), moist, little fine gravel.	
30					30.0 ▽		1728.9
	MC	5-10-14 (24)				(ML) Sandy SILT, yellowish red (5YR 4/6), 0/25/75/0, no to low plasticity, fine sand, medium stiff to stiff, wet, cemented nodules.	
	CC					Sandy SILT with Gravel, yellowish red (5YR 5/6), 25/25/50/0, no plasticity, fine sand, fine gravel, wet. Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low plasticity, fine sand, stiff to very stiff, wet, little cemented nodules.	
35	MC	14-17-17 (34)				Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low plasticity, fine sand, stiff to very stiff, wet, little cemented nodules.	
	CC						
40					40.0		1718.9
	MC	3-6-9 (15)				(ML) SILT, yellowish red (5YR 4/6), 0/5/95/0, no plasticity, soft to medium stiff, wet, trace fine sand.	
					42.0		1716.9
	CC					(ML) Sandy SILT, yellowish red (5YR 4/6), 0/20/80/0, no plasticity, fine sand, wet.	
45							

WELL DIAGRAM



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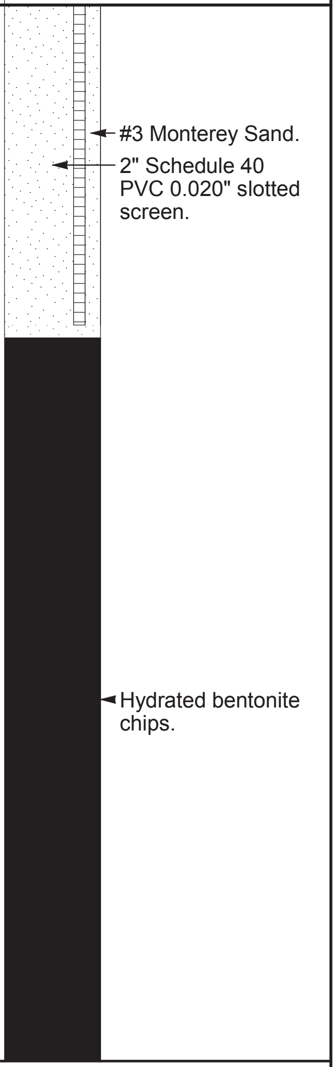
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	4-10-12 (22)			(ML) *(continued)* Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low plasticity, fine sand, medium stiff to stiff, wet, trace cemented nodules.
	CC				Large cemented nodules, pink (5YR 7/3).
50	MC	5-7-11 (18)			Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, no to low plasticity, fine sand, medium stiff to stiff, wet.
	CC				
55	MC	5-7-11 (18)			Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, no to low plasticity, fine sand, medium stiff to stiff, wet.
	CC				Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, no to low plasticity, fine sand, medium stiff to stiff, wet, trace cemented nodules.
60	MC	3-5-7 (12)			Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, no to low plasticity, fine sand, medium stiff to stiff, wet, trace cemented nodules.
				61.5	1697.4

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

BORING NUMBER UFMW-06S

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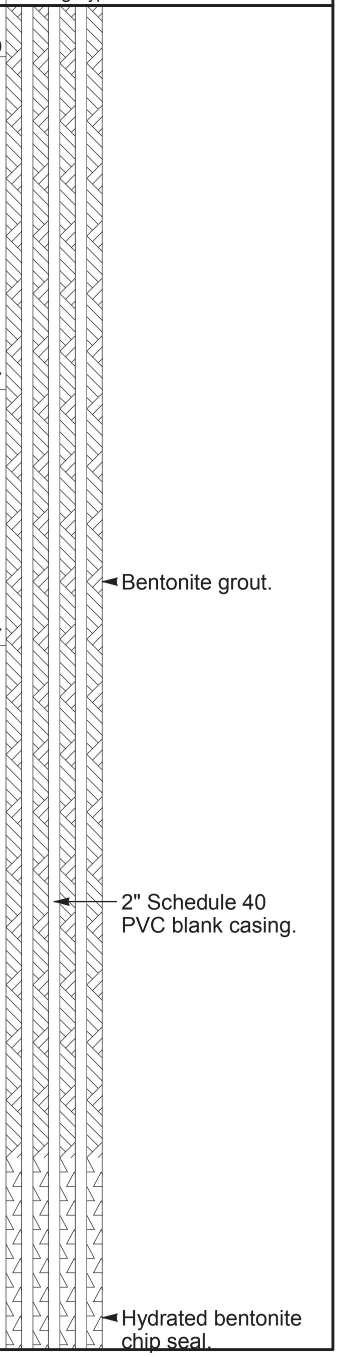
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/22/16 **COMPLETED** 8/2/16
GROUND ELEVATION 1758.74 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 34.00 ft / Elev 1724.74 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.56 ft / Elev 1731.18 ft
LOGGED BY Eric Peirce **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM Casing Type: Schedule 40 PVC
0					Compacted base material.	
				0.8	1757.9	
					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	
5						
				6.0	1752.7	
					Moderate to strong cementation 6' to 10'.	
10				10.0	1748.7	
	MC	23-50			(SM) Silty SAND with Gravel, reddish brown (5YR 5/3), 25/55/20/0, fine to coarse sand, fine to medium gravel, moist.	
	CC					
15	MC	25-25-30 (55)			Silty SAND with Gravel, reddish brown (5YR 5/3), 25/55/20/0, fine to coarse sand, fine to medium gravel, moist.	
	CC				Silty SAND, reddish brown (5YR 5/3), 0/85/15/0, fine to medium sand, moist.	
20	MC	5			Silty SAND with Gravel, reddish brown (5YR 5/3), 15/70/15/0, fine to medium sand, no plasticity, fine gravel,	



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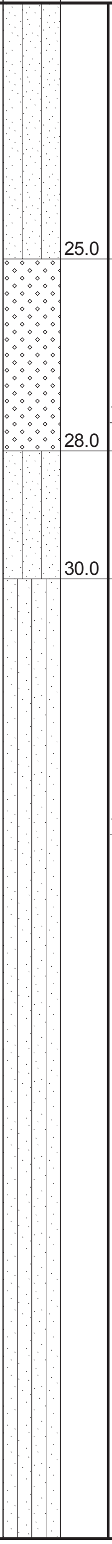
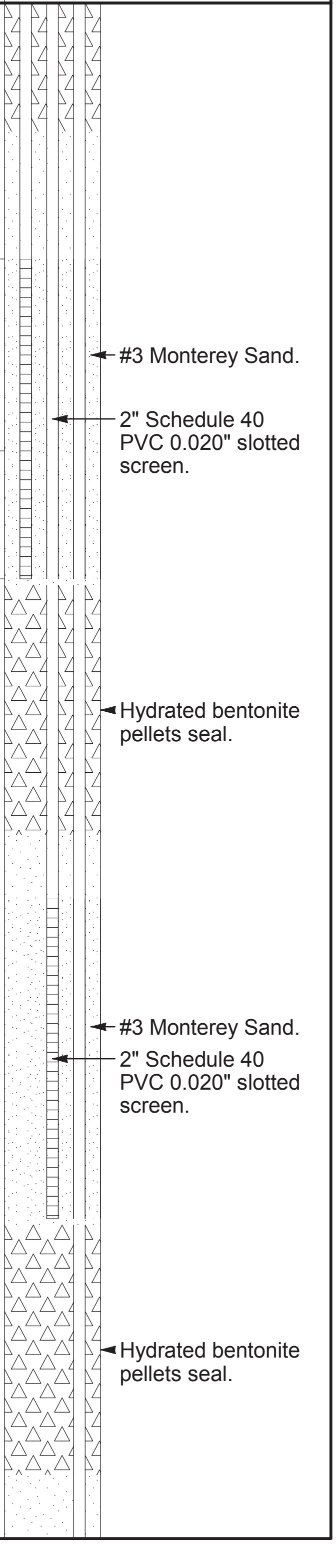
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	MATERIAL DESCRIPTION
				moist. (SM) *(continued)*
	CC			Silty SAND, dark reddish brown (5YR 3/3), 10/75/15/0, fine to medium sand, fine gravel, moist, poorly graded.
25	MC	14-28-50 (78)		25.0 — 1733.7 (SW) SAND, dark reddish brown (5YR 3/3), 10/85/5/0, fine to coarse sand, fine gravel, moist, well graded.
	CC			28.0 — 1730.7 (SM) Silty SAND, dark reddish brown (5YR 3/3), 10/75/15/0, fine to coarse sand, moist, little fine gravel.
30	MC	5-5-5 (10)		30.0 — 1728.7 (ML) Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low to no plasticity, fine sand, moist.
	CC			
35	MC	7-11-12 (23)		Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low to no plasticity, fine sand, wet.
	CC			Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low to no plasticity, fine sand, wet, some coarse gravel. Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low to no plasticity, fine sand, wet.
40	MC	7-10-13 (23)		Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, low plasticity, fine sand, wet.
	CC			
45				

GRAPHIC LOG



WELL DIAGRAM



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TETRA TECH, INC.

BORING NUMBER UFMW-06S

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CLIENT Nevada Environmental Response Trust (NERT)

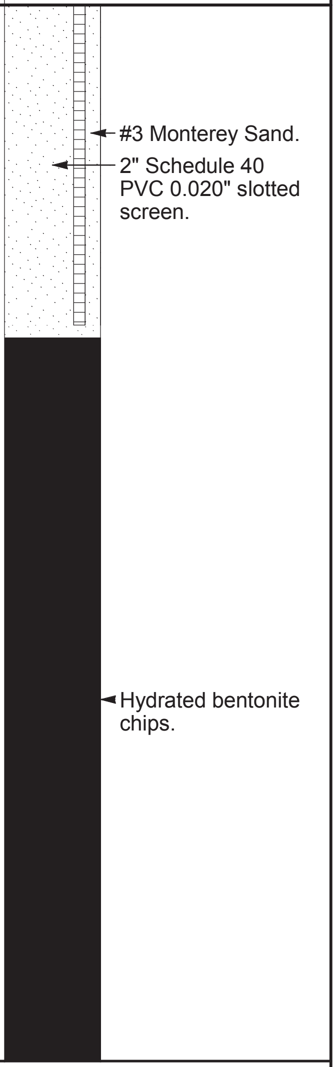
PROJECT NAME NERT - AP Area Treatability Study

PROJECT NUMBER 194-87600012-M13

PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG		MATERIAL DESCRIPTION	
45	MC	3-7-15 (22)				(ML) *(continued)* Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, low plasticity, fine sand, wet, few cemented nodules.	
	CC						
50	MC	3-5-7 (12)				Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, low plasticity, fine to coarse sand, wet, few cemented nodules.	
	CC					Sandy SILT, yellowish red (5YR 5/6), 0/25/75/0, low plasticity, fine sand, wet, few cemented nodules.	
55	MC	7-9-12 (21)				Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, low plasticity, fine to coarse sand, wet, few cemented nodules.	
	CC						
60	MC	3-7-10 (17)			61.5	Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low plasticity, fine to coarse sand, wet, few cemented nodules.	1697.2

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

BORING NUMBER UFMW-06I

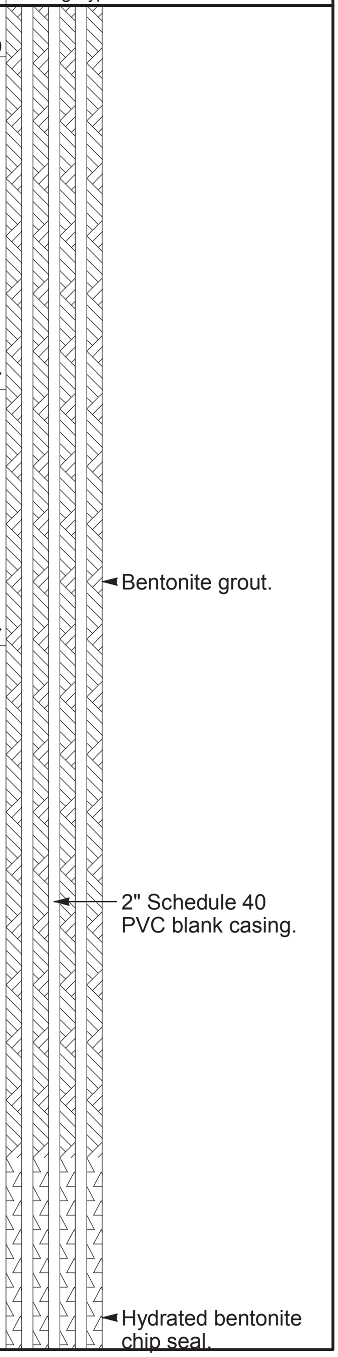
PAGE 1 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/22/16 **COMPLETED** 8/2/16
GROUND ELEVATION 1758.71 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 34.00 ft / Elev 1724.71 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.49 ft / Elev 1731.22 ft
LOGGED BY Eric Peirce **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0					Compacted base material.	
				0.8		1757.9
					(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	
5						
				6.0		1752.7
					Moderate to strong cementation 6' to 10'.	
10				10.0		1748.7
	MC	23-50			(SM) Silty SAND with Gravel, reddish brown (5YR 5/3), 25/55/20/0, fine to coarse sand, fine to medium gravel, moist.	
	CC					
15	MC	25-25-30 (55)			Silty SAND with Gravel, reddish brown (5YR 5/3), 25/55/20/0, fine to coarse sand, fine to medium gravel, moist.	
	CC				Silty SAND, reddish brown (5YR 5/3), 0/85/15/0, fine to medium sand, moist.	
20	MC	5			Silty SAND with Gravel, reddish brown (5YR 5/3), 15/70/15/0, fine to medium sand, no plasticity, fine gravel,	

WELL DIAGRAM

Casing Type: Schedule 40 PVC



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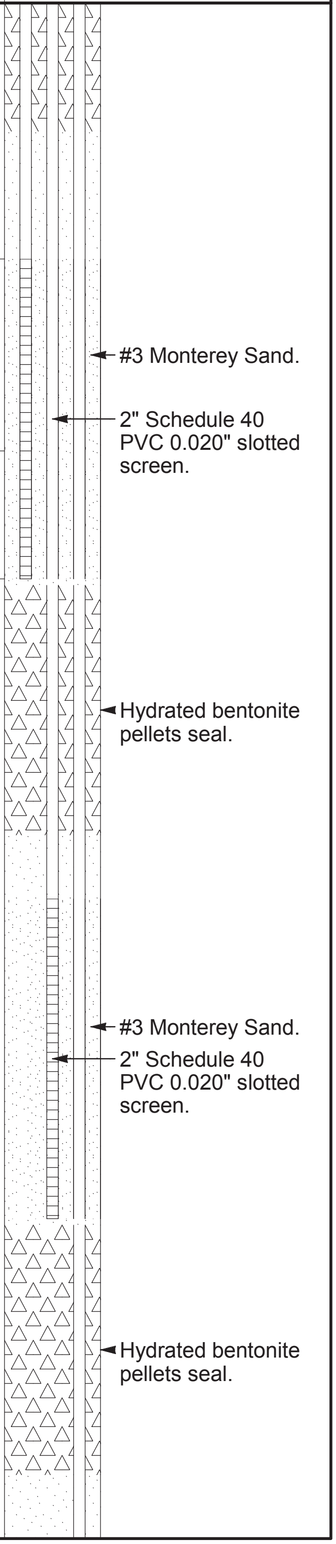
CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	MATERIAL DESCRIPTION	
				moist. (SM) *(continued)*	
	CC			Silty SAND, dark reddish brown (5YR 3/3), 10/75/15/0, fine to medium sand, fine gravel, moist, poorly graded.	
25				25.0	1733.7
	MC	14-28-50 (78)		(SW) SAND, dark reddish brown (5YR 3/3), 10/85/5/0, fine to coarse sand, fine gravel, moist, well graded.	
	CC			▼	
				28.0	1730.7
				(SM) Silty SAND, dark reddish brown (5YR 3/3), 10/75/15/0, fine to coarse sand, moist, little fine gravel.	
30				30.0	1728.7
	MC	5-5-5 (10)		(ML) Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low to no plasticity, fine sand, moist.	
	CC			▽	
35					
	MC	7-11-12 (23)		Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low to no plasticity, fine sand, wet.	
	CC			Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low to no plasticity, fine sand, wet, some coarse gravel. Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low to no plasticity, fine sand, wet.	
40					
	MC	7-10-13 (23)		Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, low plasticity, fine sand, wet.	
	CC				
45					

WELL DIAGRAM



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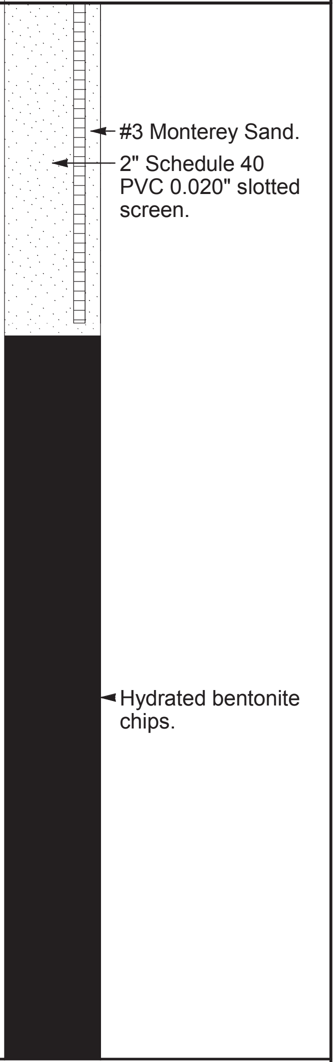
TETRA TECH, INC.

BORING NUMBER UFMW-06I

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	MATERIAL DESCRIPTION
45	MC	3-7-15 (22)		(ML) *(continued)* Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, low plasticity, fine sand, wet, few cemented nodules.
	CC			
50	MC	3-5-7 (12)		Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, low plasticity, fine to coarse sand, wet, few cemented nodules.
	CC			Sandy SILT, yellowish red (5YR 5/6), 0/25/75/0, low plasticity, fine sand, wet, few cemented nodules.
55	MC	7-9-12 (21)		Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, low plasticity, fine to coarse sand, wet, few cemented nodules.
	CC			
60	MC	3-7-10 (17)		Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low plasticity, fine to coarse sand, wet, few cemented nodules.
61.5				1697.2

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

TETRA TECH, INC.

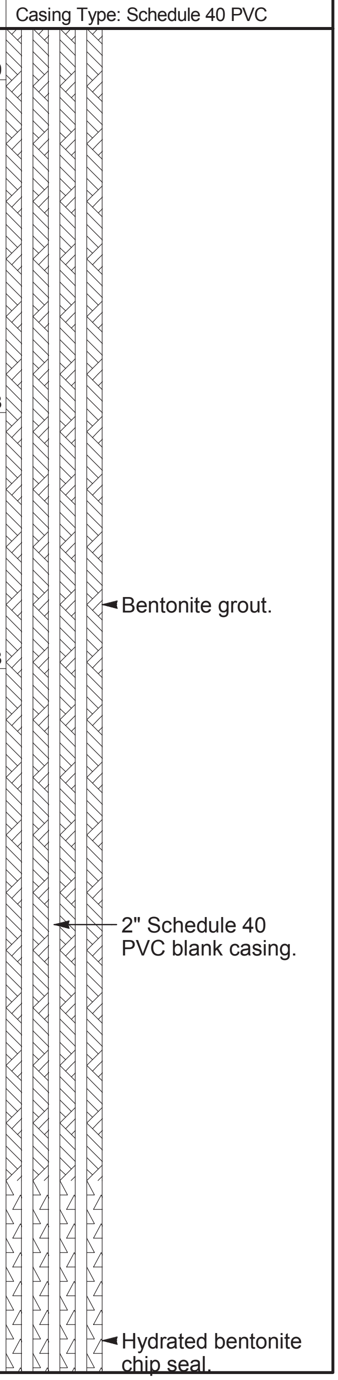
BORING NUMBER UFMW-06D

PAGE 1 OF 3

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV
DATE STARTED 7/22/16 **COMPLETED** 8/2/16
GROUND ELEVATION 1758.76 ft **HOLE SIZE** 12 in
DRILLING CONTRACTOR National EWP
WATER LEVEL AT TIME OF DRILLING 34.00 ft / Elev 1724.76 ft
DRILLING METHOD Hollow Stem Auger
WATER LEVEL AFTER DRILLING 27.56 ft / Elev 1731.20 ft
LOGGED BY Eric Peirce **CHECKED BY** M. Crews
NOTES Well completed with an 18" traffic rated well box. Well is co-located as part of a nested well construction.

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION	
0				0.8	Compacted base material.	1758.0
5				6.0	(SM) Silty SAND, yellowish red (5YR 4/6), 10/75/15/0, fine to medium sand, loose, moist, few fine gravel.	1752.8
10				10.0	Moderate to strong cementation 6' to 10'.	1748.8
	MC	23-50			(SM) Silty SAND with Gravel, reddish brown (5YR 5/3), 25/55/20/0, fine to coarse sand, fine to medium gravel, moist.	
	CC					
15	MC	25-25-30 (55)			Silty SAND with Gravel, reddish brown (5YR 5/3), 25/55/20/0, fine to coarse sand, fine to medium gravel, moist.	
	CC				Silty SAND, reddish brown (5YR 5/3), 0/85/15/0, fine to medium sand, moist.	
20	MC	5			Silty SAND with Gravel, reddish brown (5YR 5/3), 15/70/15/0, fine to medium sand, no plasticity, fine gravel,	

WELL DIAGRAM



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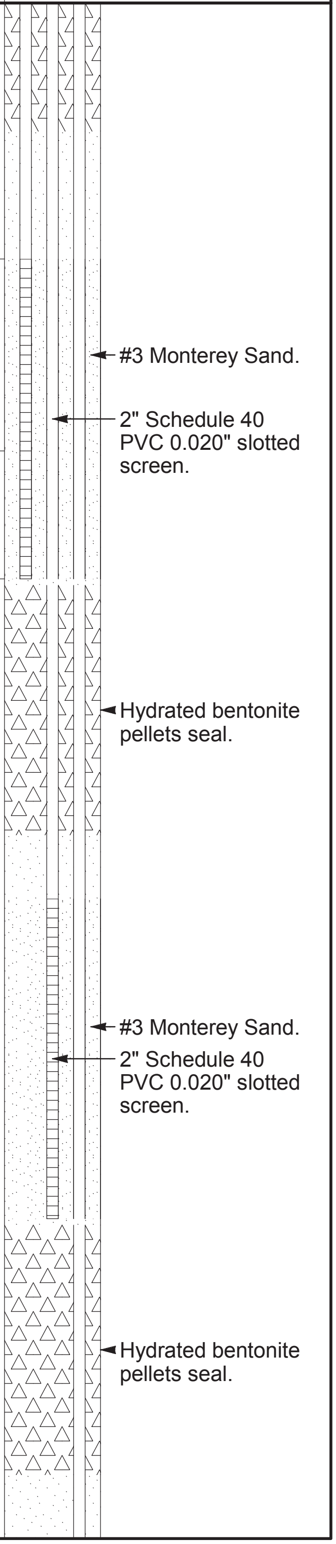
CLIENT Nevada Environmental Response Trust (NERT) **PROJECT NAME** NERT - AP Area Treatability Study

PROJECT NUMBER 194-87600012-M13 **PROJECT LOCATION** Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
	MC				moist. (SM) *(continued)*
	CC				Silty SAND, dark reddish brown (5YR 3/3), 10/75/15/0, fine to medium sand, fine gravel, moist, poorly graded.
25				25.0	1733.8
	MC	14-28-50 (78)			(SW) SAND, dark reddish brown (5YR 3/3), 10/85/5/0, fine to coarse sand, fine gravel, moist, well graded.
	CC			▼	
				28.0	1730.8
					(SM) Silty SAND, dark reddish brown (5YR 3/3), 10/75/15/0, fine to coarse sand, moist, little fine gravel.
30				30.0	1728.8
	MC	5-5-5 (10)			(ML) Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low to no plasticity, fine sand, moist.
	CC			▽	
35					
	MC	7-11-12 (23)			Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low to no plasticity, fine sand, wet.
	CC				Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low to no plasticity, fine sand, wet, some coarse gravel. Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low to no plasticity, fine sand, wet.
40					
	MC	7-10-13 (23)			Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, low plasticity, fine sand, wet.
	CC				
45					

WELL DIAGRAM



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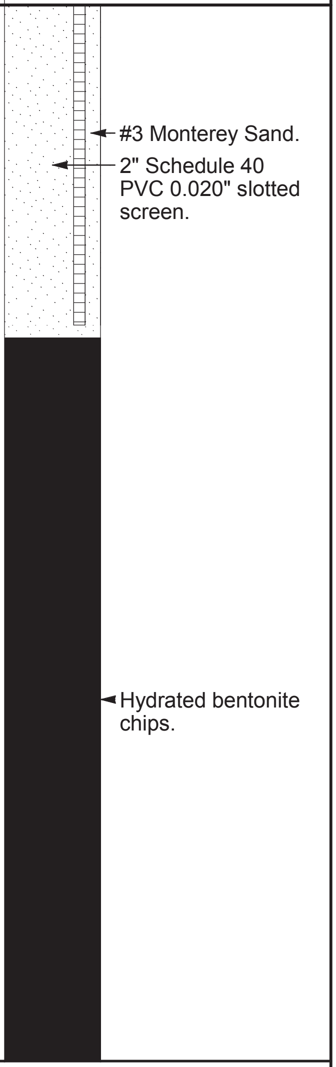
BORING NUMBER UFMW-06D

TETRA TECH, INC.

CLIENT Nevada Environmental Response Trust (NERT)
PROJECT NAME NERT - AP Area Treatability Study
PROJECT NUMBER 194-87600012-M13
PROJECT LOCATION Henderson, NV

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	ENVIRONMENTAL DATA	GRAPHIC LOG	MATERIAL DESCRIPTION
45	MC	3-7-15 (22)			(ML) *(continued)* Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, low plasticity, fine sand, wet, few cemented nodules.
	CC				
50	MC	3-5-7 (12)			Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, low plasticity, fine to coarse sand, wet, few cemented nodules.
	CC				Sandy SILT, yellowish red (5YR 5/6), 0/25/75/0, low plasticity, fine sand, wet, few cemented nodules.
55	MC	7-9-12 (21)			Sandy SILT, yellowish red (5YR 5/6), 0/15/85/0, low plasticity, fine to coarse sand, wet, few cemented nodules.
	CC				
60	MC	3-7-10 (17)		61.5	Sandy SILT, yellowish red (5YR 5/6), 0/20/80/0, low plasticity, fine to coarse sand, wet, few cemented nodules. 1697.3

WELL DIAGRAM



Bottom of borehole at 61.5 feet.

Appendix C
Aquifer Testing Results Technical Memorandum

Biological Reduction Study

TETRA TECH

TECHNICAL MEMORANDUM

To:	**Arul Ayyaswami, Tetra Tech**
Cc:	Carl Lenker and Mike Crews, Tetra Tech
From:	Sonya Cadle, Chris Gutmann, and Ellyn Swenson, Tetra Tech
Date:	November 1, 2017
Subject:	Aquifer Testing Results – In-Situ Chromium Treatability Study

1.0 INTRODUCTION

This technical memorandum presents the results of the aquifer slug testing and specific capacity tests performed as part of the NERT In-Situ Chromium Treatability Study hydrogeological evaluation. The slug tests were conducted in the deep ("D") wells, since there was insufficient water in the shallow ("S") wells to permit slug testing. Specific capacity tests were conducted in both shallow and deep wells and used to provide supplemental estimates of aquifer parameters.

The locations of the wells are shown below. The objective of the aquifer slug and pump testing was to estimate aquifer hydraulic conductivity (K) in the study area before injection testing. Because the shallow alluvial wells had extremely small saturated thicknesses (often less than a foot), the aquifer parameter estimates were extremely dependent on the exact saturated thickness. Hence, these estimates were not considered representative of the overall K of the alluvium but proved useful in estimating potential injection rates. Selected wells were also tested after the injection was completed to assess whether the injections affected hydraulic conductivity.

2.0 SLUG TESTS

Slug testing was performed in February, April, and October/November 2017. Well construction information is provided in Table 1. The tests consisted of monitoring water level displacements caused by the insertion or removal of a solid slug from a well. Water level displacement was measured using a Solinst Levelogger Gold M5 pressure transducer, which was programmed to collect data at one-half second time intervals. When the rate of recovery allowed multiple tests, several tests were performed at each well. The size of the slug was selected to be consistent with the diameter of the well.

The slug test data were downloaded from the transducer and the drawdown was calculated from the downloaded data. Several slug tests were selected for analysis from each well. Slug test analysis was performed using the commercially-available AQTESOLV software (HydroSOLVE 2007). The Bouwer and Rice (1976) method for analyzing slug tests in an unconfined aquifer was used to estimate hydraulic conductivity. The AQTESOLV interpretation plots are provided as Attachment A. Table 2 summarizes the results of the slug test analysis; the K values provided for each well represent a mean of the K estimates obtained from individual tests at that well. Water levels measured during the testing events are summarized in Table 3.

All tested wells were screened in the Upper Muddy Creek Formation (UMCf). The estimated Ks are generally consistent with the logged lithology of the screened interval of the wells, which was primarily silt to sandy silt. Prior estimates of the hydraulic conductivity for the UMCf have ranged from less than 0.01 feet per day (ft/day) to more than 10 ft/day. The estimates from the In-Situ Chromium Treatability Study area slug tests ranged from about 0.2 to 3 ft/day, which is consistent with the previous range.

Many factors can affect slug test results. In considering whether the K from a slug test is representative of the overall formation K, the values estimated from slug tests are strongly influenced by factors such as a low-K well skin, drilling-induced disturbances, highly anisotropic formations, and the quality of well development (Butler 1998, Hyder and Butler 1995). Other possible factors could include non-instantaneous or incomplete slug removal, accidental transducer or slug movement after the test began, and others. However, in general, the individual slug tests analyzed were very consistent within each well.

3.0 SPECIFIC CAPACITY TESTS

Specific capacity tests were performed in shallow wells as well as some deep wells. Each well was pumped for 20-30 minutes at a low flow rate and then allowed to recover. Most tests were analyzed using the Theis (1935) method or the Hantush-Jacob (1955) leaky aquifer solution. Table 4 presents the estimated hydraulic conductivity for each of the specific capacity tests.

Because specific capacity tests are not commonly used to estimate K, the specific capacity K estimates in the deeper wells were compared to the corresponding slug test K estimates from the same wells. The results were quite similar, as a quick comparison of Tables 2 and 4 will confirm. However, the specific capacity test results from the shallow wells are likely to be heavily influenced by saturated thickness, since less than two feet of saturated thickness exists in the shallow wells. For example, if the saturated interval of a well consists of a 5-inch sand stringer underlain by primarily silt, then decreasing the saturated thickness by only a few inches would significantly decrease the well’s production capacity and hence the estimated K. This may be what happened to wells CTMW-01S and CTMW-02S when the saturated thickness decreased by about half a foot between April and October 2017. The wells’ production capacity decreased so significantly that they quickly went dry, even when pumped at a much lower rate.

4.0 COMPARISON BEFORE AND AFTER INJECTIONS

Treatability study-related injections began after the April 2017 aquifer testing event was completed. Several wells were tested in October/November 2017 after all injections were completed in order to assess whether the injections had potentially influenced K. The K estimates from the pre-injection (December 2016 and April 2017) and post-injection (October/November 2017) tests are provided in Table 2.

The comparison of aquifer test results before and after treatability study-related injections showed that most wells experienced no significant changes between the K estimates before and after injection occurred. There were several exceptions:

- Well CTIW-02D experienced a decrease in K of approximately one order of magnitude between the April and November 2017 slug tests. Because well CTIW-02D was used for injection, well fouling is a possible cause for the K change.

- Wells CTMW-01S and CTMW-02S also experienced significant decreases in K. However, as discussed in the prior section, the decrease in saturated thickness between the two tests may be the cause of this change.

5.0 REFERENCES

Bouwer, H. and Rice, R.C., 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, pp. 423-428.

Butler, James J. Jr., 1998. The Design, Performance, and Analysis of Slug Tests., CRC Press LLC, 252 pages.

Hantush, M.S., 1960. Modification of the theory of leaky aquifers, Jour. of Geophys. Res., vol. 65, no. 11, pp. 3713-3725.

Hantush, M.S. and C.E. Jacob, 1955. Non-steady radial flow in an infinite leaky aquifer, Am. Geophys. Union Trans., vol. 36, pp. 95-100.

Hyder, Z. and Butler, J.J. Jr., 1995. Slug tests in unconfined formations: an assessment of the Bouwer and Rice technique, Ground Water, vol. 33, no. 1, pp. 16-22.

HydroSOLVE, Inc., 2007. AQTESOLV version 4.50 – Professional. Developed by Glenn M. Duffield

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, Am. Geophys. Union Trans., vol. 16, pp. 519-524

Table 1: Well Construction Information
In-Situ Chromium Treatability Study, Henderson, Nevada

Well ID	UMCf Contact (feet bgs)	Screened Interval (feet bgs)	Screen Length (feet)	Top of Casing (feet amsl)	Well Diameter (inches)	Slug Dimensions	
						Diameter (inches)	Length (feet)
CTIW-01S	23.5	18.5 - 23.5	5	1,757.41	2	--	--
CTIW-01D	23.5	33 - 38	5	1,757.34	2	1.66	5
CTIW-02S	24	19 - 24	5	1,757.45	2	--	--
CTIW-02D	24	34 - 49	15	1,757.31	2	1.66	5
CTIW-03S	24	19 - 24	5	1,757.32	2	--	--
CTIW-03D	24	34 - 49	15	1,757.48	2	1.66	5
CTMW-01S	24	19 - 24	5	1,757.16	2	--	--
CTMW-01D	24	34 - 49	15	1,757.14	2	1.66	5
CTMW-02S	24	19 - 24	5	1,757.21	2	--	--
CTMW-02D	24	34 - 49	15	1,757.26	2	1.66	5
CTMW-03S	24	19 - 24	5	1,757.21	2	--	--
CTMW-03D	24	34 - 39	5	1,757.23	2	1.66	5
CTMW-04S	24	19 - 24	5	1,757.00	2	--	--
CTMW-04D	24	34 - 49	15	1,757.00	2	1.66	5
CTMW-05S	24	19 - 24	5	1,757.24	2	--	--
CTMW-05D	24	34 - 54	20	1,757.25	2	1.66	5
CTMW-06S	24	19 - 24	5	1,757.43	2	--	--
CTMW-06D	24	34 - 54	20	1,757.42	2	1.66	5

Notes:

Shallow "S" wells were not tested because the saturated thickness was too small to support slug

bgs - below ground surface

amsl - above mean sea level

UMCf - Upper Muddy Creek Formation

Table 2: Slug Test Results
In-Situ Chromium Treatability Study, Henderson, Nevada

Well	Date	Mean Hydraulic Conductivity		Logged Lithology of Screened Interval
		(feet/day)	(cm/sec)	
CTIW-01D	12/9/2016	1.4	5.00E-04	Silt
	10/31/2017	0.9	3.03E-04	Silt
CTIW-02D	4/10/2017	1.0	3.42E-04	Silt
	11/1/2017	0.1	3.05E-05	Silt
CTIW-03D	4/10/2017	0.3	1.23E-04	Silt
	11/1/2017	0.4	1.24E-04	Silt
CTMW-01D	4/10/2017	0.5	1.94E-04	Silt
	10/4/2017	0.7	2.49E-04	Silt
CTMW-02D	4/10/2017	0.6	2.03E-04	Silt
	10/4/2017	0.5	1.79E-04	Silt
CTMW-03D	12/9/2016	2.5	9.00E-04	Silt
	10/5/2017	3.1	1.10E-03	Silt
CTMW-04D	4/10/2017	1.1	3.93E-04	Silt
	10/5/2017	1.3	4.42E-04	Silt
CTMW-05D	10/5/2017	1.5	5.12E-04	Silt
CTMW-06D	10/4/2017	1.0	3.59E-04	Silt

Notes:
cm/sec - centimeters per second

Table 3: Water Levels
In-Situ Chromium Treatability Study, Henderson, Nevada

Well ID	Date	Total Depth (feet btoc)	Water Level (feet btoc)
CTIW-01S	12/7/2016	23.55	22.77
	2/28/2017	23.55	21.94
	4/3/2017	23.20	22.26
CTIW-01D	12/7/2016	38.00	22.79
	2/28/2017	38.00	21.89
	4/3/2017	37.80	22.21
	10/31/2017	37.80	22.57
CTIW-02S	4/3/2017	23.60	22.49
CTIW-02D	4/3/2017	48.40	22.52
	11/1/2017	48.40	22.92
CTIW-03S	4/3/2017	23.50	22.53
CTIW-03D	4/3/2017	48.60	22.8
	11/1/2017	48.60	23.44
CTMW-01S	4/3/2017	23.50	22.21
	10/10/2017	25.00	22.68
CTMW-01D	4/3/2017	48.50	22.37
	10/4/2017	49.20	22.9
CTMW-02S	4/3/2017	23.40	22.47
	10/10/2017	25.00	23.25
CTMW-02D	4/3/2017	48.40	22.72
	10/4/2017	49.18	23.38
CTMW-03S	12/7/2016	24.05	23.04
	2/28/2017	24.05	22.17
	4/3/2017	23.60	22.36
	10/9/2017	25.00	22.74
CTMW-03D	12/7/2016	39.50	23.1
	2/28/2017	39.50	22.25
	4/3/2017	38.60	22.43
	10/5/2017	39.49	22.87
CTMW-04S	4/3/2017	23.30	22.37
	10/9/2017	25.00	22.95
CTMW-04D	4/3/2017	48.30	22.62
	10/5/2017	48.99	23.14
CTMW-05S	10/9/2017	25.00	23.38
CTMW-05D	10/5/2017	54.00	23.55
CTMW-06S	10/9/2017	25.00	23.65
CTMW-06D	10/4/2017	55.00	23.99

Notes:
btoc - below top of casing

Table 4: Specific Capacity Test Test Results
In-Situ Chromium Treatability Study, Henderson, Nevada

Well	Date	Analysis Type	Flow Rate (L/min)	Saturated Thickness (feet)	Estimated Hydraulic		Logged Lithology of Screened Interval
					(feet/day)	(cm/sec)	
CTIW-01S	2/28/2017	Theis, Unconfined	0.50	1.24	61	2.15E-02	Silty sand with gravel
		Theis, Unconfined	0.75	1.24	61	2.17E-02	
CTIW-01D	2/28/2017	Theis, Confined	1.50	6.00	1.5	5.43E-04	Silt
	4/7/2017	Theis, Confined	3.00	6.00	1.0	3.59E-04	
CTIW-02S	4/6/2017	Theis, Unconfined	1.20	1.51	30	1.05E-02	Well graded sand to silty sand
CTIW-02D	4/7/2017	Theis, Confined	0.70	16.00	0.6	2.23E-04	Silt
CTIW-03S	4/6/2017	Theis, Unconfined	1.00	1.47	53	1.87E-02	Well graded sand to silty sand
CTIW-03D	4/7/2017	Theis, Confined	0.50	16.00	0.2	6.65E-05	Silt
CTMW-01S	2/28/2017	Theis, Unconfined	1.00	1.79	15	5.12E-03	Well graded sand with silt
	10/10/2017	Bouwer-Rice, Slug Test*	0.20	1.32	0.41	1.45E-04	
CTMW-01D	4/7/2017	Theis, Confined	0.30	16.00	0.5	1.92E-04	Silt
CTMW-02S	4/6/2017	Theis, Unconfined	0.70	1.53	27	9.39E-03	Well graded sand with silt and gravel
	10/10/2017	Bouwer-Rice, Slug Test*	0.10	0.75	0.51	1.80E-04	
CTMW-02D	4/7/2017	Theis, Confined	0.75	16.00	0.4	1.41E-04	Silt
CTMW-03S	2/28/2017	Theis, Unconfined	0.50	1.64	75	2.64E-02	Silty sand with gravel
CTMW-03S	10/9/2017	Theis, Unconfined	1.00	1.26	134	4.71E-02	Silty sand with interbedded sand with gravel
		Hantush-Jacob, Leaky	1.00	1.26	123	4.34E-02	
CTMW-03D	2/28/2017	Theis, Confined	2.00	6.00	3.0	1.05E-03	Silt with fine to coarse grained sand and gravel
CTMW-04S	4/7/2017	Theis, Unconfined	1.00	1.63	34	1.20E-02	Well graded sand to silty sand
	10/9/2017	Hantush-Jacob, Leaky	0.50	1.05	22.8	8.05E-03	
CTMW-04D	4/7/2017	Theis, Confined	0.50	16.00	0.4	1.28E-04	Silt
CTMW-05S	10/9/2017	Theis, Unconfined	0.50	0.62	46	1.61E-02	Well graded sand
		Hantush-Jacob, Leaky	0.50	0.62	27	9.58E-03	
CTMW-06S	10/9/2017	Theis, Unconfined	0.50	0.35	119.5	4.22E-02	Well graded sand
		Hantush-Jacob, Leaky	0.50	0.35	90.6	3.20E-02	

Notes:
cm/sec - centimeters per second
* Test analyzed as a slug test because the well went dry very quickly

Imagery Sources: Esri World Map, June 2015.

TETRA TECH

www.tetratech.com

150 S. 4th Street, Unit A
Henderson, Nevada 89015
PHONE: (702) 854-2293

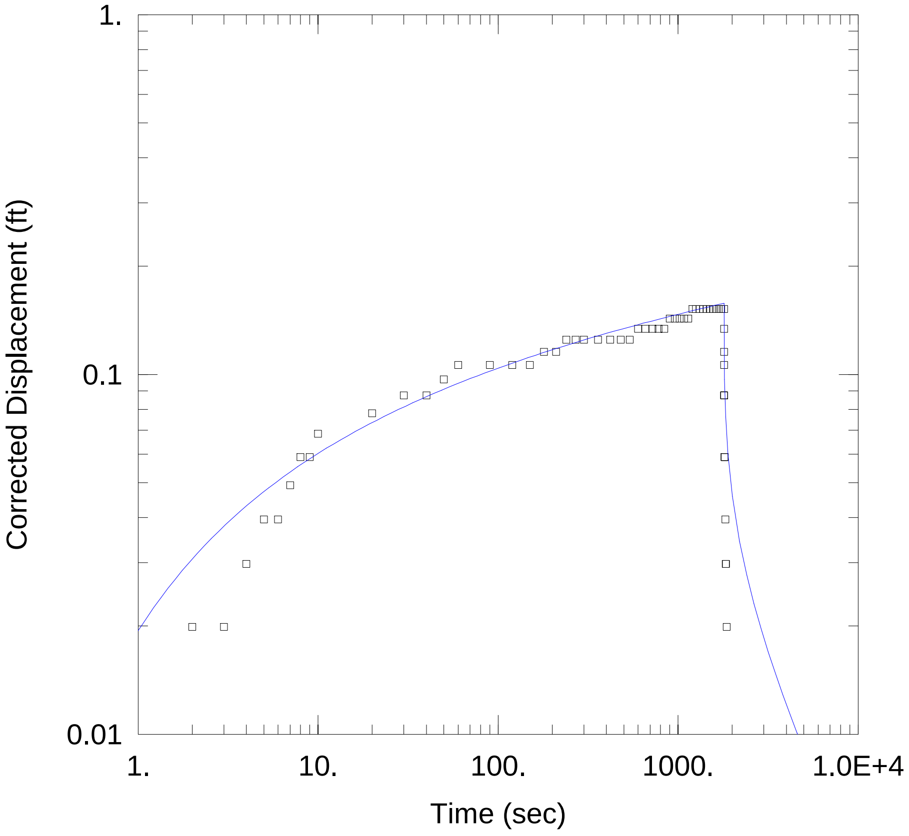
NEVADA ENVIRONMENTAL RESPONSE TRUST SITE

IN-SITU CHROMIUM SLUG AND SPECIFIC CAPACITY TESTS
HENDERSON, NEVADA

WELL LOCATIONS

Project No.:	117-7502017
Date:	OCTOBER 25, 2017
Designed By:	ES
Figure No.	1

\\GEOS051FS1\GEOLVOL1\PROJECTS\DATA\NERT\M02\FEBRUARY MEETING\FIGURES\MXD\REVISIONS\042617\FIGURE01_SITELOCATION.MXD



PUMPING TEST FOR CTIW-01S (0.5 L/MIN)

Data Set: T:\...\CTIW-01S.aqt
Date: 05/01/17 Time: 16:05:10

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-01S
Test Date: 2/28/2017

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 98.16 ft^2/day
S = 0.0114
Kz/Kr = 0.1
b = 1.61 ft

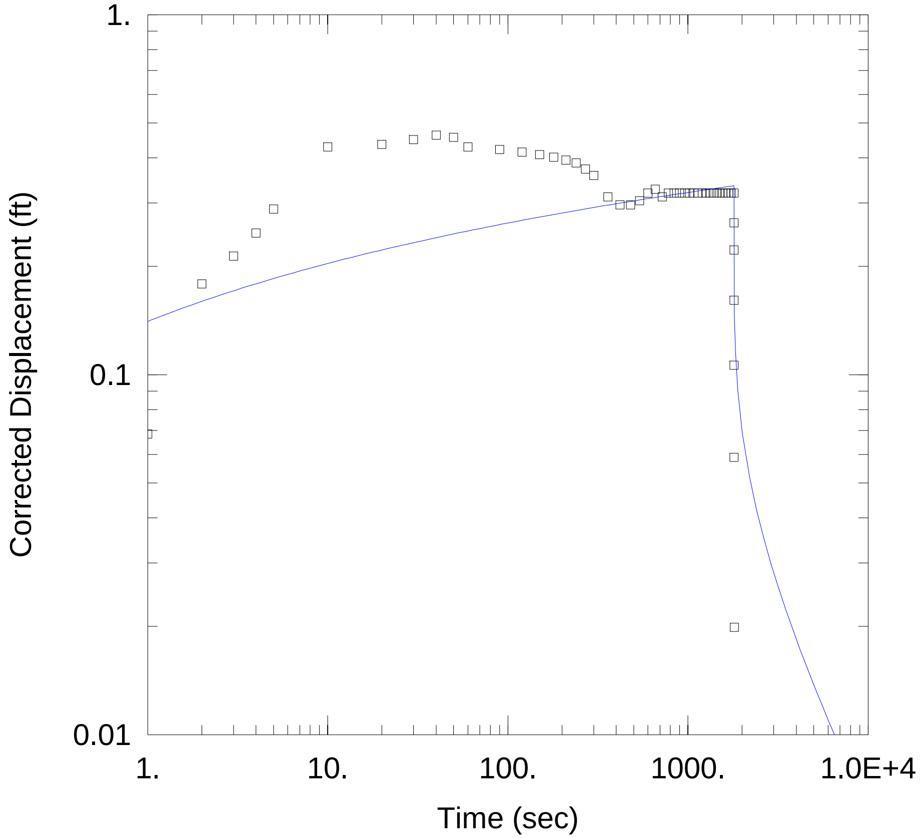
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTIW-01S	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTIW-01S	0	0



PUMPING TEST FOR CTIW-01S, 0.75L/MIN

Data Set: T:\...\CTIW-01S 0.75.aqt
Date: 05/02/17 Time: 14:23:09

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-01S
Test Date: 2/28/2017

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 98.86 ft^2/day
S = 0.0002011
Kz/Kr = 0.1
b = 1.61 ft

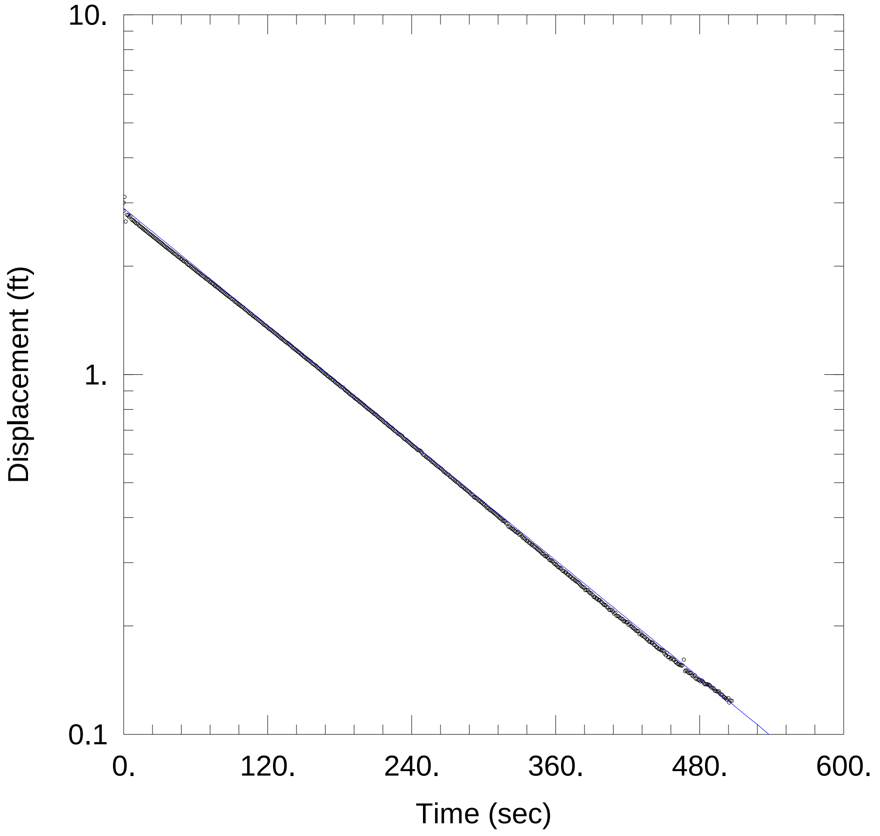
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTIW-01S	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTIW-01S	0	0



CTIW-01D SLUG IN 1

Data Set: T:\...\CTIW_01D_slugin_1.aqt
Date: 01/06/17 Time: 14:41:59

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-01D
Test Date: 12/09/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

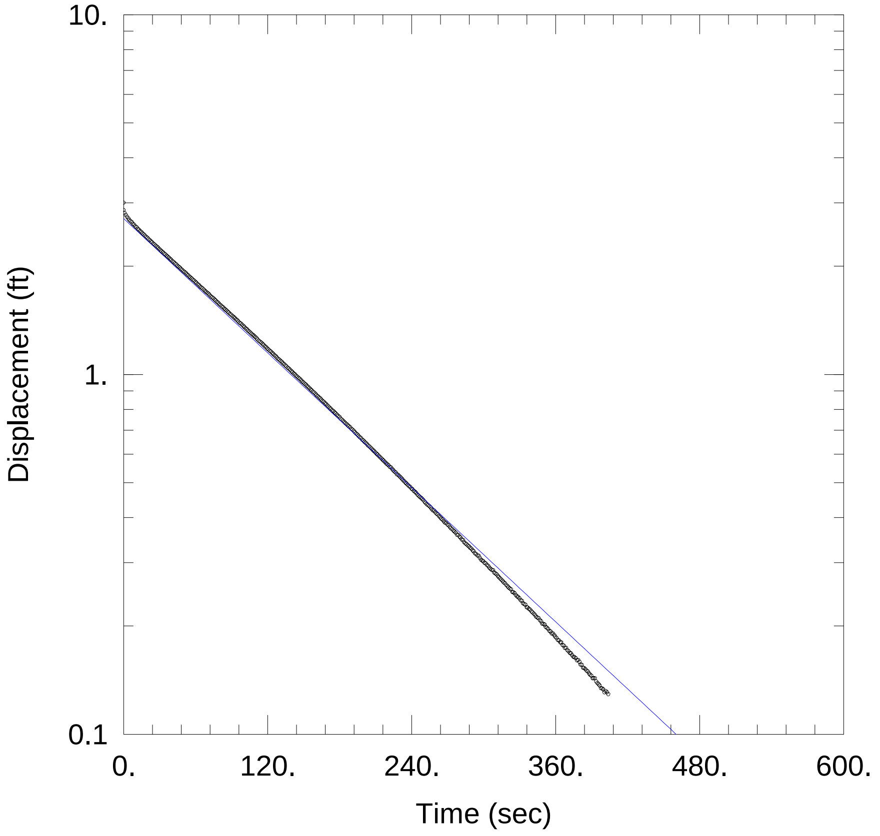
K = 1.347 ft/day
y0 = 2.896 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTIW-01D)

Initial Displacement: 3. ft
Total Well Penetration Depth: 14.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 15.21 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



CTIW-01D SLUG OUT 1

Data Set: T:\...\CTIW_01D_slugout_1.aqt
Date: 01/06/17 Time: 14:32:29

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-01D
Test Date: 12/09/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

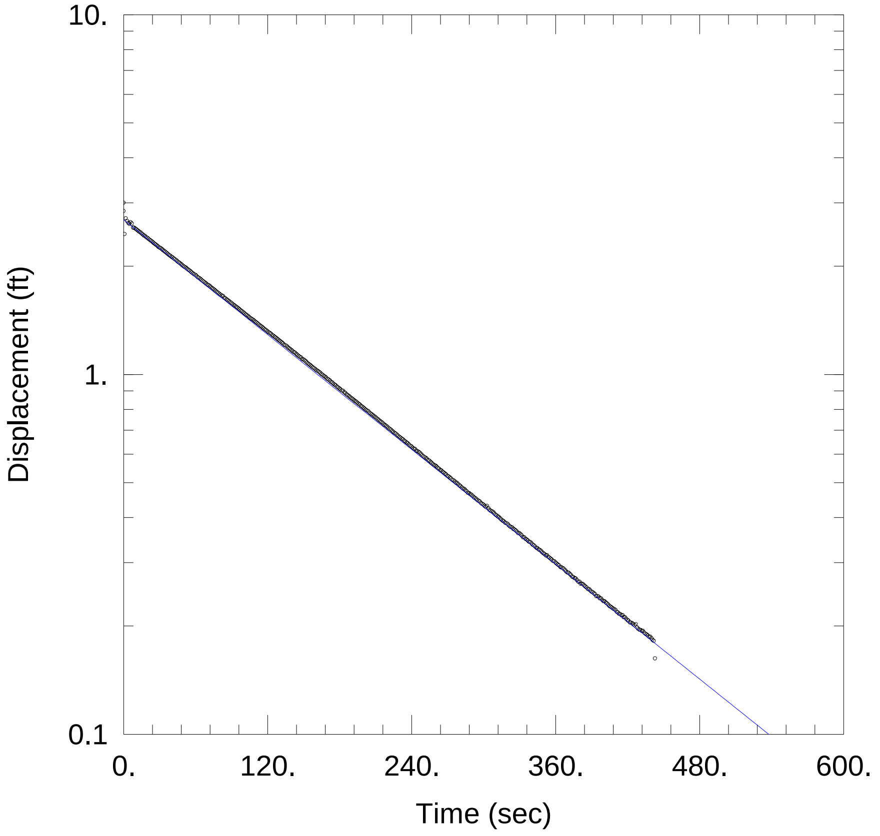
K = 1.543 ft/day
y0 = 2.714 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTIW-01D)

Initial Displacement: 3. ft
Total Well Penetration Depth: 14.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 15.21 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



CTIW-01D SLUG IN 2

Data Set: T:\...\CTIW_01D_slugin_2.aqt
Date: 01/06/17 Time: 14:32:14

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-01D
Test Date: 12/09/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

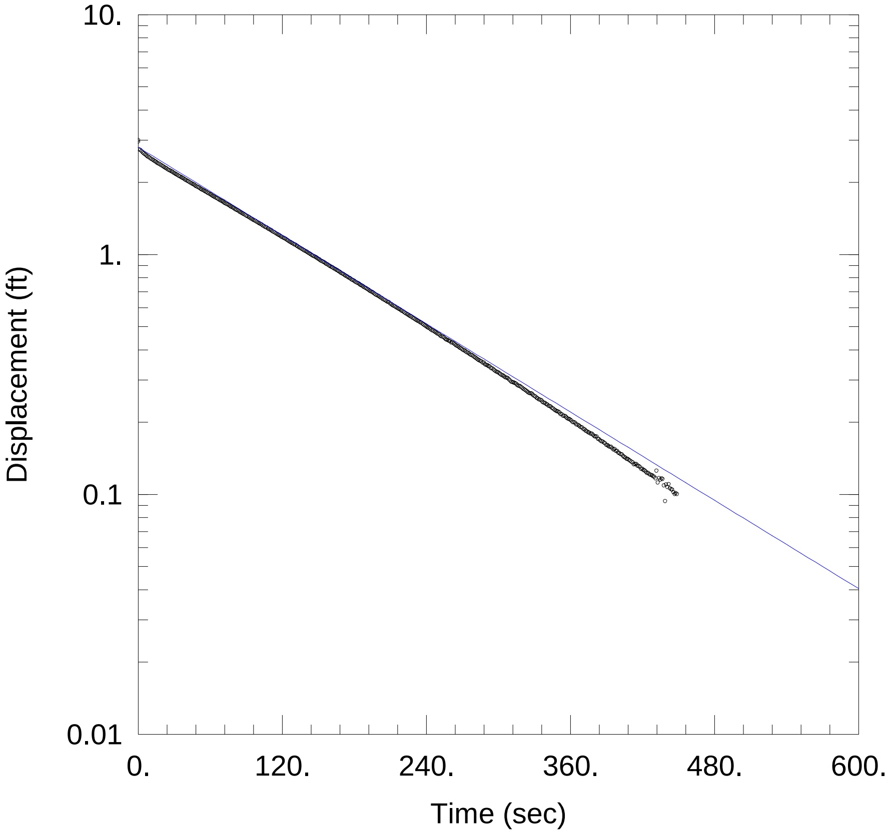
K = 1.318 ft/day
y0 = 2.689 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTIW-01D)

Initial Displacement: 3. ft
Total Well Penetration Depth: 14.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 15.21 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



CTIW-01D SLUG OUT 2

Data Set: T:\...\CTIW_01D_slugout_2.aqt
Date: 01/06/17 Time: 14:32:43

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-01D
Test Date: 12/09/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

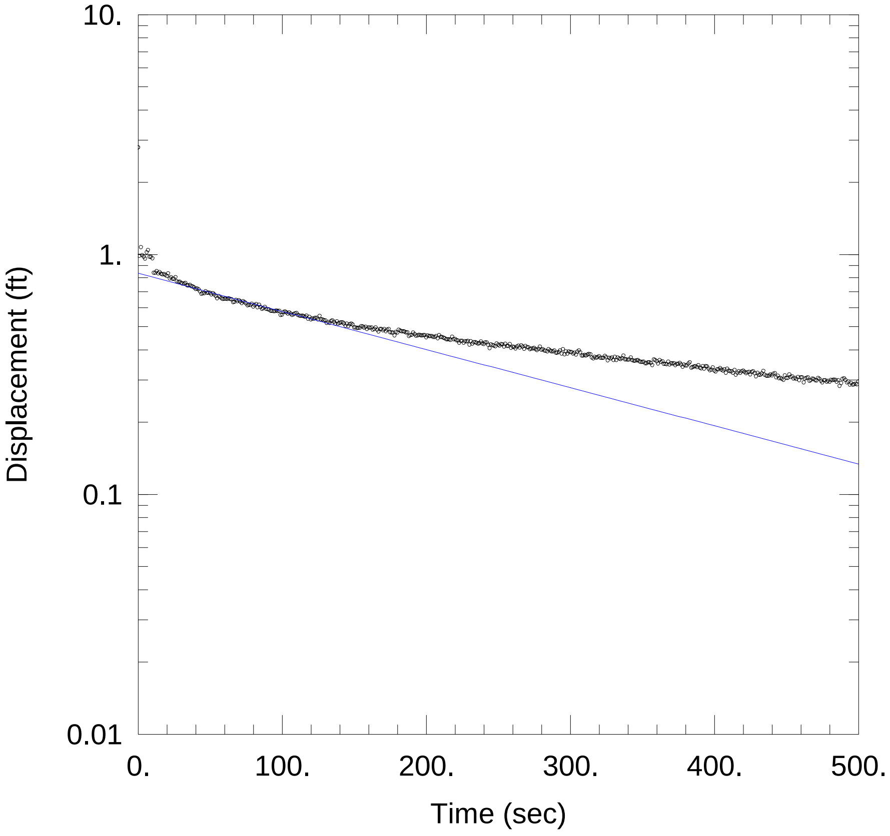
K = 1.52 ft/day
y0 = 2.803 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTIW-01D)

Initial Displacement: 3. ft
Total Well Penetration Depth: 14.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 15.21 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



CTIW-01D SLUG IN 1

Data Set: \...\CTIW_01D_slugin_1.aqt
Date: 11/01/17 Time: 14:17:32

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-01D
Test Date: 10/31/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

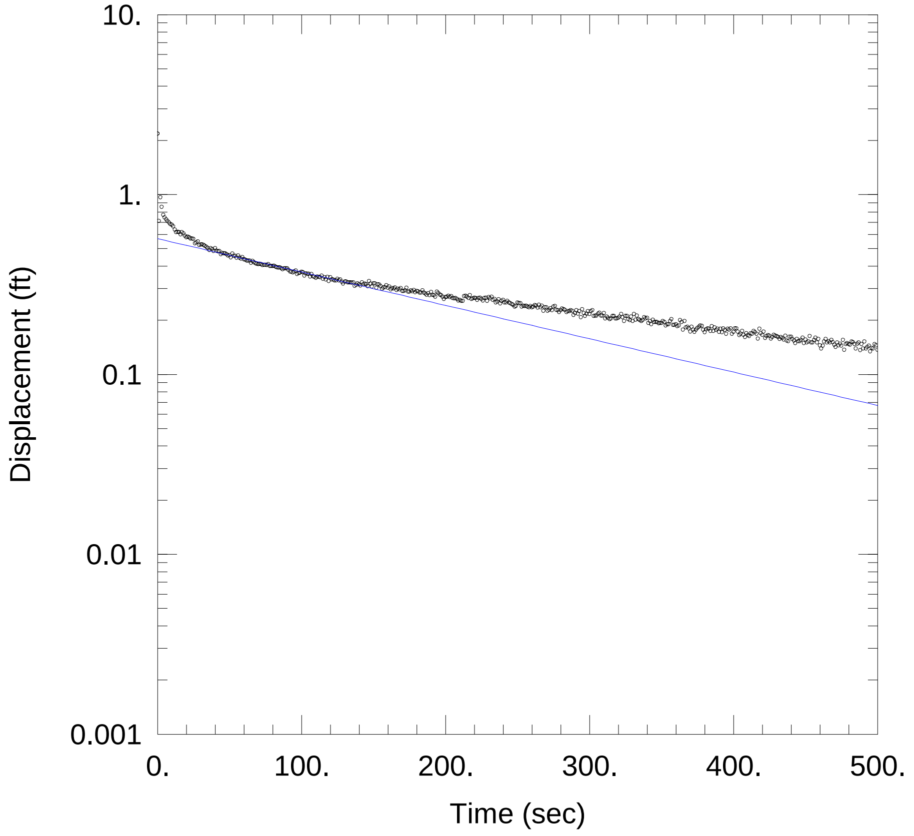
K = 0.7944 ft/day
y0 = 0.8348 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTIW-01D)

Initial Displacement: 2.795 ft
Total Well Penetration Depth: 15.23 ft
Casing Radius: 0.083 ft
Static Water Column Height: 15.23 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



CTIW-01D SLUG OUT 1

Data Set: \...\CTIW_01D_slugout_1.aqt
Date: 11/01/17 Time: 14:37:09

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-01D
Test Date: 10/31/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

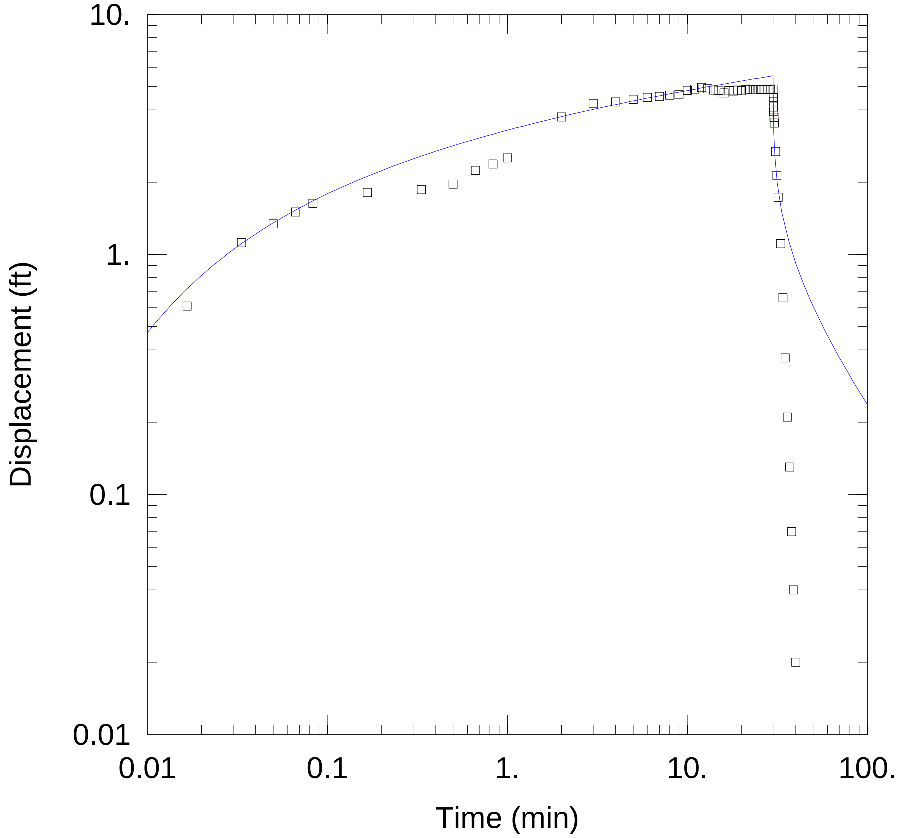
K = 0.9262 ft/day
y0 = 0.5679 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTIW-01D)

Initial Displacement: 2.175 ft
Total Well Penetration Depth: 15.23 ft
Casing Radius: 0.083 ft
Static Water Column Height: 15.23 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



PUMPING TEST FOR CTIW-01D (1.5 L/MIN)

Data Set: \...\CTIW-01D 1.5.aqt
Date: 05/02/17 Time: 09:20:29

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Project: In-Situ Chromium Treatment
Location: Henderson NV
Test Well: CTIW-01D
Test Date: 2-28-2017

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 9.232 ft^2/day
S = 0.0009148
Kz/Kr = 0.1
b = 6. ft

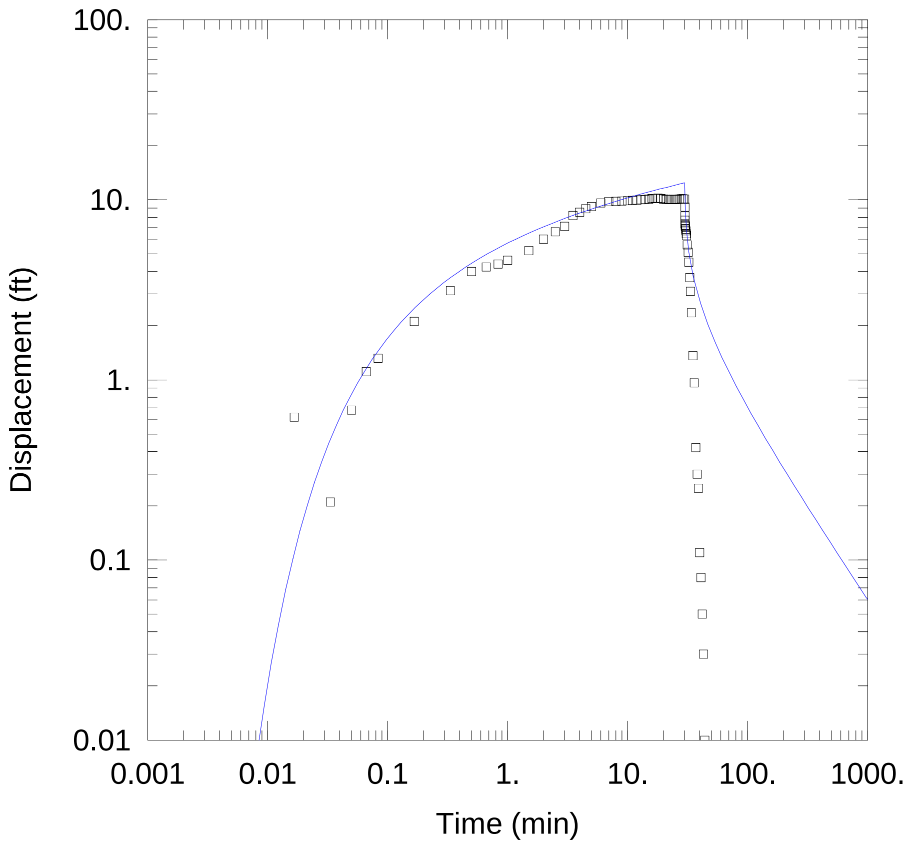
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTIW-01D	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTIW-01D	0	0



PUMPING TEST FOR CTIW-01D (3.0 L/MIN)

Data Set: \...\CTIW-01D 3.0.aqt
Date: 05/02/17 Time: 09:14:00

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Project: In-Situ Chromium Treatment
Location: Henderson NV
Test Well: CTIW-01D
Test Date: 4-7-2017

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 6.11 ft^2/day
S = 0.004891
Kz/Kr = 0.1
b = 6. ft

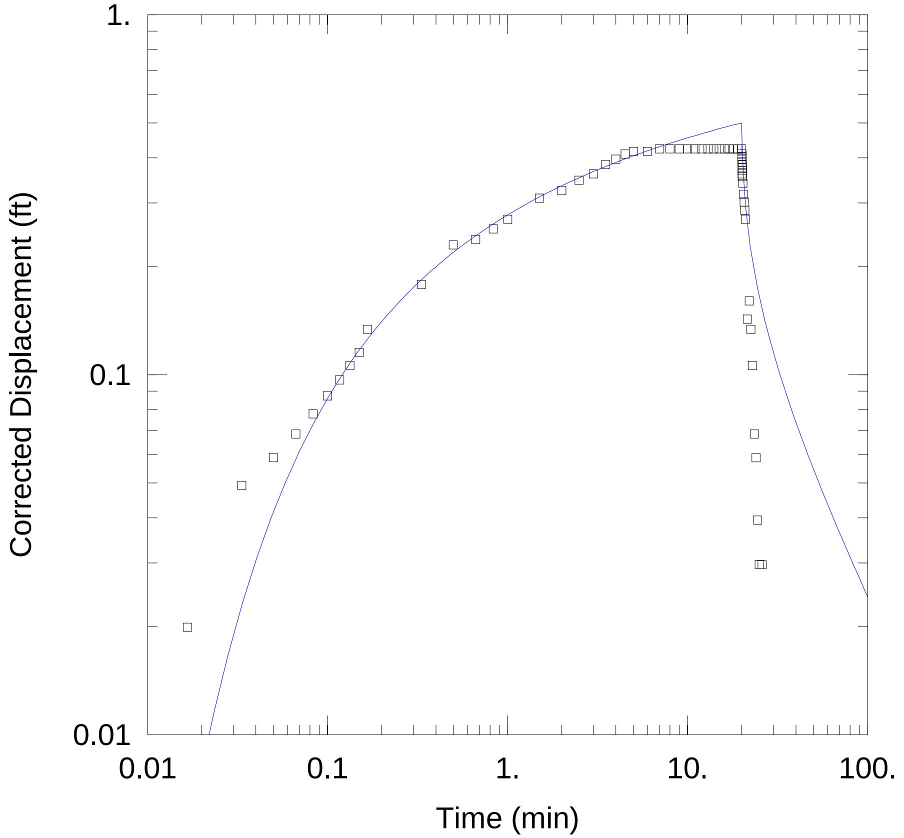
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTIW-01D	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTIW-01D	0	0



PUMPING TEST FOR CTIW-02S (1.2 L/MIN)

Data Set: T:\...\CTIW-02S 1.2.aqt
Date: 05/02/17 Time: 10:19:39

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Project: In-Situ Chromium Treatment
Location: Henderson NV
Test Well: CTIW-02S
Test Date: 4-6-2017

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 44.85 ft^2/day
S = 0.03848
Kz/Kr = 0.1
b = 1.51 ft

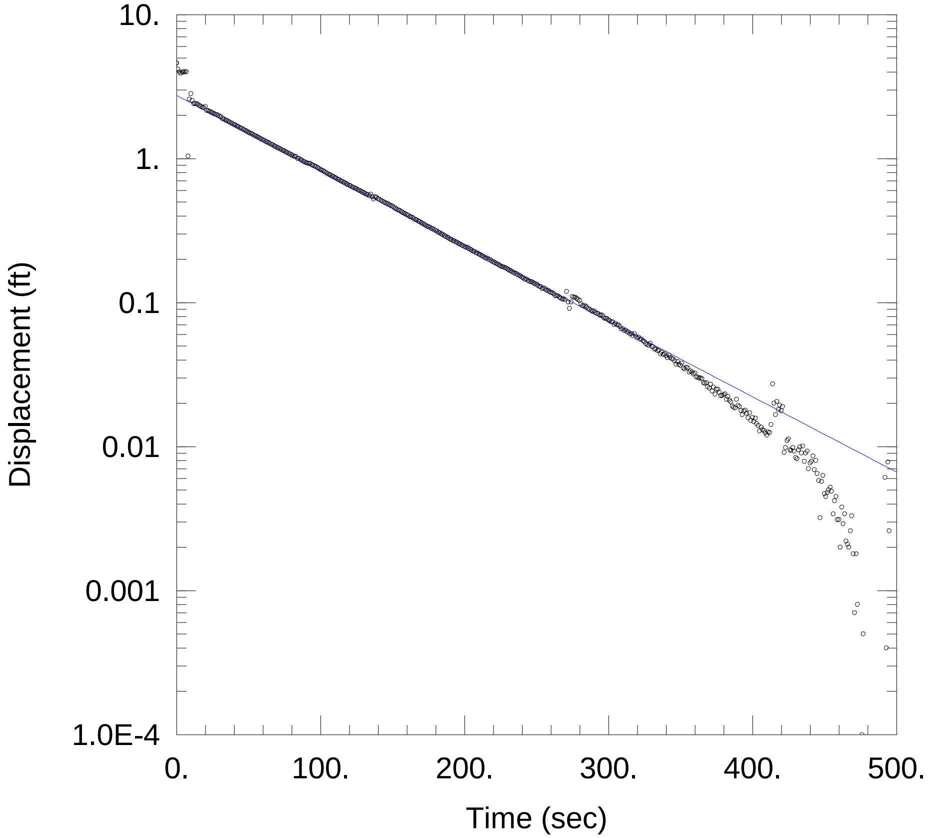
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTIW-02S	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTIW-02S	0	0



CTIW-02D_1 SLUG IN 1

Data Set: T:\...\CTIW_02D_1_slugin_1.aqt
Date: 04/26/17 Time: 09:07:59

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-02D_1
Test Date: 4/10/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

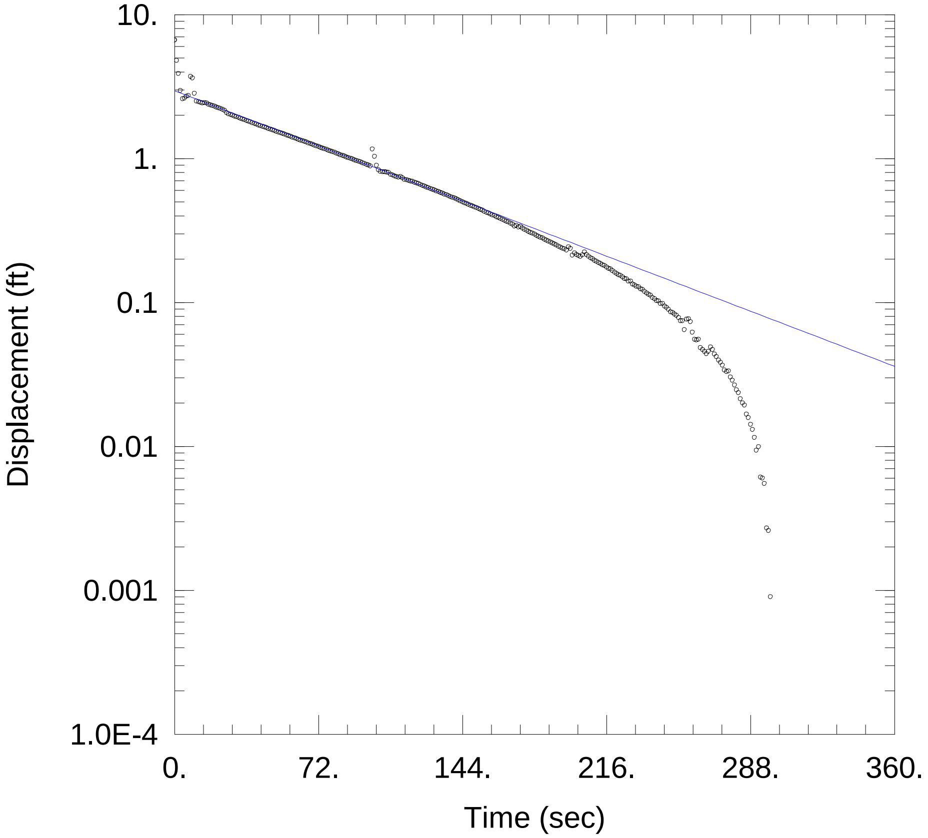
K = 0.9975 ft/day
y0 = 2.749 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTIW-02D)

Initial Displacement: 4.605 ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.88 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



CTIW-02D_1 SLUG OUT 1

Data Set: T:\...\CTIW_02D_1_slugout_1.aqt
Date: 04/26/17 Time: 09:08:33

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-02D_1
Test Date: 4/10/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

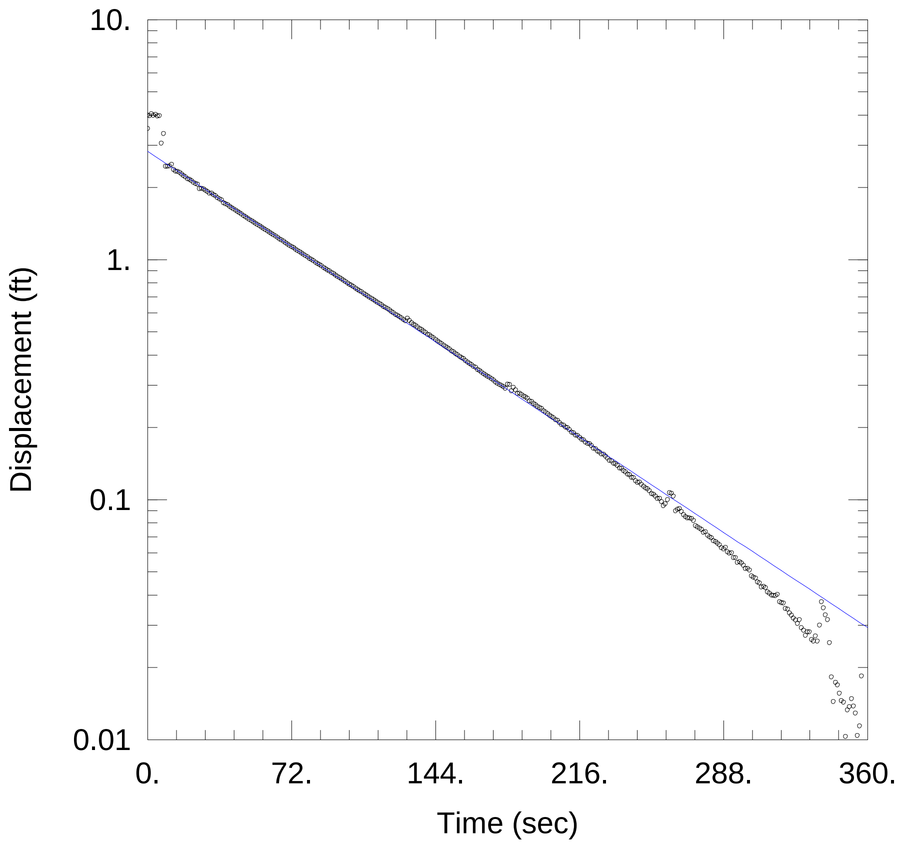
K = 1.014 ft/day
y0 = 2.957 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTIW-02D)

Initial Displacement: 6.654 ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.88 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



CTIW-02D_2 SLUG IN 1

Data Set: T:\...\CTIW_02D_2_slugin_1.aqt
Date: 04/26/17 Time: 09:11:02

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-02D_2
Test Date: 4/10/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

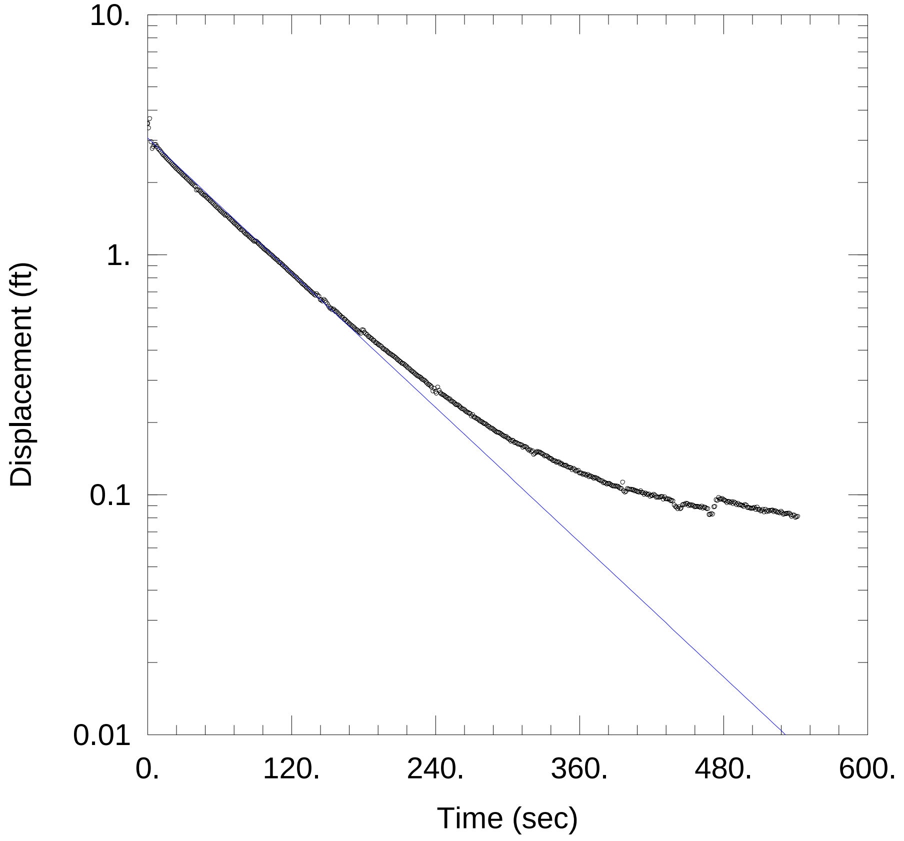
K = 1.051 ft/day
y0 = 2.828 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTIW-02D)

Initial Displacement: 4. ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.88 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



CTIW-02D_2 SLUG OUT 1

Data Set: T:\...\CTIW_02D_2_slugout_1.aqt
Date: 04/26/17 Time: 09:11:33

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-02D_2
Test Date: 4/10/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

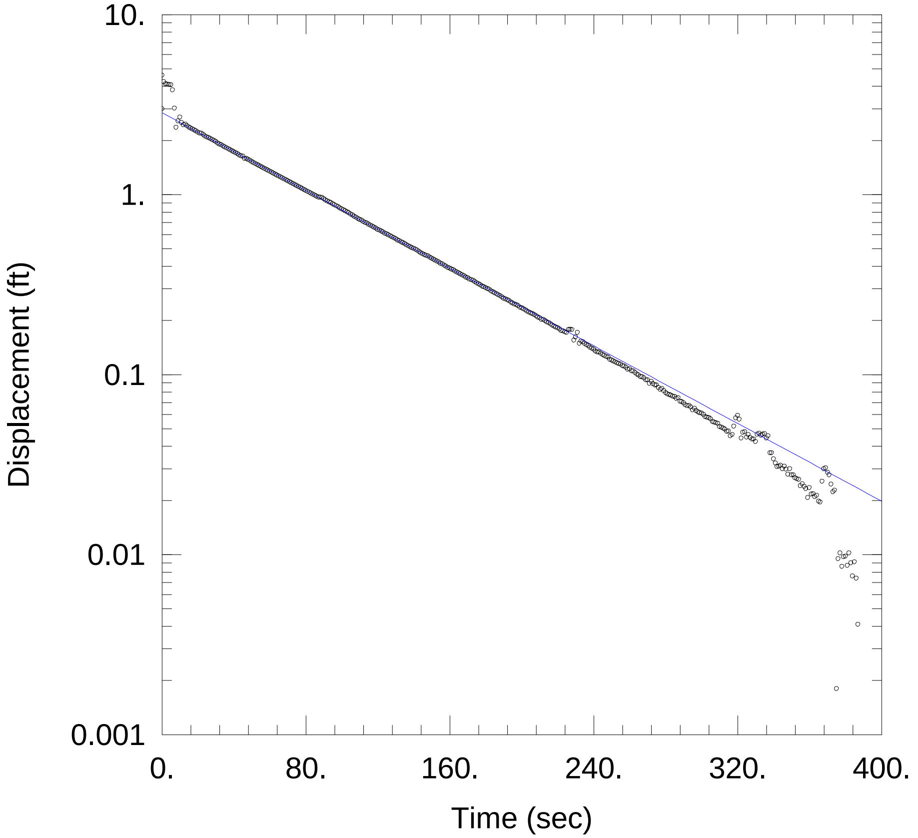
K = 0.8915 ft/day
y0 = 3.061 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTIW-02D)

Initial Displacement: 3.5 ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.88 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



CTIW-02D_3 SLUG IN 1

Data Set: T:\...\CTIW_02D_3_slugin_1.aqt
Date: 04/26/17 Time: 09:12:39

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-02D_3
Test Date: 4/10/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

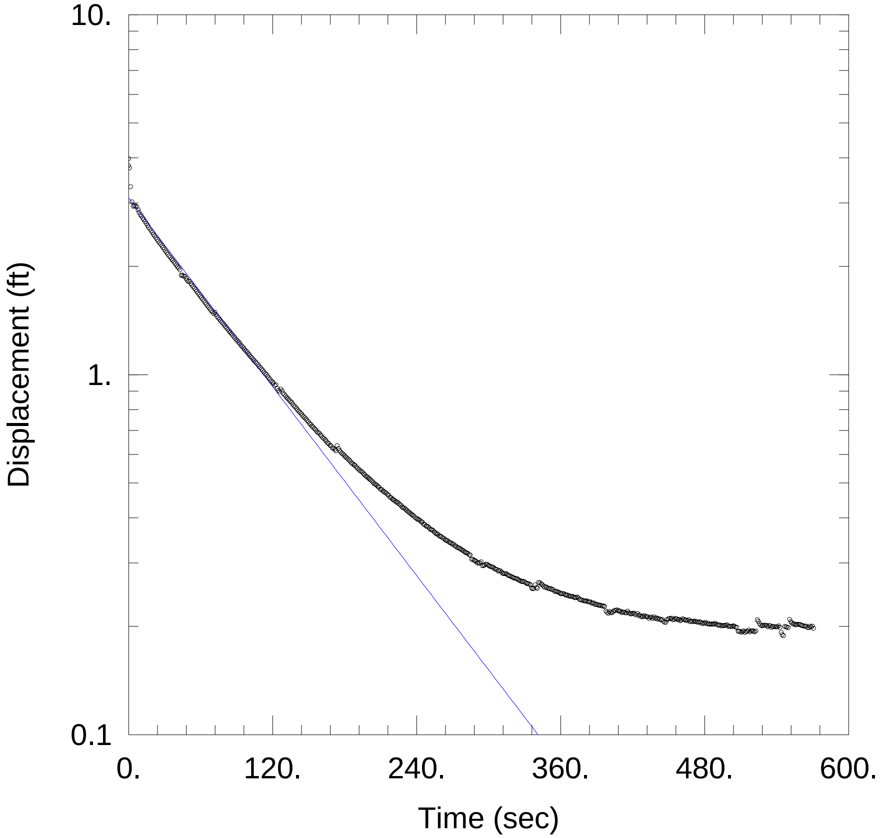
K = 1.028 ft/day
y0 = 2.849 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTIW-02D)

Initial Displacement: 3. ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.88 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



CTIW-02D_3 SLUG OUT 1

Data Set: T:\...\CTIW_02D_3_slugout_1.aqt
Date: 04/26/17 Time: 09:13:05

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-02D_3
Test Date: 4/10/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

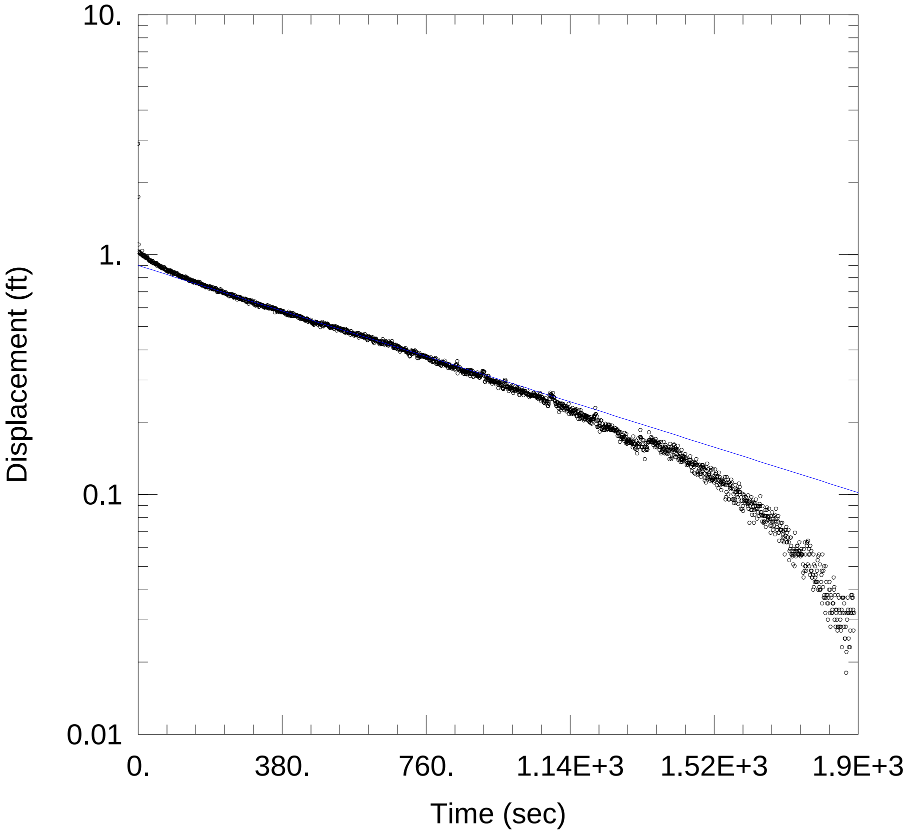
K = 0.8333 ft/day
y0 = 3.1 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTIW-02D)

Initial Displacement: 3.8 ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.88 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



CTIW-02D SLUG IN 1

Data Set: \...\CTIW_02D_slugin_1.aqt
Date: 11/01/17 Time: 14:03:25

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-02D
Test Date: 11/1/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

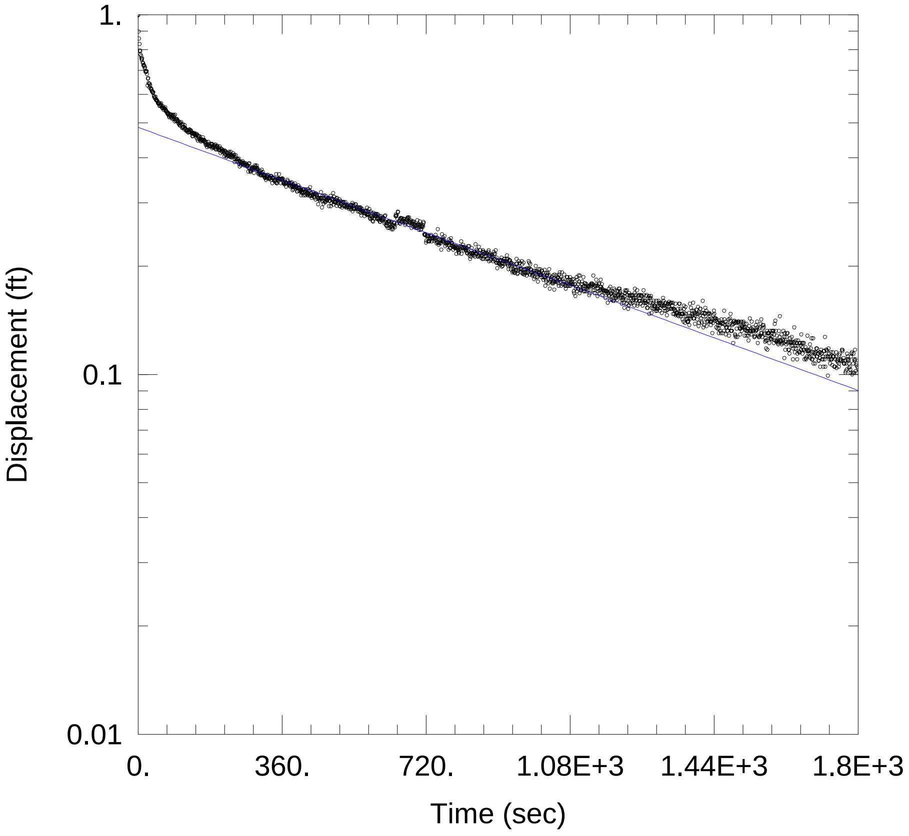
K = 0.09523 ft/day
y0 = 0.8993 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTIW-02D)

Initial Displacement: 2.89 ft
Total Well Penetration Depth: 25.48 ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.48 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



CTIW-02D SLUG OUT 1

Data Set: \...\CTIW_02D_slugout_1.aqt
Date: 11/01/17 Time: 14:05:48

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-02D
Test Date: 11/1/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

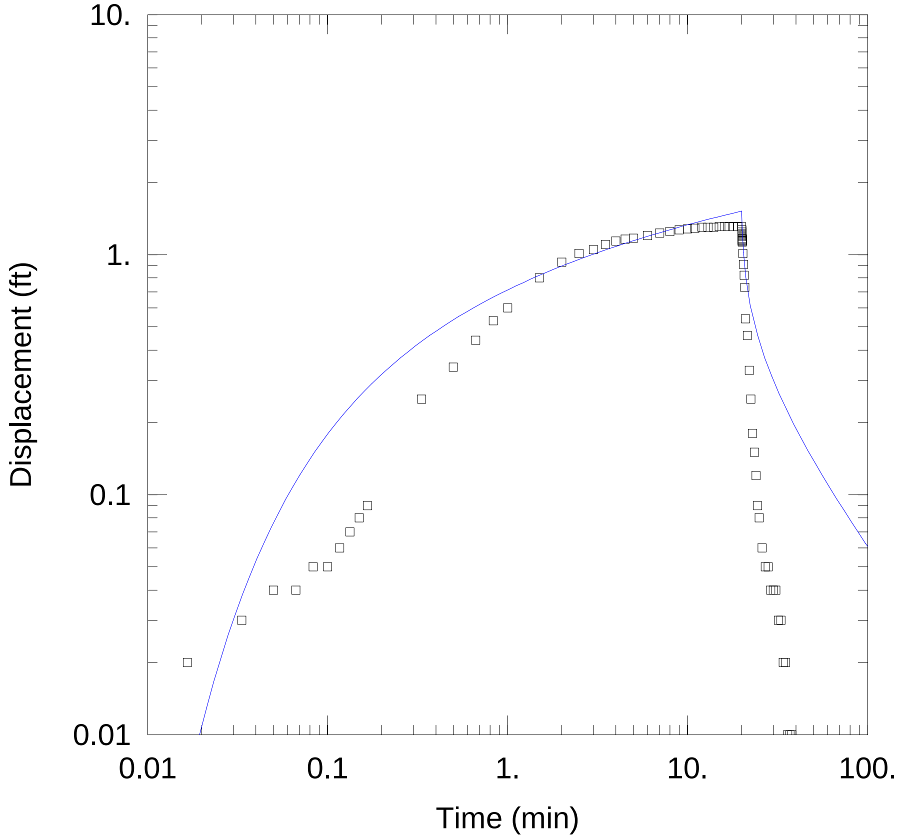
K = 0.07765 ft/day
y0 = 0.4861 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTIW-02D)

Initial Displacement: 0.994 ft
Total Well Penetration Depth: 25.48 ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.48 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



PUMPING TEST FOR CTIW-02D (0.7 L/MIN)

Data Set: \...\CTIW-02D 0.7.aqt
Date: 05/02/17 Time: 09:10:38

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Project: In-Situ Chromium Treatment
Location: Henderson NV
Test Well: CTIW-02D
Test Date: 4-7-2017

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 10.1 ft^2/day
S = 0.01089
Kz/Kr = 0.1
b = 16. ft

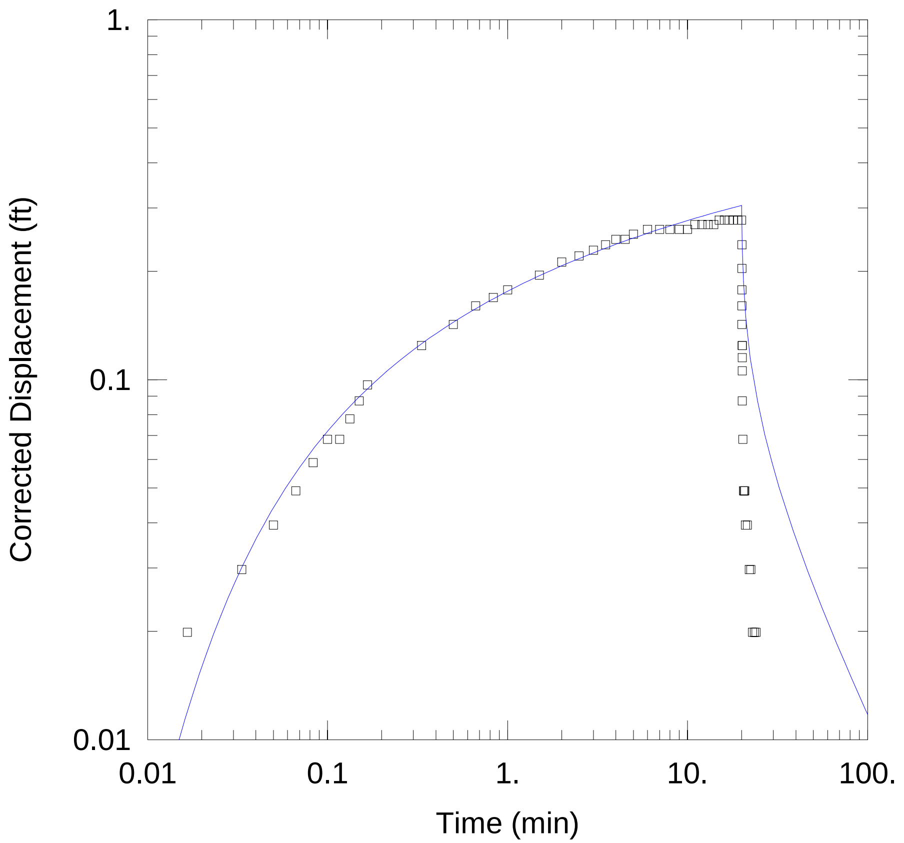
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTIW-02D	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTIW-02D	0	0



PUMPING TEST FOR CTIW-03S (1.0 L/MIN)

Data Set: T:\...\CTIW-03S 1.0.aqt
Date: 05/02/17 Time: 10:17:47

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Project: In-Situ Chromium Treatment
Location: Henderson NV
Test Well: CTIW-03S
Test Date: 4-6-2017

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 563.2 ft^2/day
S = 0.2299
Kz/Kr = 0.1
b = 1.47 ft

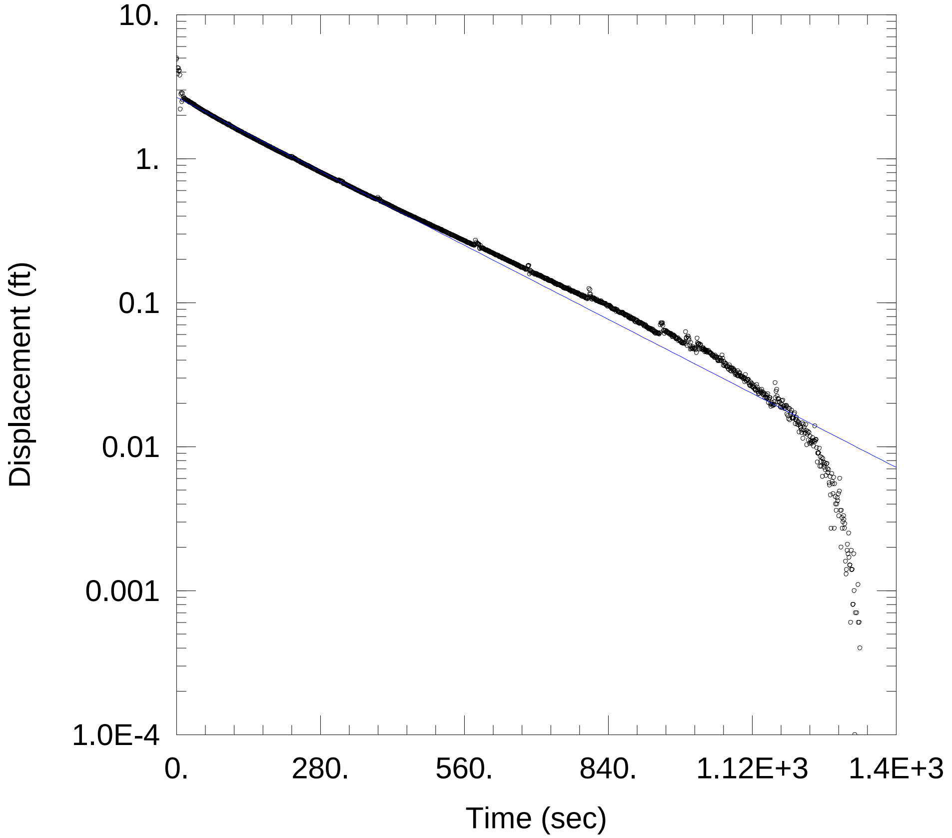
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTIW-03S	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTIW-03S	0	0



CTIW-03D SLUG IN 1

Data Set: T:\...\CTIW_03D_slugin_1.aqt
Date: 05/02/17 Time: 10:55:17

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-03D
Test Date: 4/10/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.35 ft/day
y0 = 2.67 ft

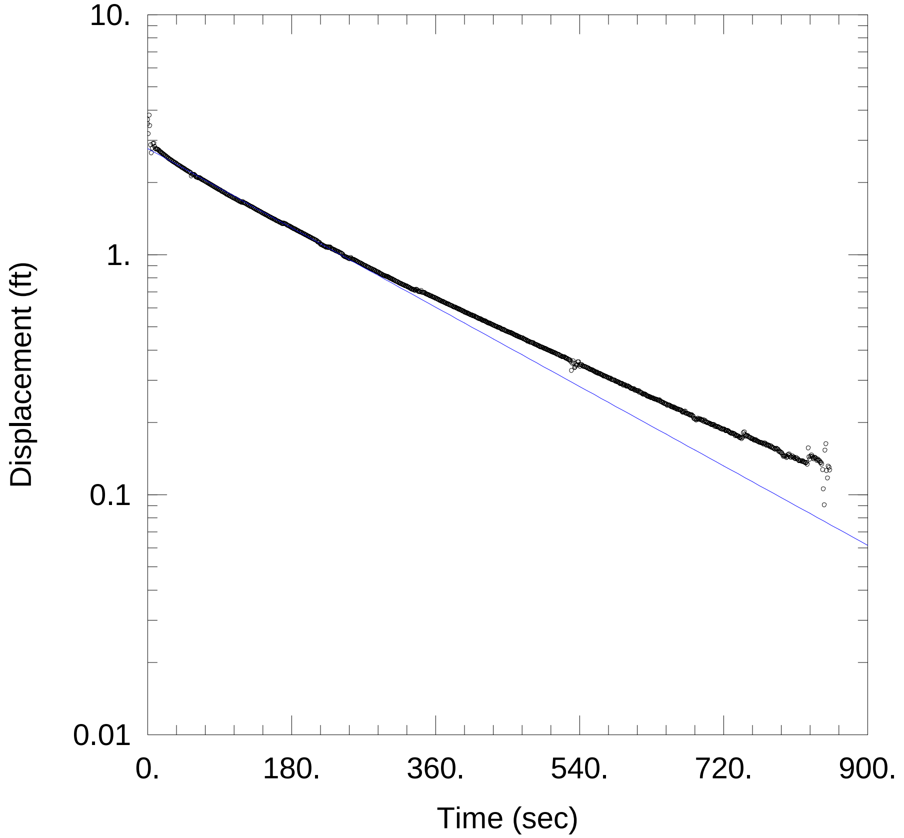
AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTIW-03D)

Initial Displacement: 5. ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft

Static Water Column Height: 25.8 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



CTIW-03D SLUG OUT 1

Data Set: T:\...\CTIW_03D_slugout_1.aqt
Date: 05/02/17 Time: 10:58:29

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-03D
Test Date: 4/10/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.3502 ft/day
y0 = 2.77 ft

AQUIFER DATA

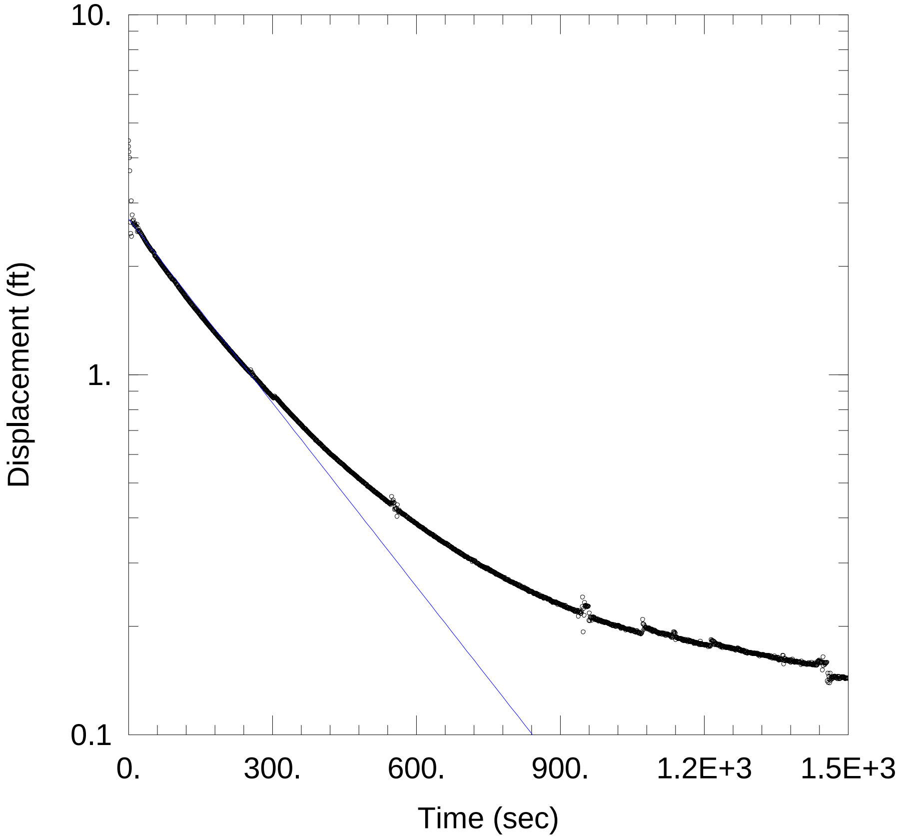
Saturated Thickness: 16. ft

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTIW-03D)

Initial Displacement: 3.5 ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft

Static Water Column Height: 25.8 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



CTIW-03D SLUG IN 2

Data Set: T:\...\CTIW_03D_slugin_2.aqt
Date: 05/02/17 Time: 10:56:49

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-03D
Test Date: 4/10/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.3242 ft/day
y0 = 2.704 ft

AQUIFER DATA

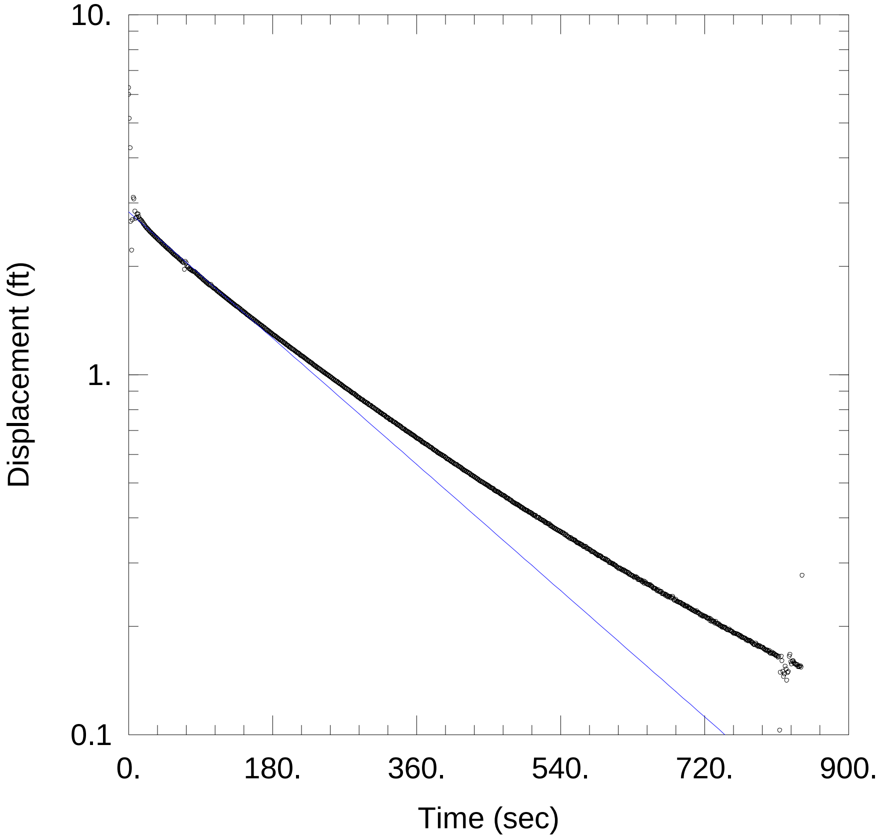
Saturated Thickness: 16. ft

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTIW-03D)

Initial Displacement: 4.3 ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft

Static Water Column Height: 25.8 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



CTIW-03D SLUG OUT 2

Data Set: T:\...\CTIW_03D_slugout_2.aqt
Date: 05/02/17 Time: 11:01:01

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-03D
Test Date: 4/10/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

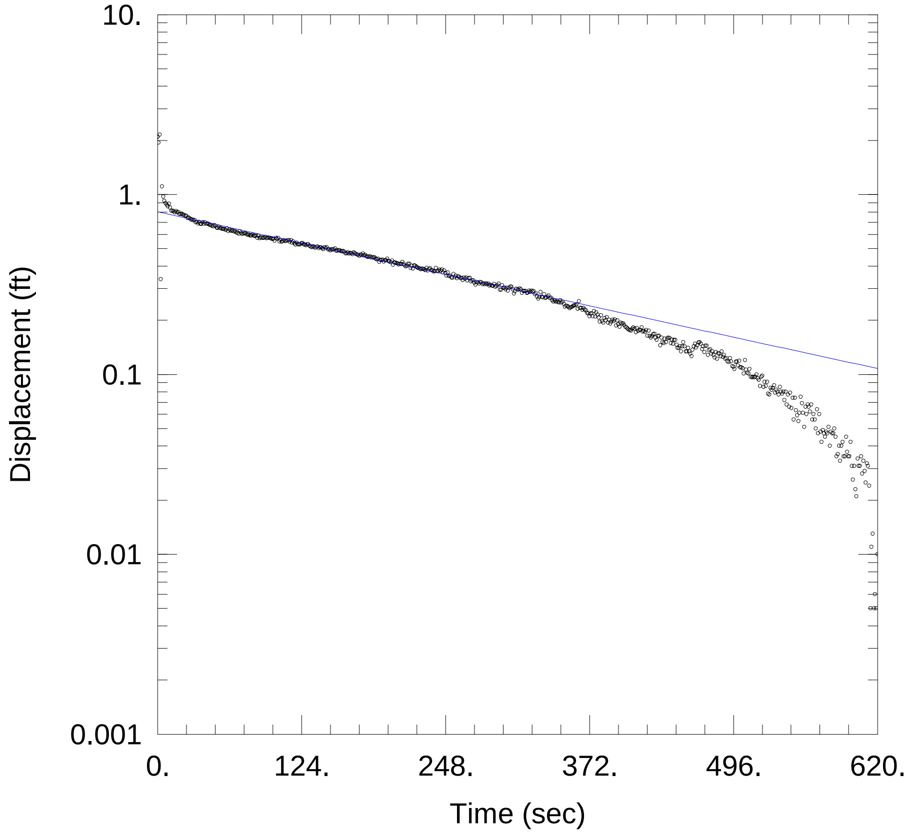
K = 0.3713 ft/day
y0 = 2.832 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTIW-03D)

Initial Displacement: 6. ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.8 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



CTIW-03D SLUG IN 1

Data Set: \...\CTIW_03D_slugin_1.aqt
Date: 11/01/17 Time: 14:32:38

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-03D
Test Date: 11/1/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.2681 ft/day
y0 = 0.8016 ft

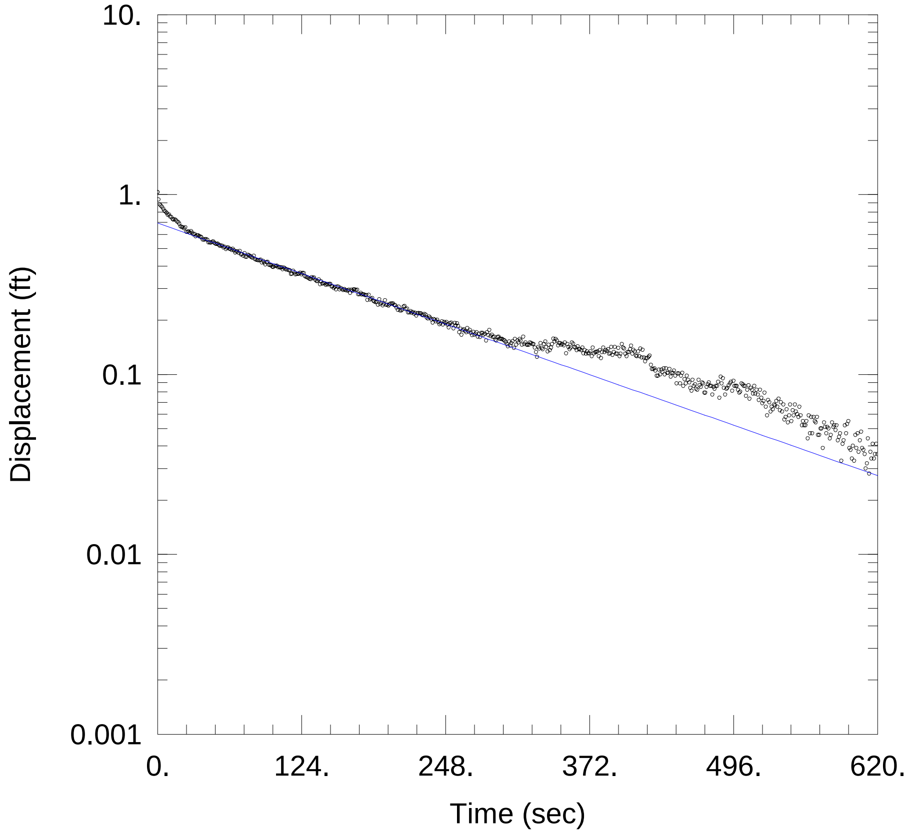
AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTIW-03D)

Initial Displacement: 2.089 ft
Total Well Penetration Depth: 25.16 ft
Casing Radius: 0.083 ft

Static Water Column Height: 25.16 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



CTIW-03D SLUG OUT 1

Data Set: \...\CTIW_03D_slugout_1.aqt
Date: 11/01/17 Time: 14:30:11

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTIW-03D
Test Date: 11/1/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

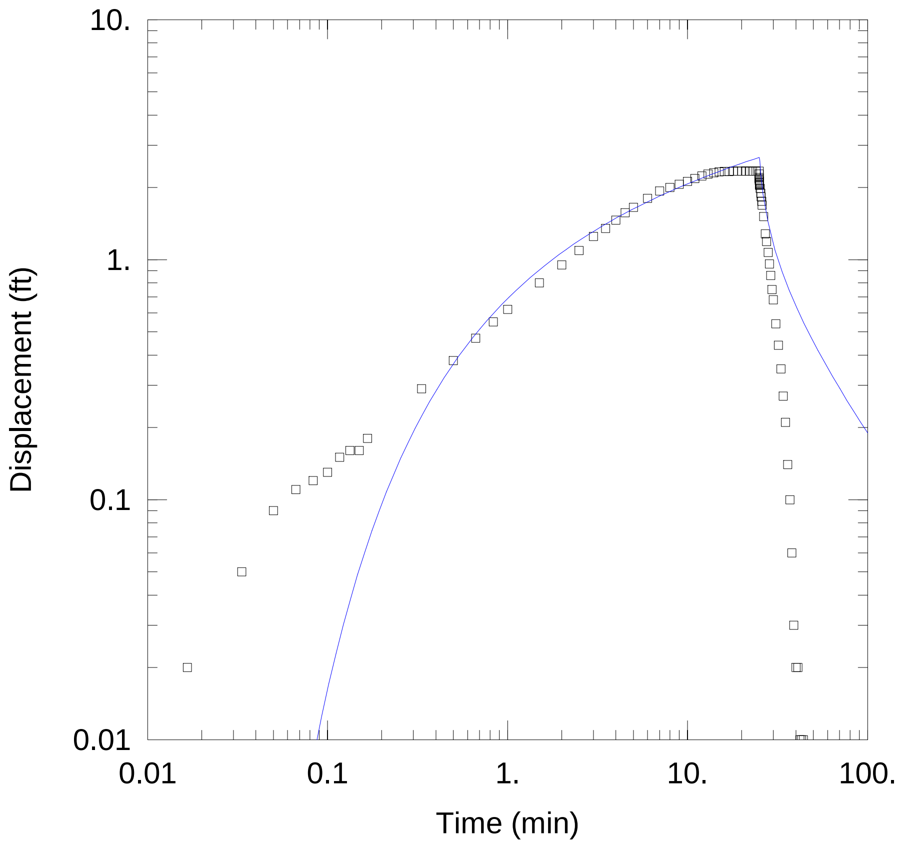
K = 0.4321 ft/day
y0 = 0.6938 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTIW-03D)

Initial Displacement: 1.03 ft
Total Well Penetration Depth: 25.16 ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.16 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



PUMPING TEST FOR CTIW-03D (0.5 L/MIN)

Data Set: T:\...\CTIW-03D 0.5.aqt
Date: 05/02/17 Time: 09:23:53

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Project: In-Situ Chromium Treatment
Location: Henderson NV
Test Well: CTIW-03D
Test Date: 4-7-2017

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 3.014 ft^2/day
S = 0.01897
Kz/Kr = 0.1
b = 16. ft

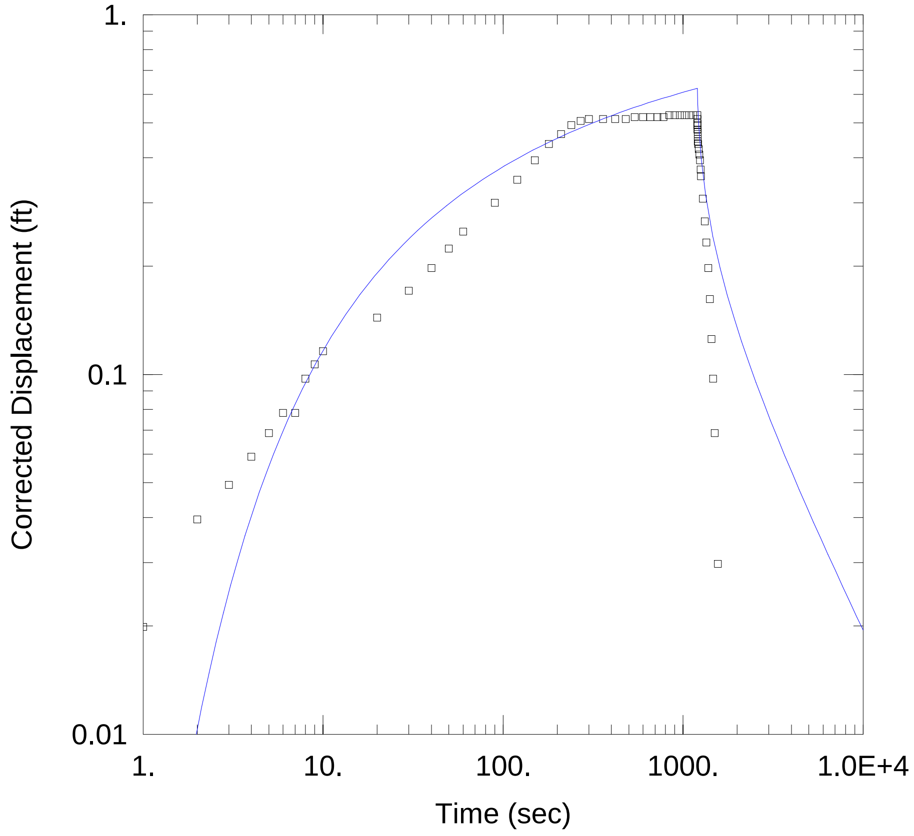
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTIW-03D	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTIW-03D	0	0



PUMPING TEST FOR CTMW-01S, 1.0 L/MIN

Data Set: \...\CTMW-01S 1.0.aqt
Date: 10/25/17 Time: 13:04:28

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-01S
Test Date: 2/28/2017

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 26. ft^2/day
S = 0.03831
Kz/Kr = 0.1
b = 1.79 ft

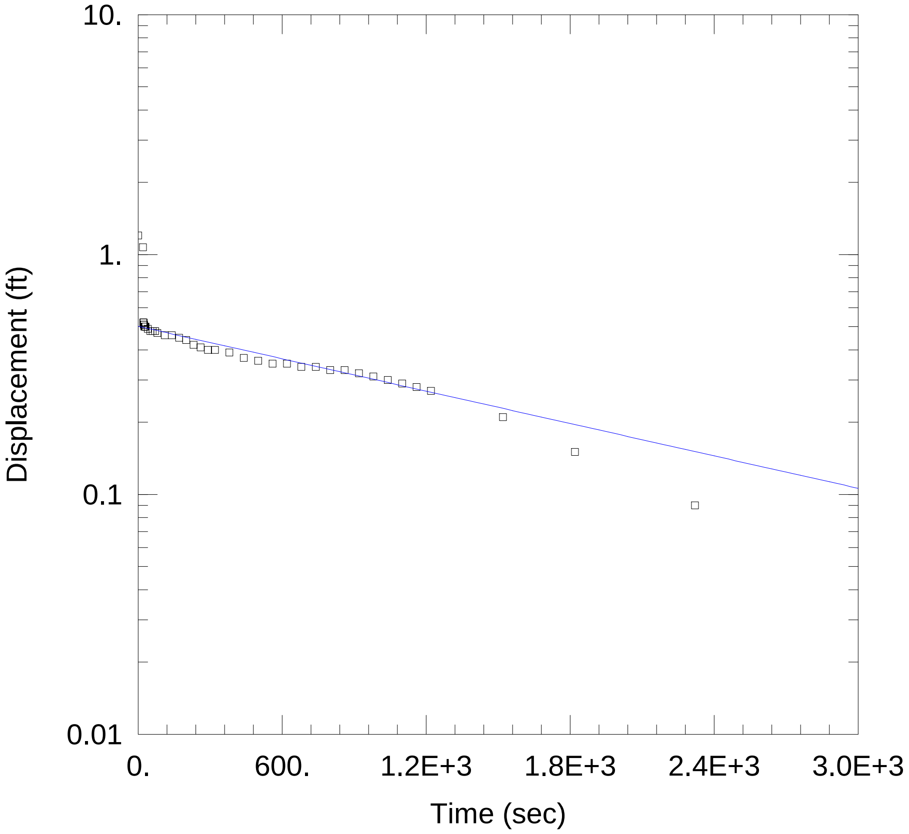
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTMW-01S	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTMW-01S	0	0



PUMPING TEST FOR CTMW-01S 0.2 (L/MIN)

Data Set: \...\CTMW-01S 0.2_Bouwer-Rice_slugtest.aqt
Date: 10/25/17 Time: 14:17:26

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-01S
Test Date: 10/10/2017

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

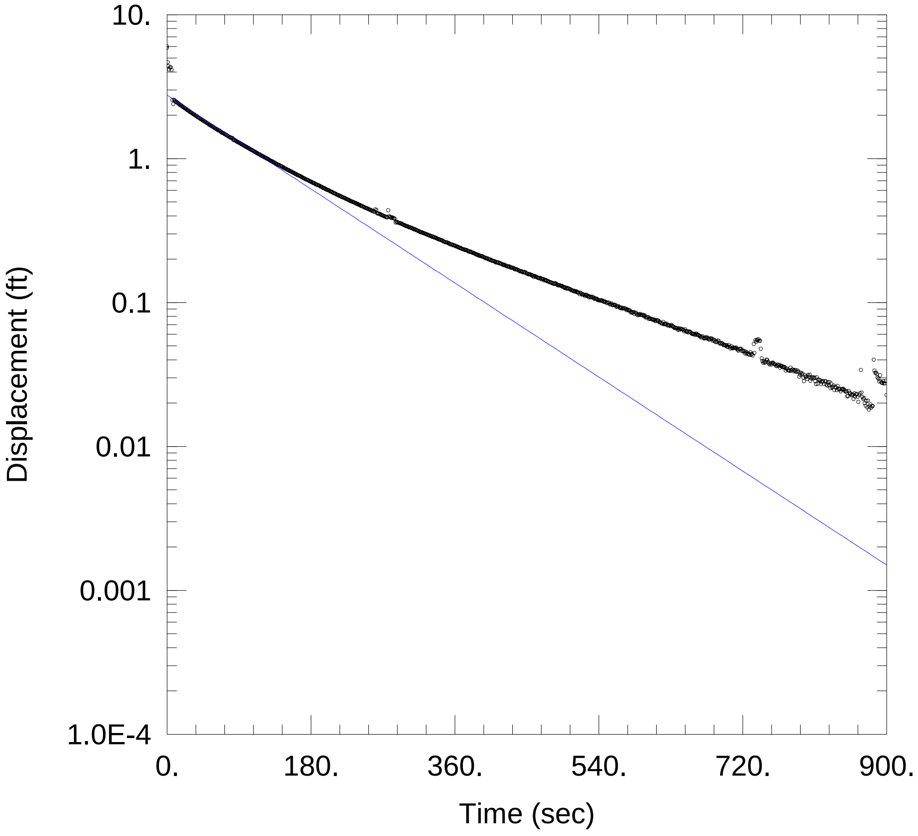
K = 0.4133 ft/day
y0 = 0.5016 ft

AQUIFER DATA

Saturated Thickness: 1.32 ft
Anisotropy Ratio (Kz/Kr): 0.004

WELL DATA (CTMW-01S)

Initial Displacement: 1.2 ft
Total Well Penetration Depth: 1. ft
Casing Radius: 0.0833 ft
Static Water Column Height: 1. ft
Screen Length: 1. ft
Well Radius: 0.3333 ft



CTMW-01D SLUG IN 1

Data Set: T:\...\CTMW_01D_slugin_1.aqt
Date: 04/27/17 Time: 08:26:55

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-01D
Test Date: 4/10/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

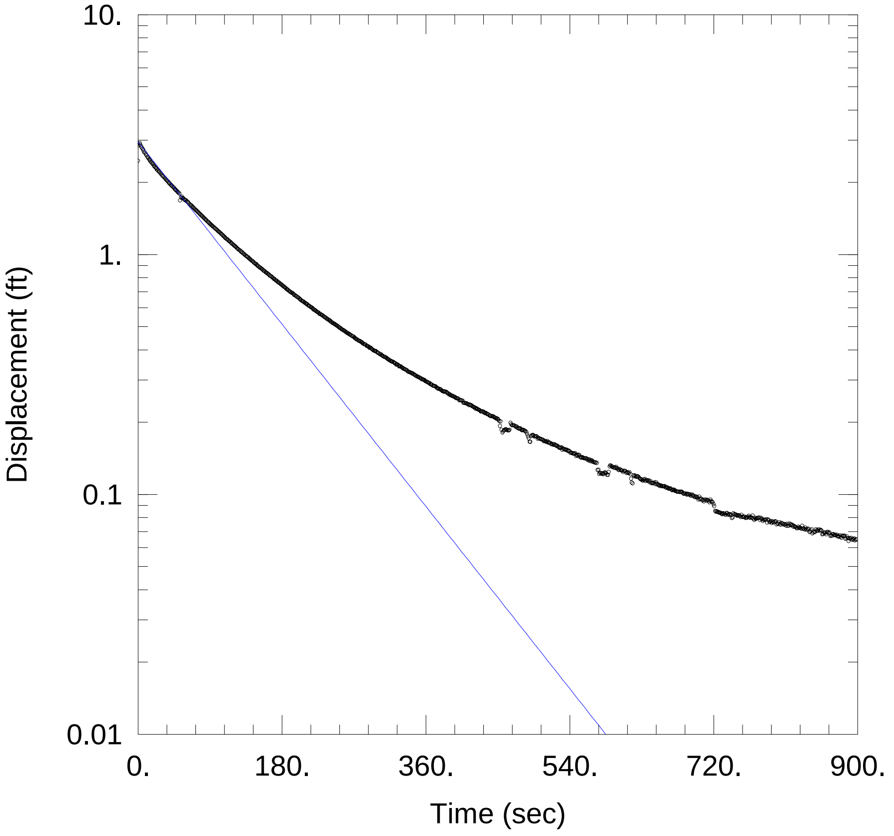
K = 0.5072 ft/day
y0 = 2.763 ft

AQUIFER DATA

Saturated Thickness: 5. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-01D)

Initial Displacement: 6. ft
Total Well Penetration Depth: 25.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 26.13 ft
Screen Length: 16. ft
Well Radius: 0.33 ft



CTMW-01D SLUG OUT 1

Data Set: T:\...\CTMW_01D_slugout_1.aqt
Date: 04/27/17 Time: 08:27:25

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-01D
Test Date: 4/10/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

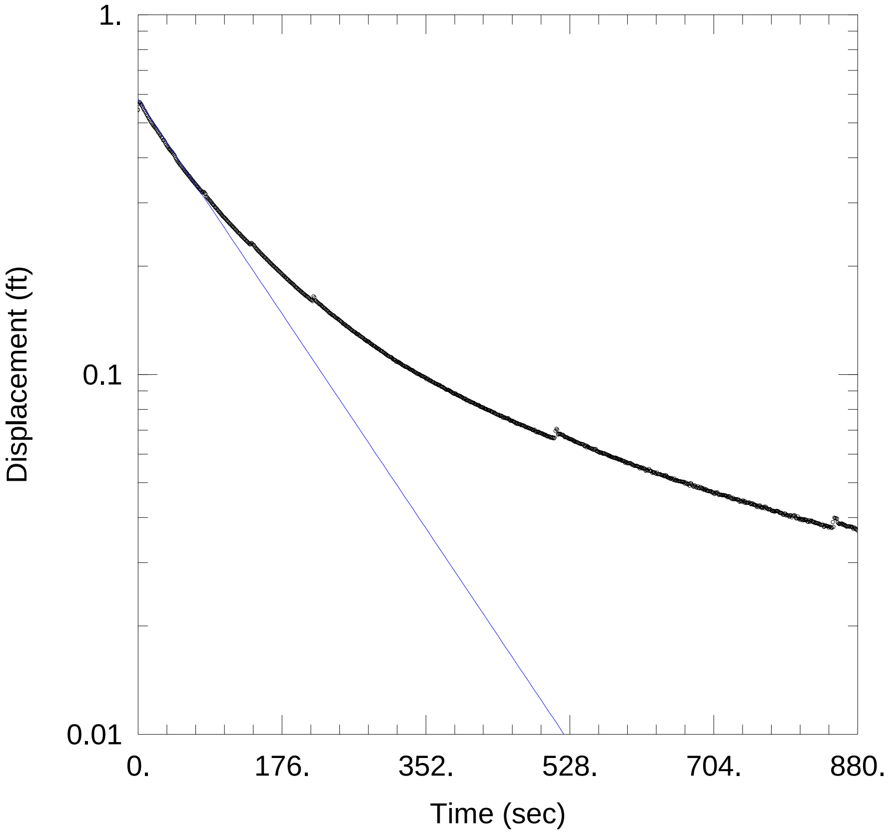
K = 0.5903 ft/day
y0 = 2.952 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-01D)

Initial Displacement: 2.9 ft
Total Well Penetration Depth: 25.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 26.13 ft
Screen Length: 16. ft
Well Radius: 0.33 ft



CTMW-01D SLUG IN 1

Data Set: \...\CTMW_01D_slugin_1.aqt
Date: 10/23/17 Time: 09:39:29

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-01D
Test Date: 10/04/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

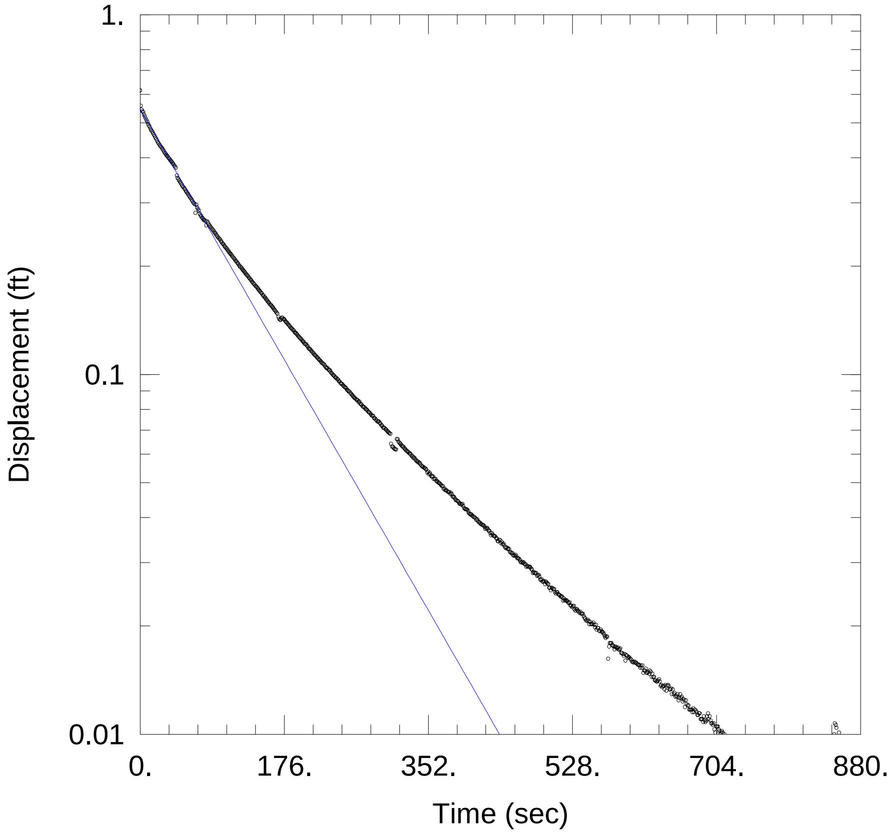
K = 0.651 ft/day
y0 = 0.5827 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-01D)

Initial Displacement: 0.5431 ft
Total Well Penetration Depth: 26.3 ft
Casing Radius: 0.083 ft
Static Water Column Height: 26.3 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



CTMW-01D SLUG OUT 1

Data Set: \...\CTMW_01D_slugout_1.aqt
Date: 10/23/17 Time: 09:39:53

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-01D
Test Date: 10/04/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

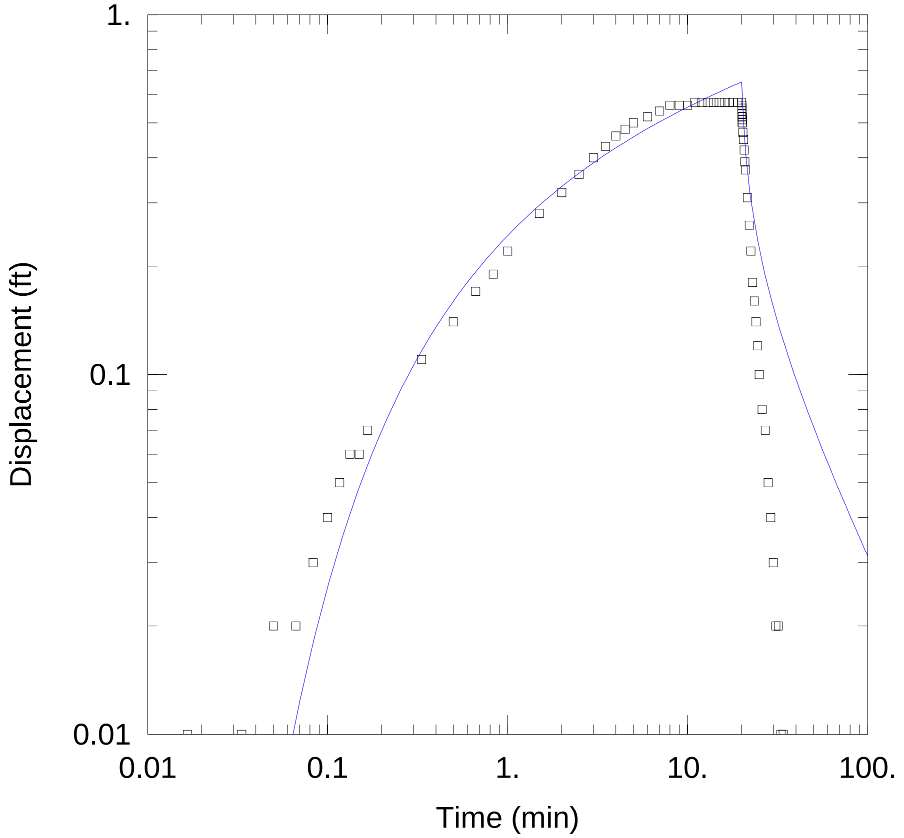
K = 0.7604 ft/day
y0 = 0.5466 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-01D)

Initial Displacement: 0.6148 ft
Total Well Penetration Depth: 26.3 ft
Casing Radius: 0.083 ft
Static Water Column Height: 26.3 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



PUMPING TEST FOR CTMW-01D (0.3 L/MIN)

Data Set: T:\...\CTMW-01D 0.3.aqt
Date: 05/02/17 Time: 09:27:40

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Project: In-Situ Chromium Treatment
Location: Henderson NV
Test Well: CTMW-01D
Test Date: 4-7-2017

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 8.709 ft^2/day
S = 0.02432
Kz/Kr = 0.1
b = 16. ft

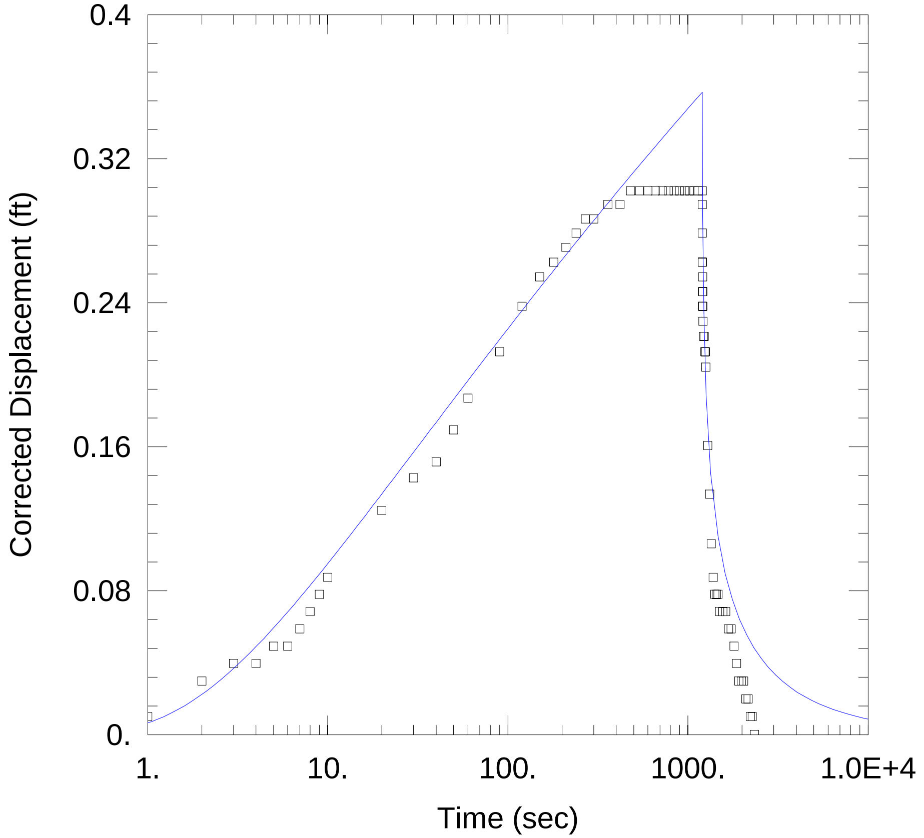
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTMW-01D	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTMW-01D	0	0



PUMPING TEST FOR CTMW-02S (0.7 L/MIN)

Data Set: T:\...\CTMW-02S 0.7.aqt
Date: 05/02/17 Time: 10:11:25

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-02S
Test Date: 4/6/2017

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 40.72 ft^2/day
S = 0.02596
Kz/Kr = 0.1
b = 1.53 ft

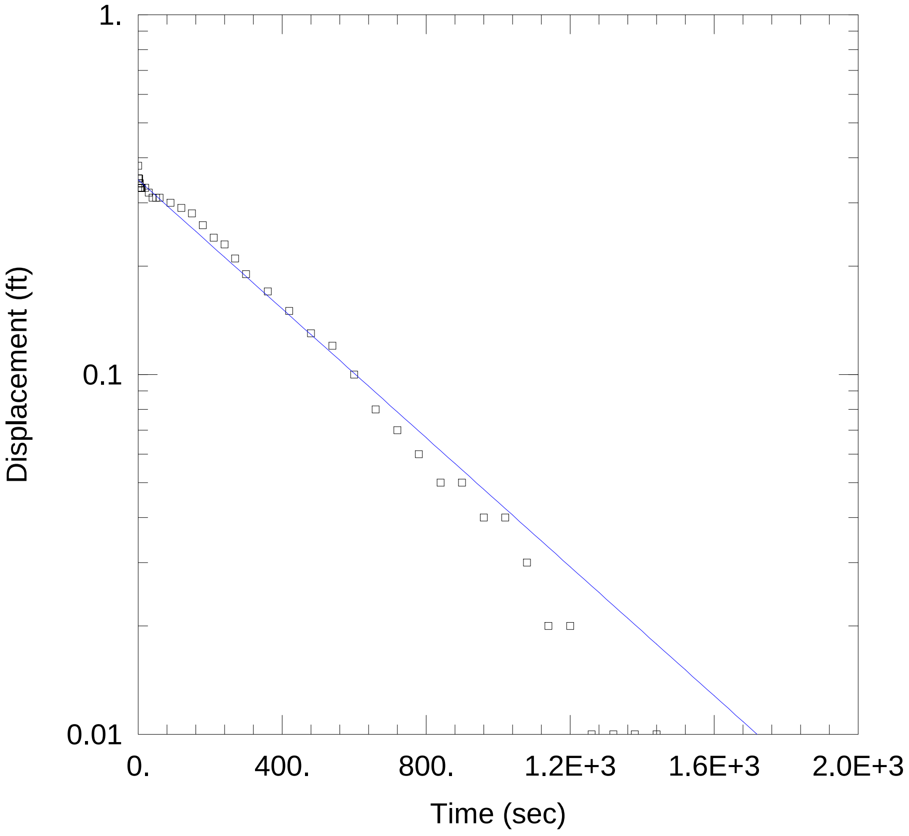
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTMW-02S	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTMW-02S	0	0



PUMPING TEST FOR CTMW-02S 0.1 (L/MIN)

Data Set: \...\CTMW-02S 0.1_Bouwer-Rice_slugtest.aqt
Date: 10/25/17 Time: 14:17:42

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-02S
Test Date: 10/10/2017

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

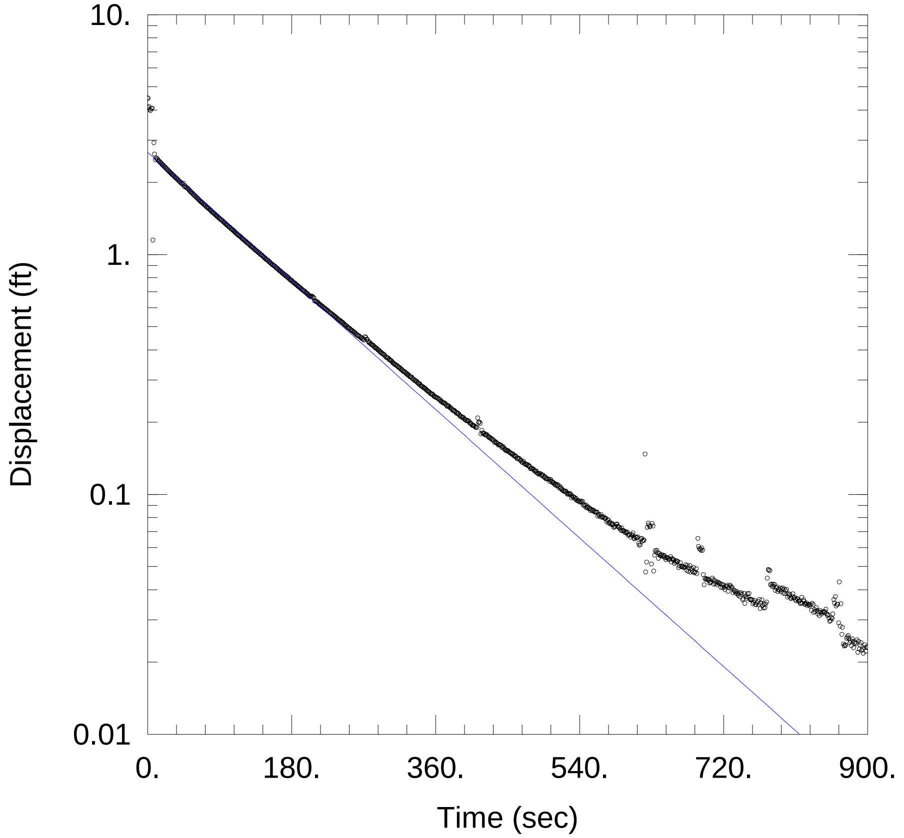
K = 0.5081 ft/day
y0 = 0.3475 ft

AQUIFER DATA

Saturated Thickness: 0.7865 ft
Anisotropy Ratio (Kz/Kr): 0.1023

WELL DATA (CTMW-02S)

Initial Displacement: 0.38 ft
Total Well Penetration Depth: 1. ft
Casing Radius: 0.0833 ft
Static Water Column Height: 1. ft
Screen Length: 1. ft
Well Radius: 0.3333 ft



CTMW-02D SLUG IN 1

Data Set: T:\...\CTMW_02D_slugin_1.aqt
Date: 05/02/17 Time: 10:49:29

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-02D
Test Date: 4/10/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

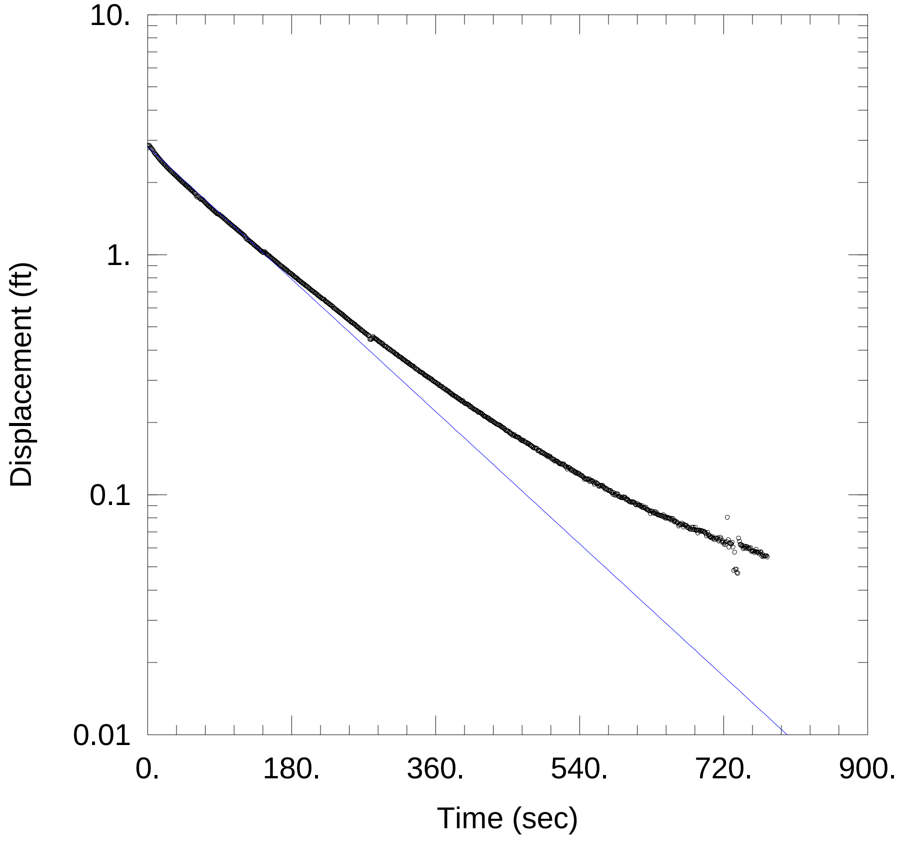
K = 0.5674 ft/day
y0 = 2.664 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-02D)

Initial Displacement: 4.5 ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.68 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



CTMW-02D SLUG OUT 1

Data Set: T:\...\CTMW_02D_slugout_1.aqt
Date: 05/02/17 Time: 10:51:31

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-02D
Test Date: 4/10/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

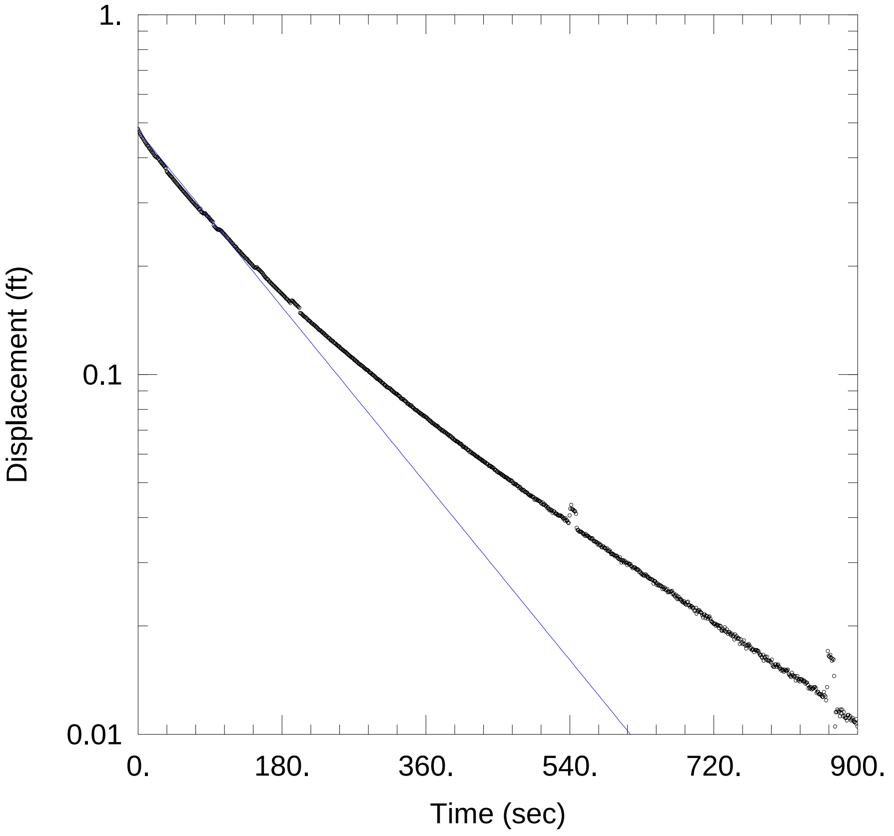
K = 0.5841 ft/day
y0 = 2.816 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-02D)

Initial Displacement: 2.85 ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.68 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



CTMW-02D SLUG IN 1

Data Set: \...\CTMW_02D_slugin_1.aqt
Date: 10/23/17 Time: 09:40:08

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-02D
Test Date: 10/04/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

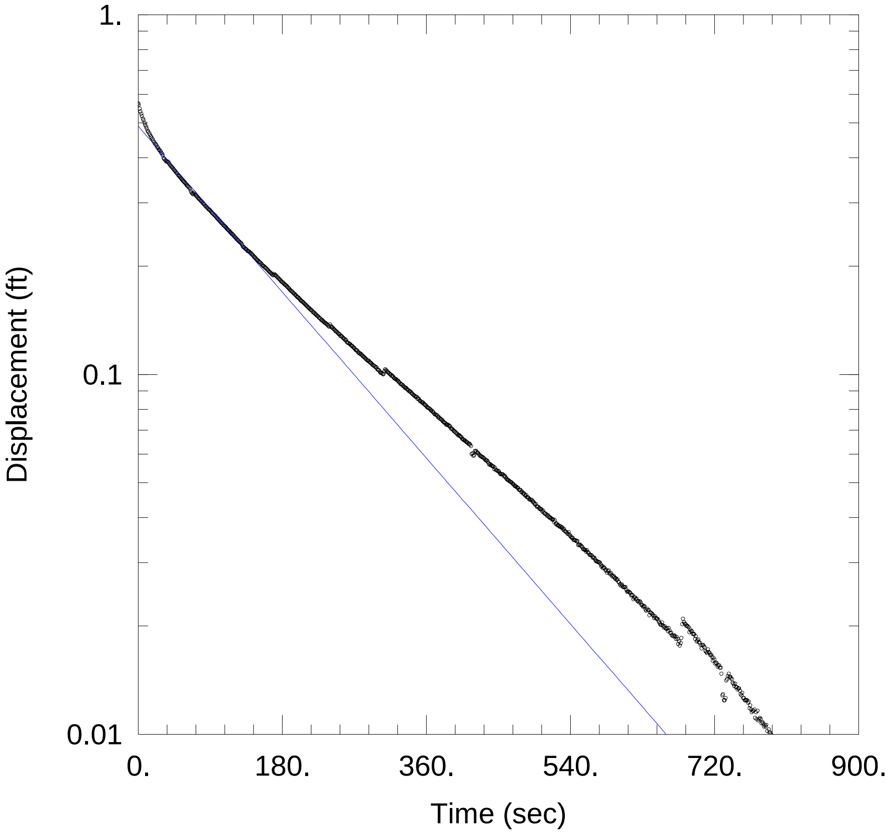
K = 0.522 ft/day
y0 = 0.4765 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-02D)

Initial Displacement: 0.4798 ft
Total Well Penetration Depth: 25.8 ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.8 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



CTMW-02D SLUG OUT 1

Data Set: \...\CTMW_02D_slugout_1.aqt
Date: 10/23/17 Time: 09:40:19

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-02D
Test Date: 10/04/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

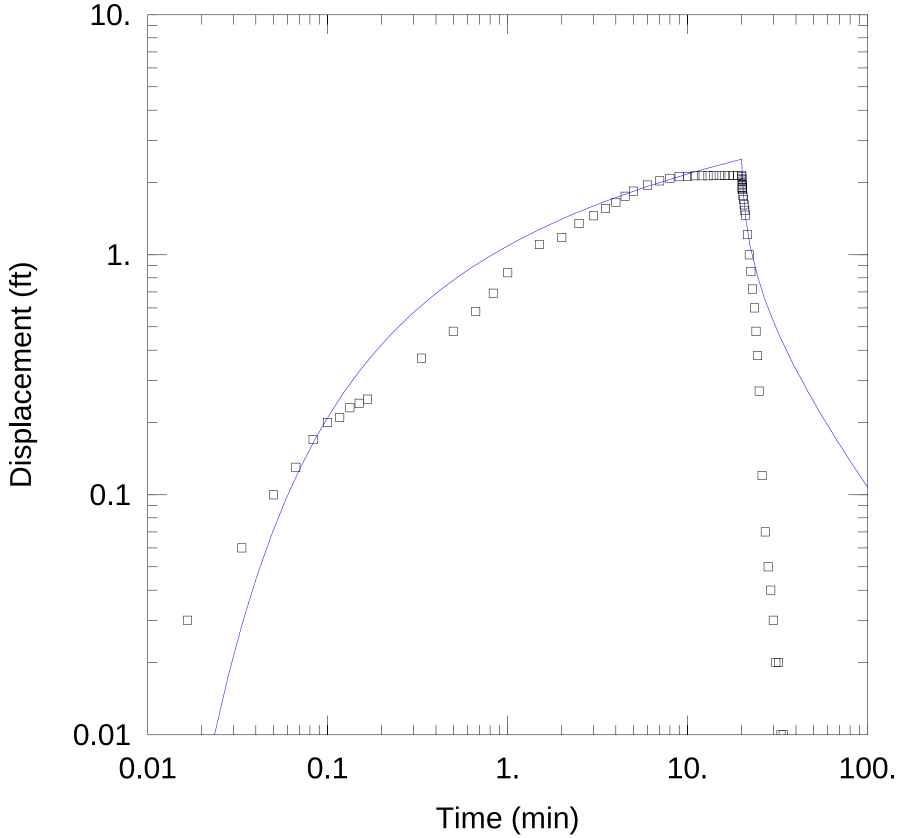
K = 0.4909 ft/day
y0 = 0.4902 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-02D)

Initial Displacement: 0.5658 ft
Total Well Penetration Depth: 25.8 ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.8 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



PUMPING TEST FOR CTMW-02D (0.75 L/MIN)

Data Set: T:\...\CTMW-02D 0.75.aqt
Date: 05/02/17 Time: 09:38:58

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Project: In-Situ Chromium Treatment
Location: Henderson NV
Test Well: CTMW-02D
Test Date: 4-7-2017

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 6.373 ft^2/day
S = 0.009936
Kz/Kr = 0.1
b = 16. ft

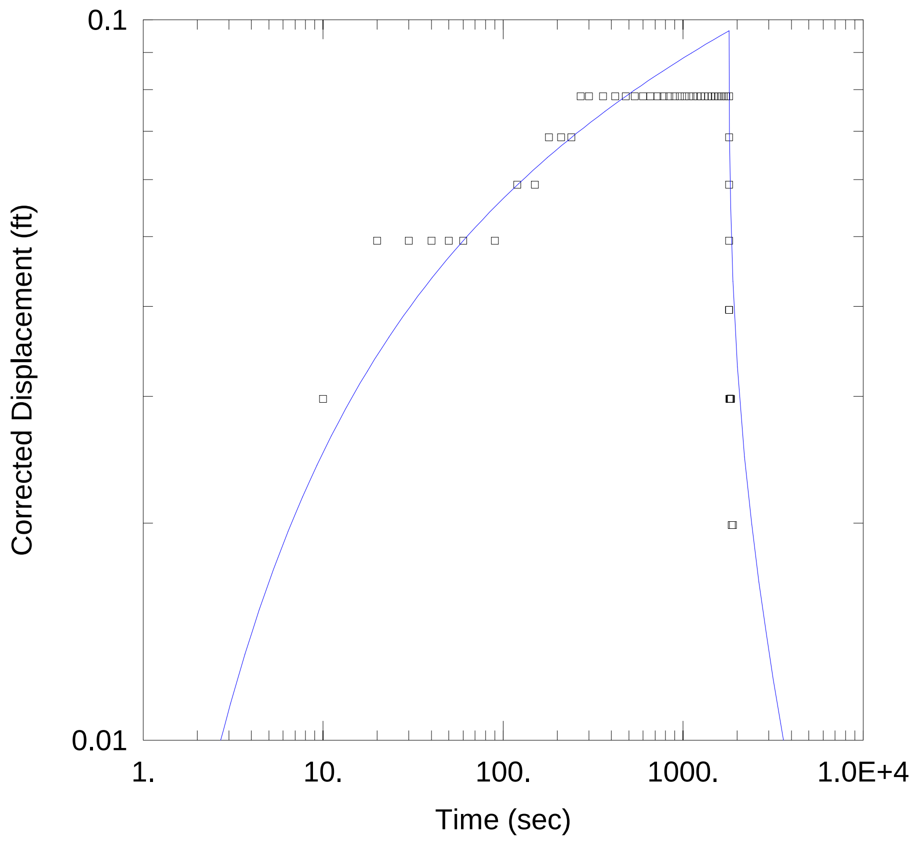
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTMW-02D	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTMW-02D	0	0



PUMPING TEST FOR CTMW-03S (0.5 L/MIN)

Data Set: T:\...\CTMW-03S 0.5.aqt
Date: 05/01/17 Time: 16:44:41

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-03S
Test Date: 2/28/2017

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 136.9 ft^2/day
S = 0.06285
Kz/Kr = 0.1
b = 1.83 ft

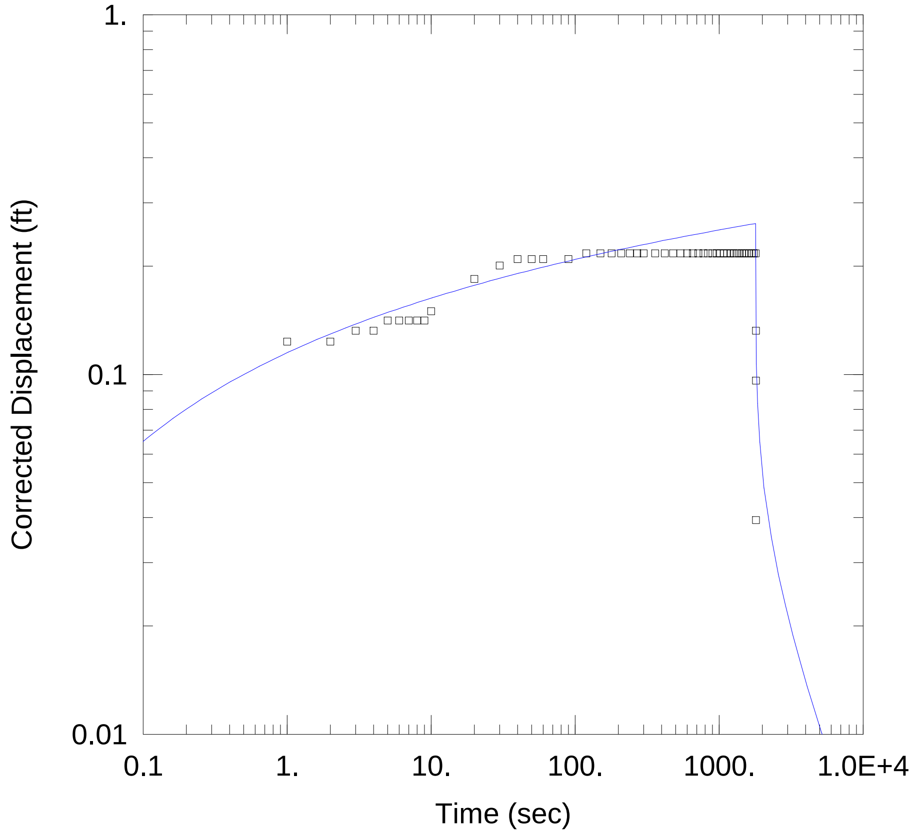
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTMW-03S	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTMW-03S	0	0



PUMPING TEST FOR CTMW-03S 1 (L/MIN)

Data Set: \...\CTMW-03S 1.aqt
Date: 10/25/17 Time: 14:17:59

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-03S
Test Date: 10/9/2017

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 168.3 ft^2/day
S = 0.0001075
Kz/Kr = 0.1
b = 1.26 ft

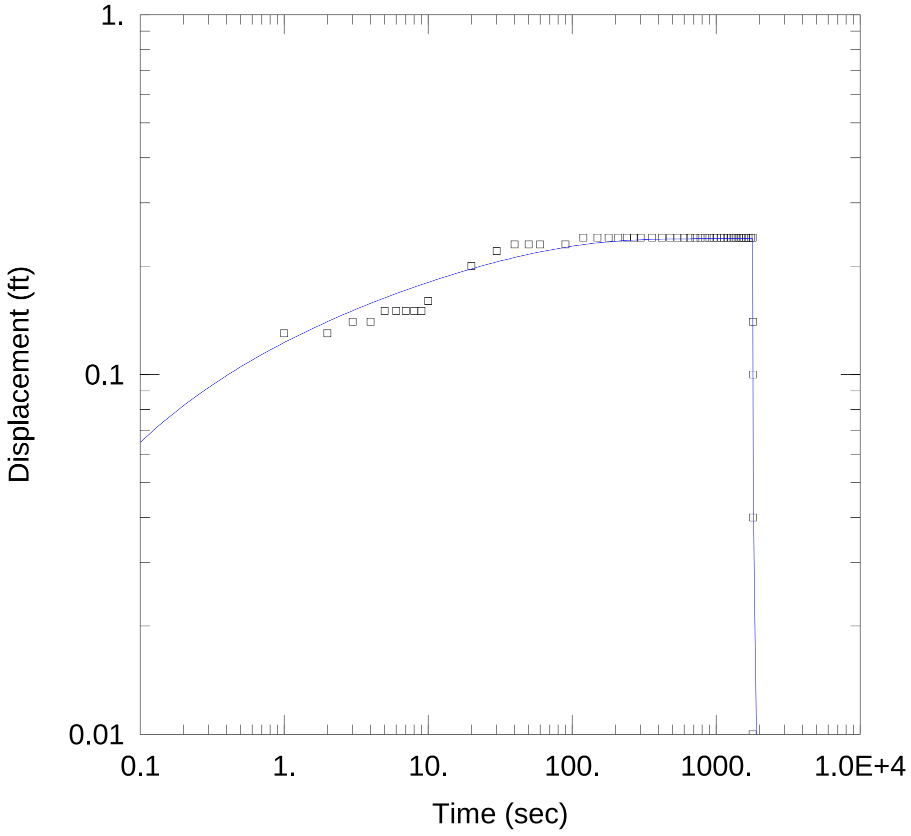
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTMW-03S	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTMW-03S	0	0



PUMPING TEST FOR CTMW-03S 1 (L/MIN)

Data Set: \...\CTMW-03S 1_leaky_Hantush-Jacob.aqt
Date: 10/25/17 Time: 14:18:21

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-03S
Test Date: 10/9/2017

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 155.1 ft^2/day
S = 0.0001362
r/B = 0.01086
Kz/Kr = 0.1
b = 1.26 ft

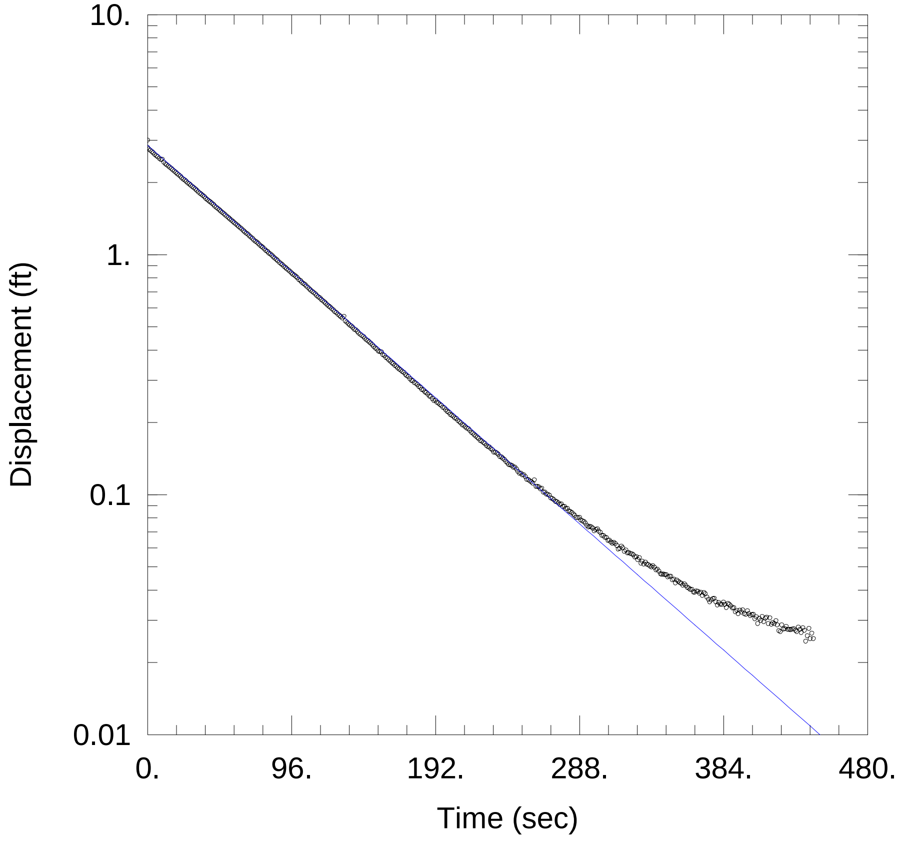
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTMW-03S	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTMW-03S	0	0



CTMW-03D SLUG IN 1

Data Set: T:\...\CTIW_03D_slugin_1.aqt
Date: 04/27/17 Time: 12:13:24

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-03D
Test Date: 12/09/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

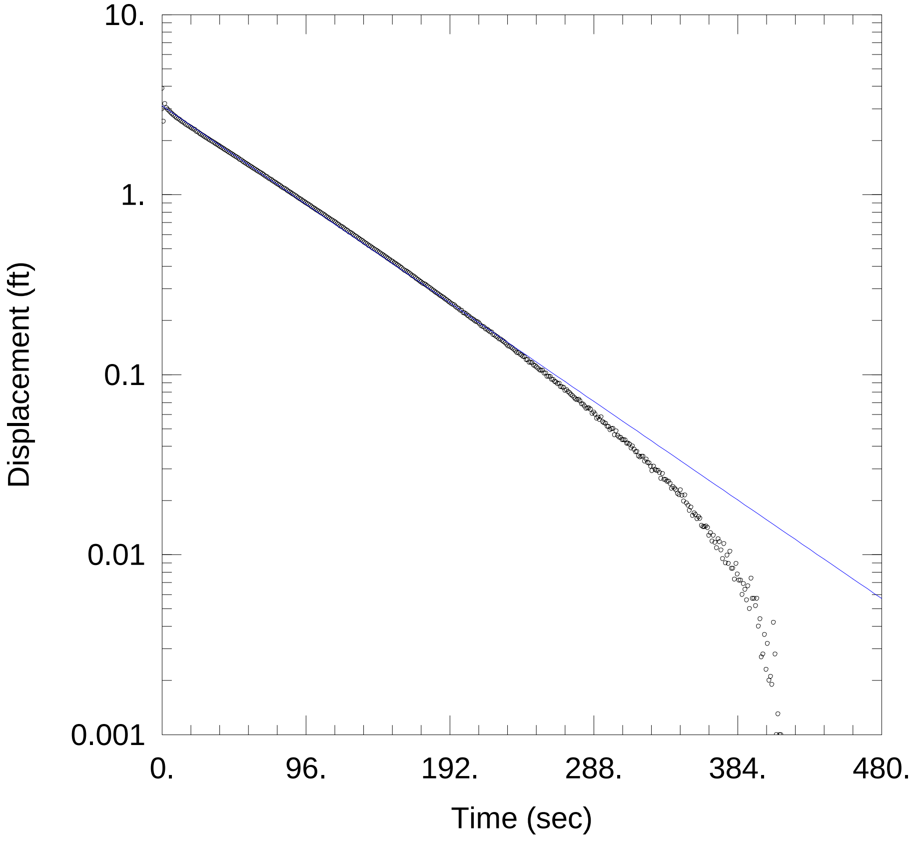
K = 2.457 ft/day
y0 = 2.854 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-03D)

Initial Displacement: 3. ft
Total Well Penetration Depth: 15. ft
Casing Radius: 0.083 ft
Static Water Column Height: 16.4 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



CTMW-03D SLUG OUT 1

Data Set: T:\...\CTMW_03D_slugout_1.aqt
Date: 04/27/17 Time: 12:09:53

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-03D
Test Date: 12/09/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

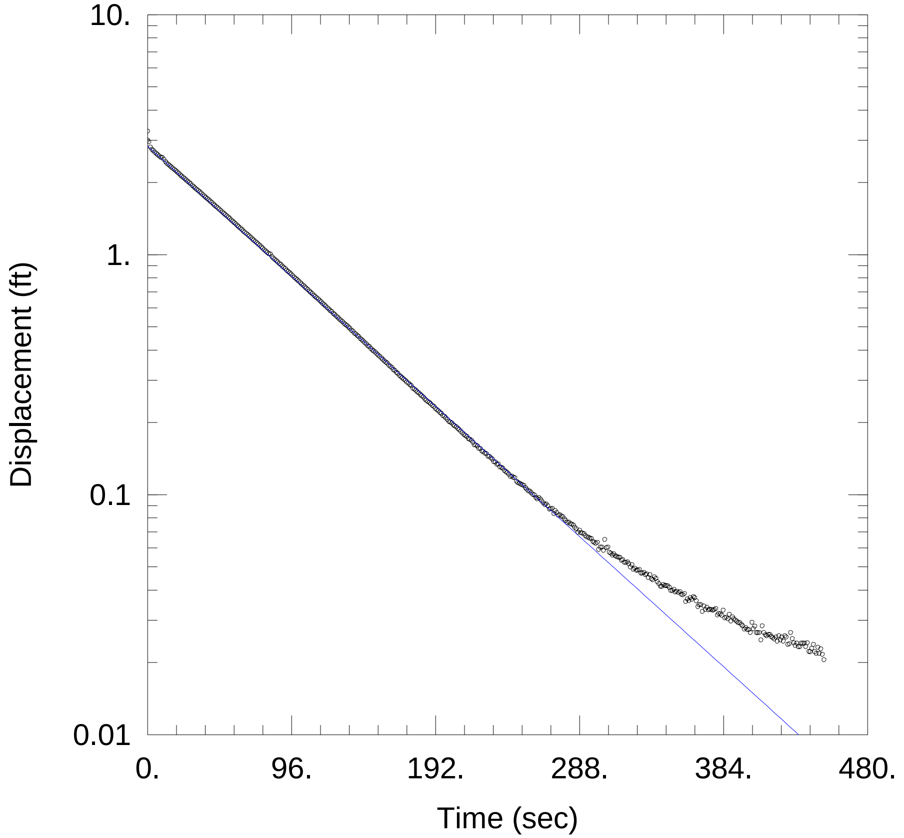
K = 2.559 ft/day
y0 = 3.12 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-03D)

Initial Displacement: 3. ft
Total Well Penetration Depth: 15. ft
Casing Radius: 0.083 ft
Static Water Column Height: 16.4 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



CTMW-03D SLUG IN 2

Data Set: T:\...\CTMW_03D_slugin_2.aqt
Date: 04/27/17 Time: 12:14:21

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-03D
Test Date: 12/09/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

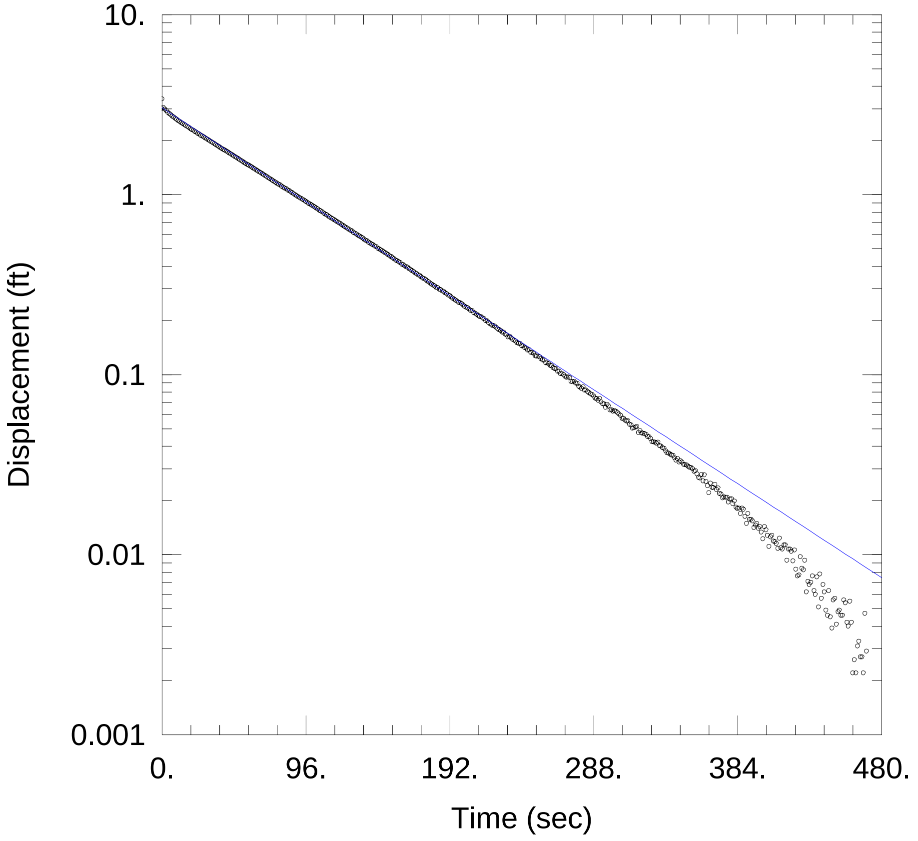
K = 2.535 ft/day
y0 = 2.834 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-03D)

Initial Displacement: 3. ft
Total Well Penetration Depth: 15. ft
Casing Radius: 0.083 ft
Static Water Column Height: 16.4 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



CTMW-03D SLUG OUT 2

Data Set: T:\...\CTMW_03D_slugout_2.aqt
Date: 04/27/17 Time: 12:09:02

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-03D
Test Date: 12/09/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

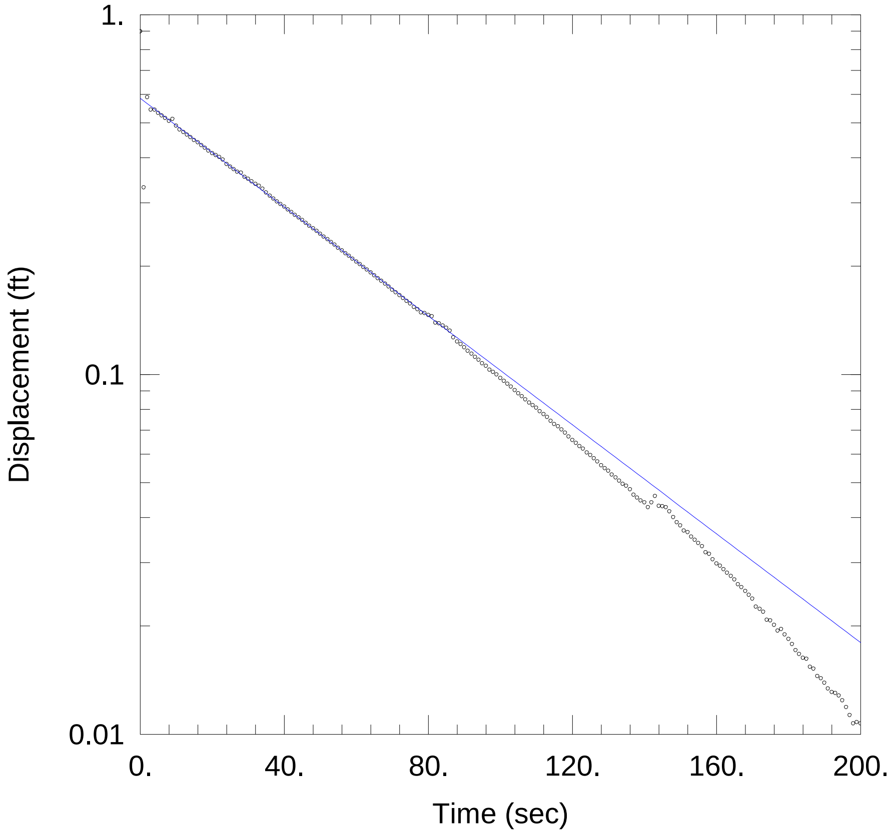
K = 2.44 ft/day
y0 = 3.04 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-03D)

Initial Displacement: 3. ft
Total Well Penetration Depth: 15. ft
Casing Radius: 0.083 ft
Static Water Column Height: 16.4 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



CTMW-03D SLUG IN 1

Data Set: \...\CTMW_03D_slugin_1.aqt
Date: 10/23/17 Time: 09:40:34

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-03D
Test Date: 10/05/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

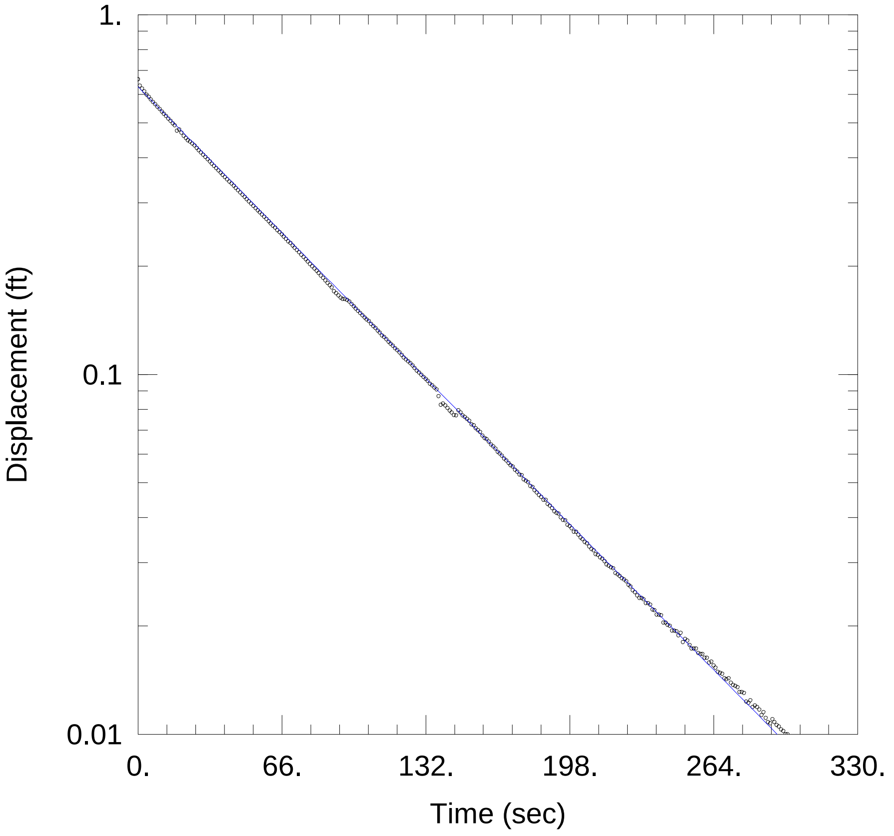
K = 3.455 ft/day
y0 = 0.586 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-03D)

Initial Displacement: 0.8979 ft
Total Well Penetration Depth: 16.62 ft
Casing Radius: 0.083 ft
Static Water Column Height: 16.62 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



CTMW-03D SLUG OUT 1

Data Set: \...\CTMW_03D_slugout_1.aqt
Date: 10/23/17 Time: 09:40:46

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-03D
Test Date: 10/05/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

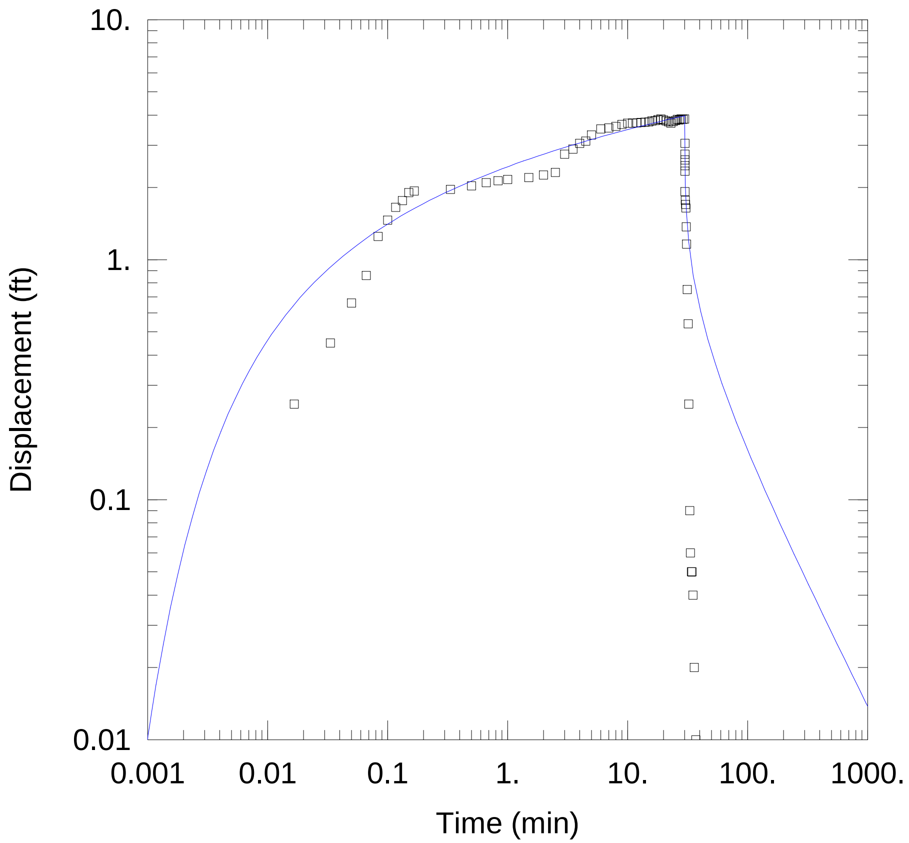
K = 2.803 ft/day
y0 = 0.6301 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-03D)

Initial Displacement: 0.6609 ft
Total Well Penetration Depth: 16.62 ft
Casing Radius: 0.083 ft
Static Water Column Height: 16.62 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



PUMPING TEST FOR CTMW-03D (2.0 L/MIN)

Data Set: T:\...\CTMW-03D 2.0.aqt
Date: 05/02/17 Time: 09:46:59

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Project: In-Situ Chromium Treatment
Location: Henderson NV
Test Well: CTMW-03D
Test Date: 2-28-2017

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 17.92 ft^2/day
S = 0.001163
Kz/Kr = 0.1
b = 6. ft

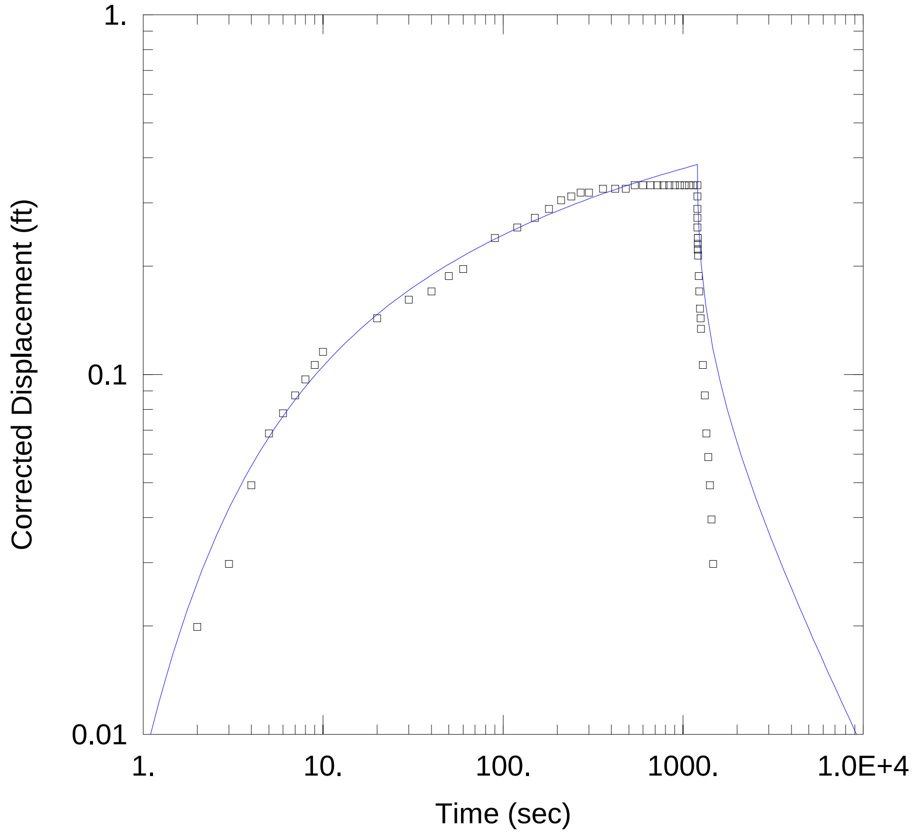
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTMW-03D	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
☐ CTMW-03D	0	0



PUMPING TEST FOR CTMW-04S (1.0 L/MIN)

Data Set: T:\...\CTMW-04S 1.0.aqt
Date: 05/01/17 Time: 16:50:04

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-04S
Test Date: 4/7/2017

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 55.43 ft^2/day
S = 0.03257
Kz/Kr = 0.1
b = 1.63 ft

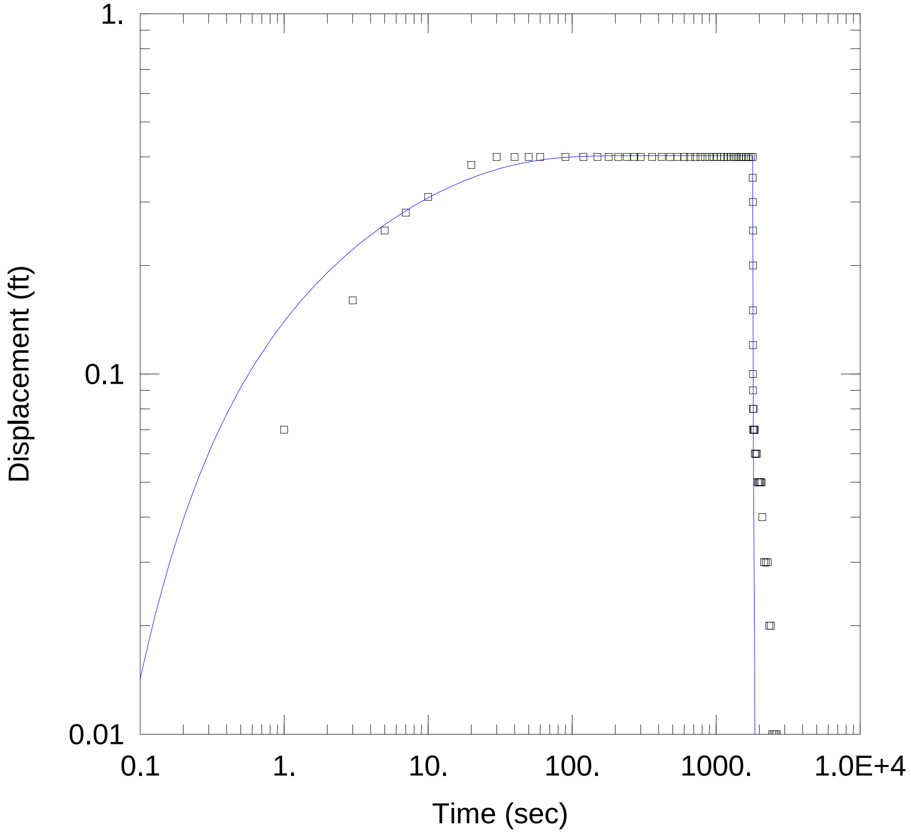
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTMW-04S	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTMW-04S	0	0



PUMPING TEST FOR CTMW-04S 0.5 (L/MIN)

Data Set: \...\CTMW-04S 0.5_Hantush-Jacob.aqt
Date: 10/25/17 Time: 14:18:35

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-04S
Test Date: 10/9/2017

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 23.95 ft^2/day
S = 0.001151
r/B = 0.1
Kz/Kr = 0.1
b = 1.05 ft

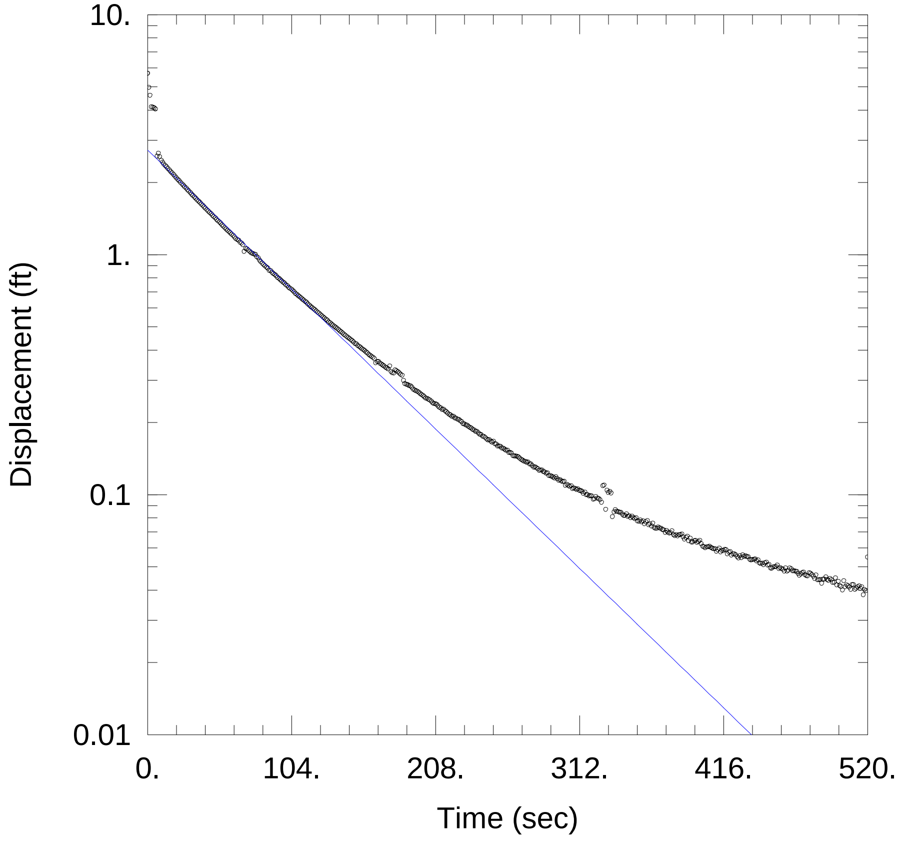
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTMW-04S	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTMW-04S	0	0



CTMW-04D SLUG IN 1

Data Set: T:\...\CTMW_04D_slugin_1.aqt
Date: 05/02/17 Time: 10:24:06

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-04D
Test Date: 4/10/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

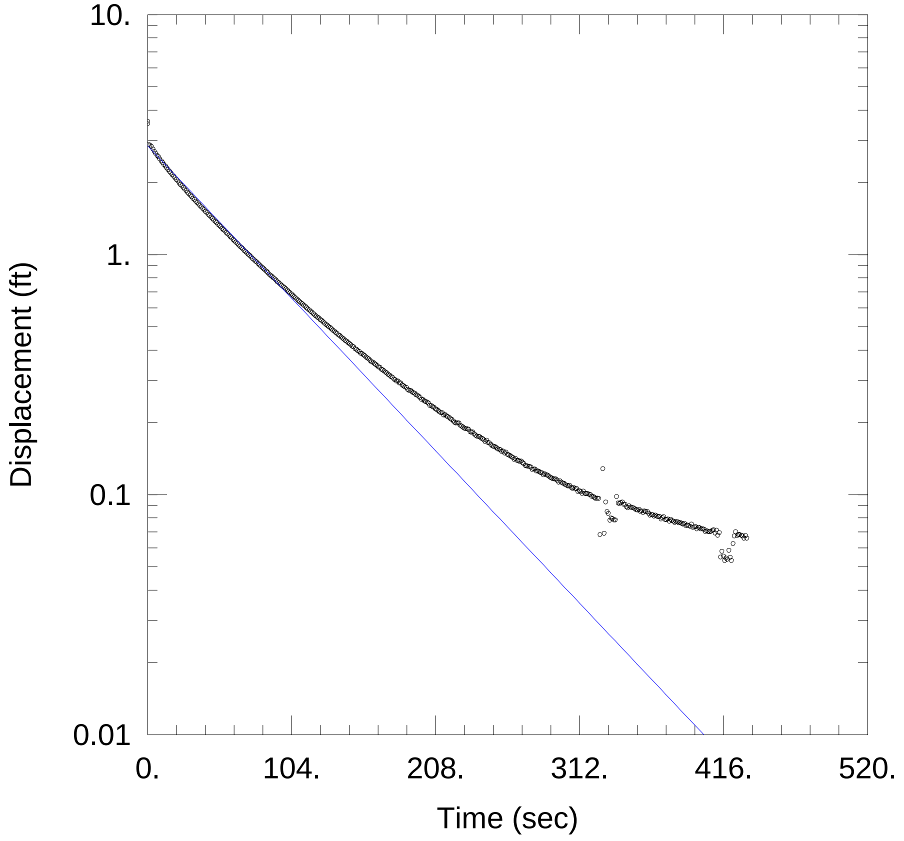
K = 1.065 ft/day
y0 = 2.729 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-04D)

Initial Displacement: 5.7 ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.68 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



CTMW-04D SLUG OUT 1

Data Set: T:\...\CTMW_04D_slugout_1.aqt
Date: 05/02/17 Time: 10:25:08

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-04D
Test Date: 4/10/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

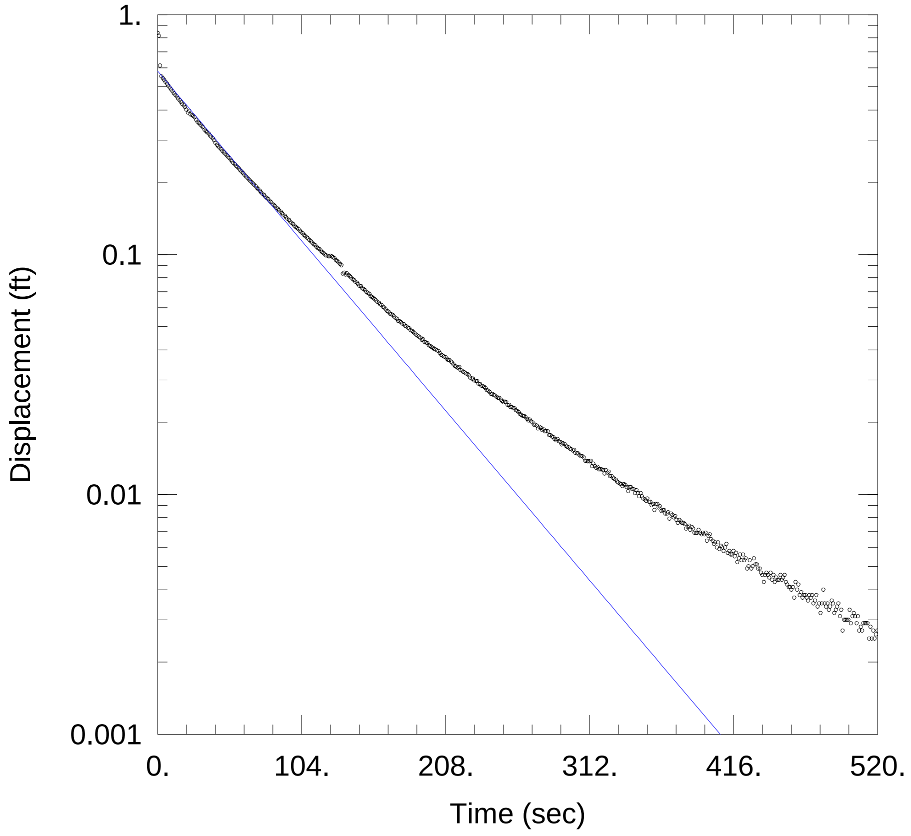
K = 1.164 ft/day
y0 = 2.841 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-04D)

Initial Displacement: 3.5 ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.68 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



CTMW-04D SLUG IN 1

Data Set: \...\CTMW_04D_slugin_1.aqt
Date: 10/23/17 Time: 09:40:59

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-04D
Test Date: 10/05/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

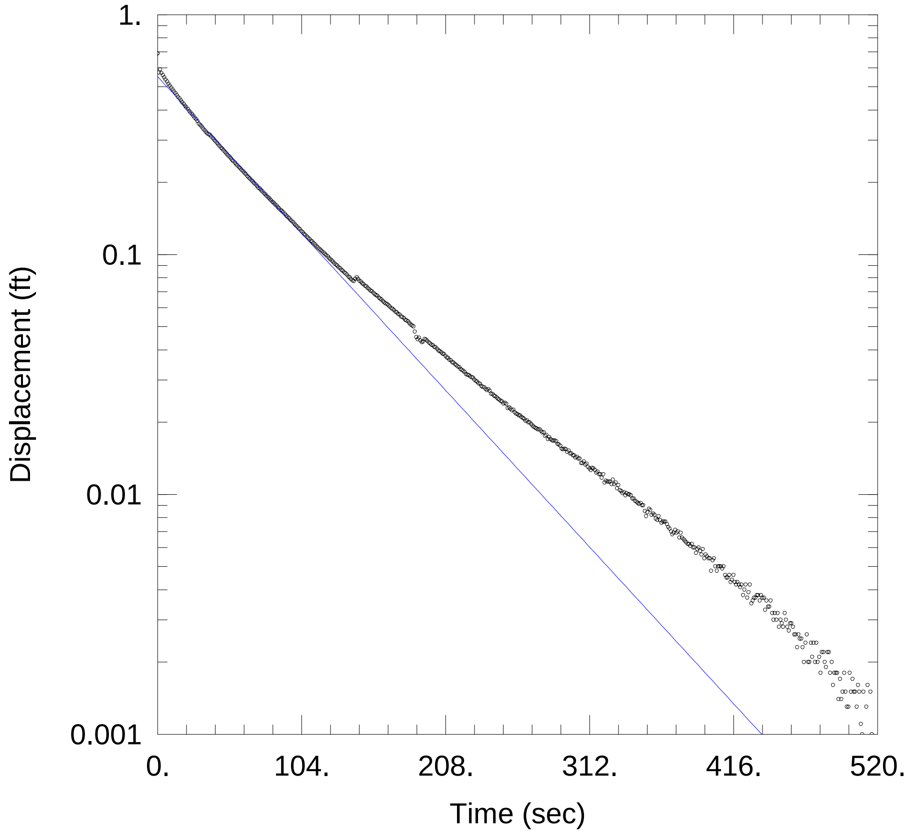
K = 1.303 ft/day
y0 = 0.5817 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-04D)

Initial Displacement: 0.8383 ft
Total Well Penetration Depth: 25.85 ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.85 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



CTMW-04D SLUG OUT 1

Data Set: \...\CTMW_04D_slugout_1.aqt
Date: 10/23/17 Time: 09:41:13

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-04D
Test Date: 10/05/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

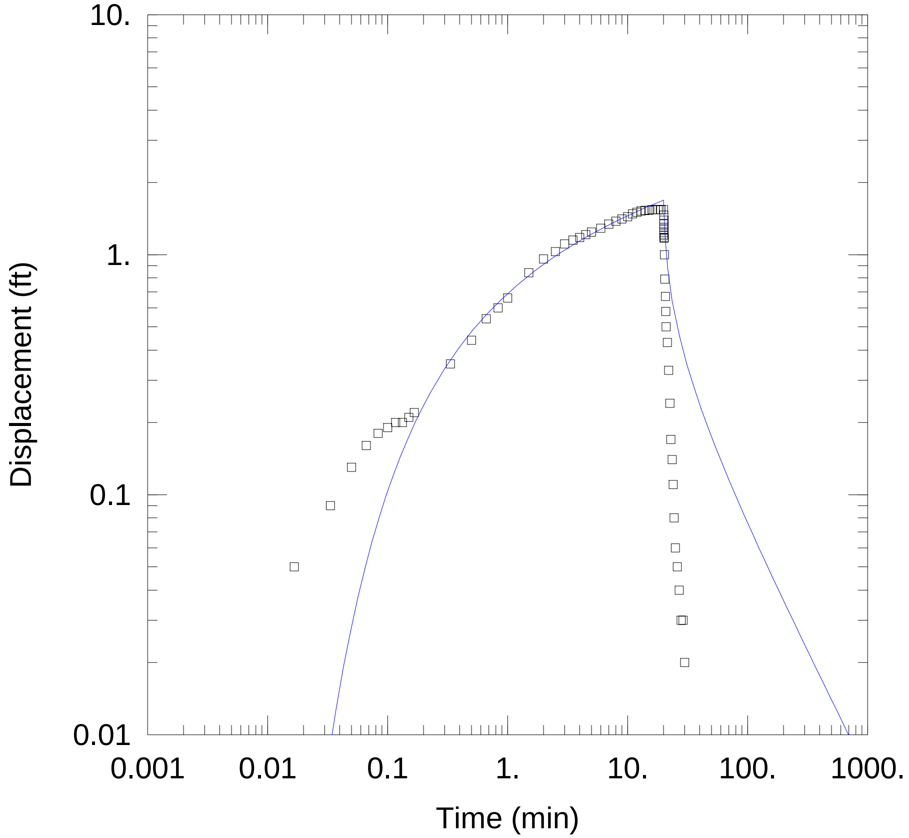
K = 1.204 ft/day
y0 = 0.5512 ft

AQUIFER DATA

Saturated Thickness: 16. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-04D)

Initial Displacement: 0.6876 ft
Total Well Penetration Depth: 25.85 ft
Casing Radius: 0.083 ft
Static Water Column Height: 25.85 ft
Screen Length: 15. ft
Well Radius: 0.33 ft



PUMPING TEST FOR CTMW-04D (0.5 L/MIN)

Data Set: T:\...\CTMW-04D 0.5.aqt
Date: 05/02/17 Time: 10:03:51

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Project: In-Situ Chromium Treatment
Location: Henderson NV
Test Well: CTMW-04D
Test Date: 4-7-2017

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 5.813 ft^2/day
S = 0.01191
Kz/Kr = 0.1
b = 16. ft

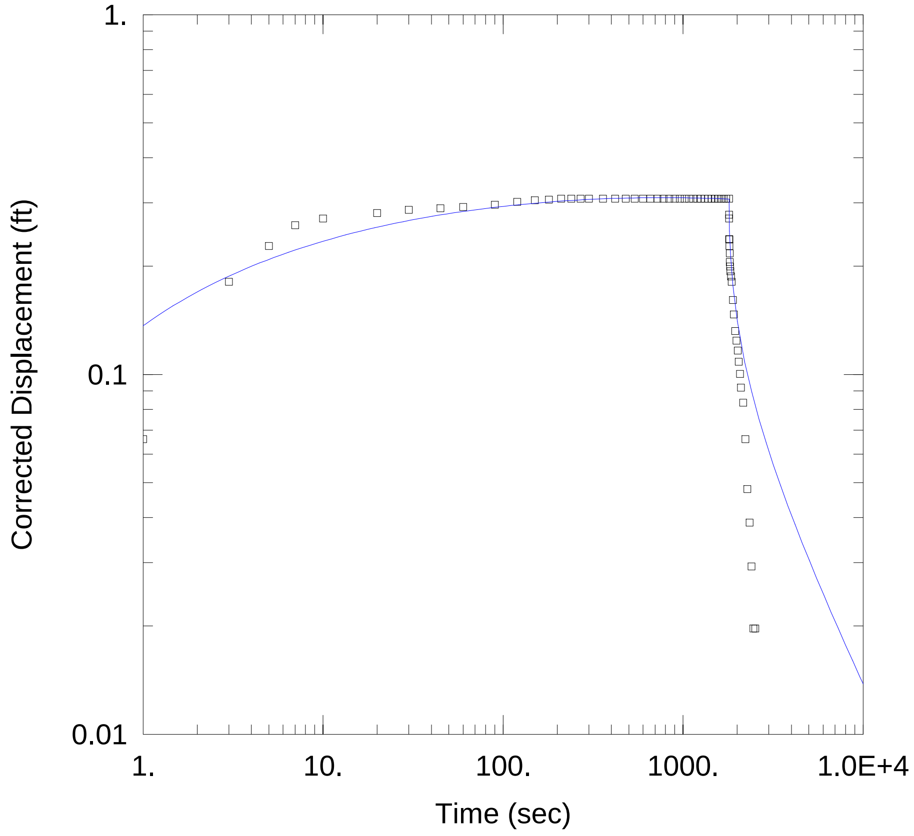
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTMW-04D	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTMW-04D	0	0



PUMPING TEST FOR CTMW-05S (0.5 L/MIN)

Data Set: \...\CTMW-05S 0.5.aqt
Date: 10/25/17 Time: 14:18:48

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-05S
Test Date: 10/9/2017

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 28.3 ft^2/day
S = 0.000768
Kz/Kr = 0.1
b = 0.62 ft

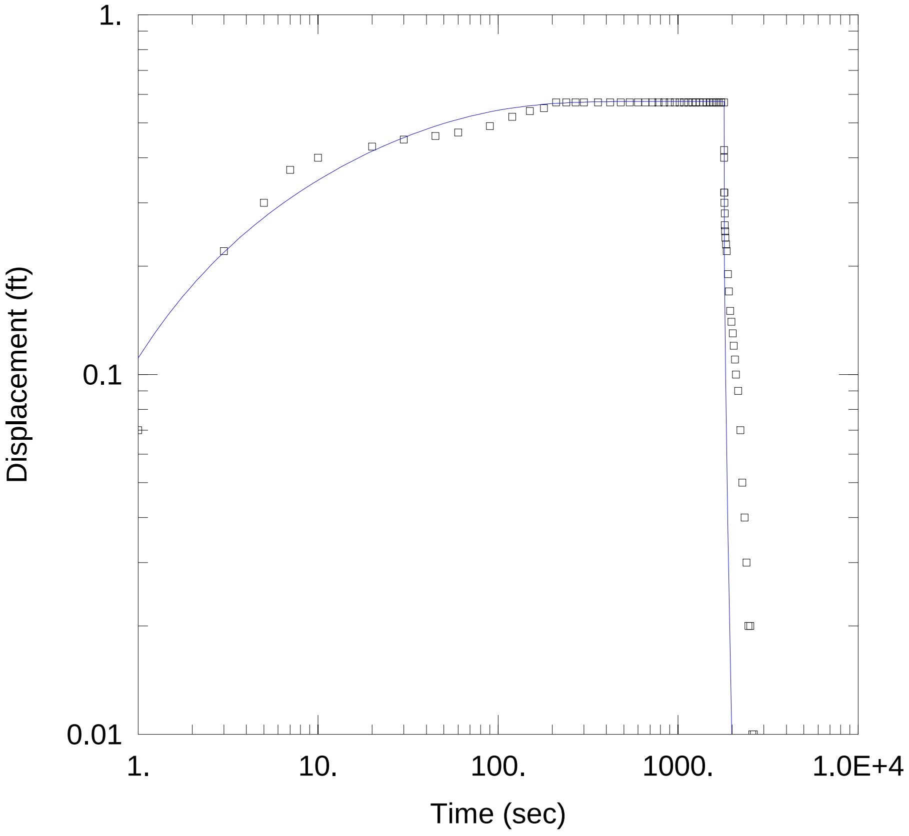
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTMW-05S	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTMW-05S	0	0



PUMPING TEST FOR CTMW-05S (0.5 L/MIN)

Data Set: \...\CTMW-05S 0.5_Hantush-Jacob.aqt
Date: 10/25/17 Time: 14:19:01

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-05S
Test Date: 10/9/2017

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 16.84 ft^2/day
S = 0.002005
r/B = 0.1
Kz/Kr = 0.1
b = 0.62 ft

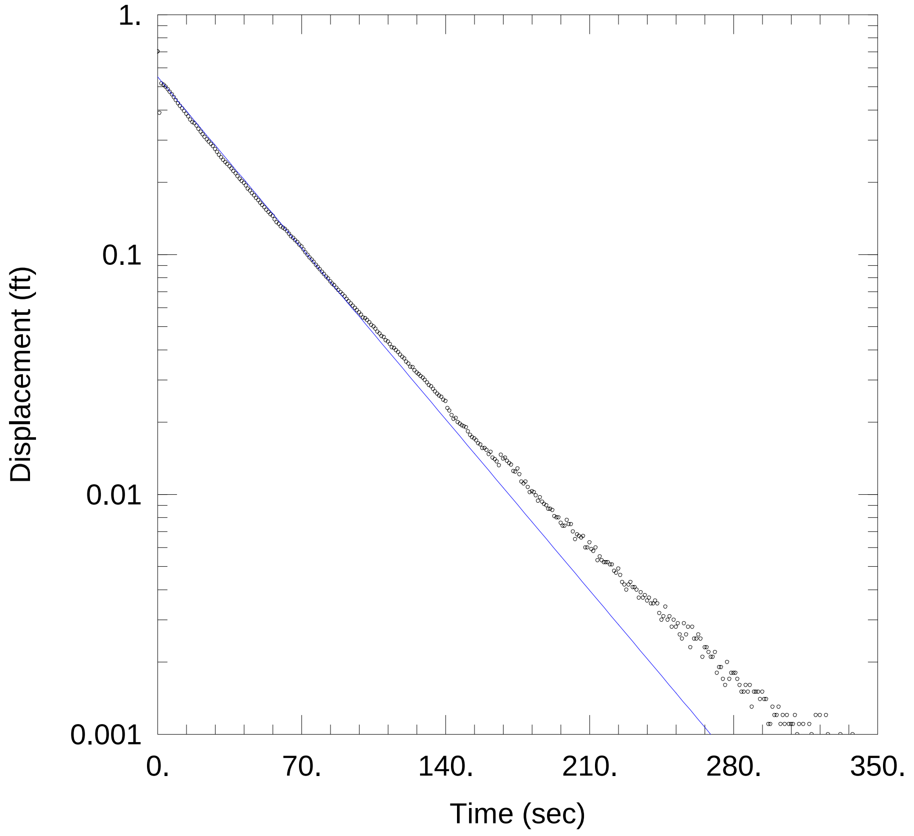
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTMW-05S	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTMW-05S	0	0



CTMW-05D SLUG IN 1

Data Set: \...\CTMW_05D_slugin_1.aqt
Date: 10/23/17 Time: 09:41:28

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-05D
Test Date: 10/05/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 1.453 ft/day
y0 = 0.5498 ft

AQUIFER DATA

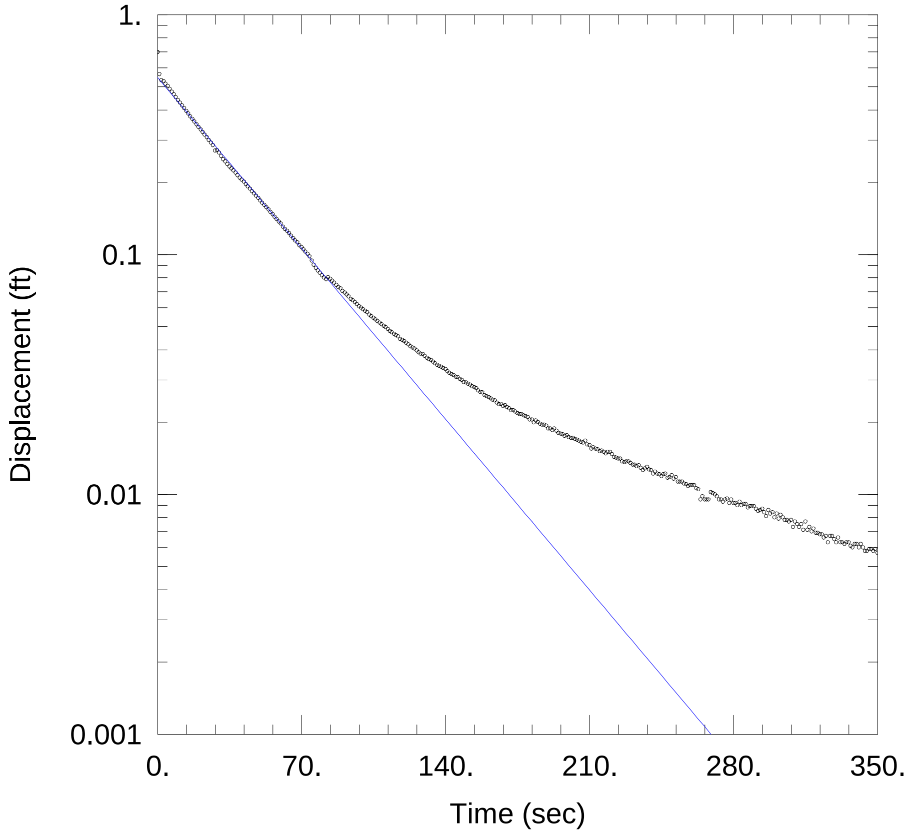
Saturated Thickness: 21. ft

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-05D)

Initial Displacement: 0.7013 ft
Total Well Penetration Depth: 30.45 ft
Casing Radius: 0.083 ft

Static Water Column Height: 30.45 ft
Screen Length: 20. ft
Well Radius: 0.4167 ft



CTMW-05D SLUG OUT 1

Data Set: \...\CTMW_05D_slugout_1.aqt
Date: 10/23/17 Time: 09:41:40

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-05D
Test Date: 10/05/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

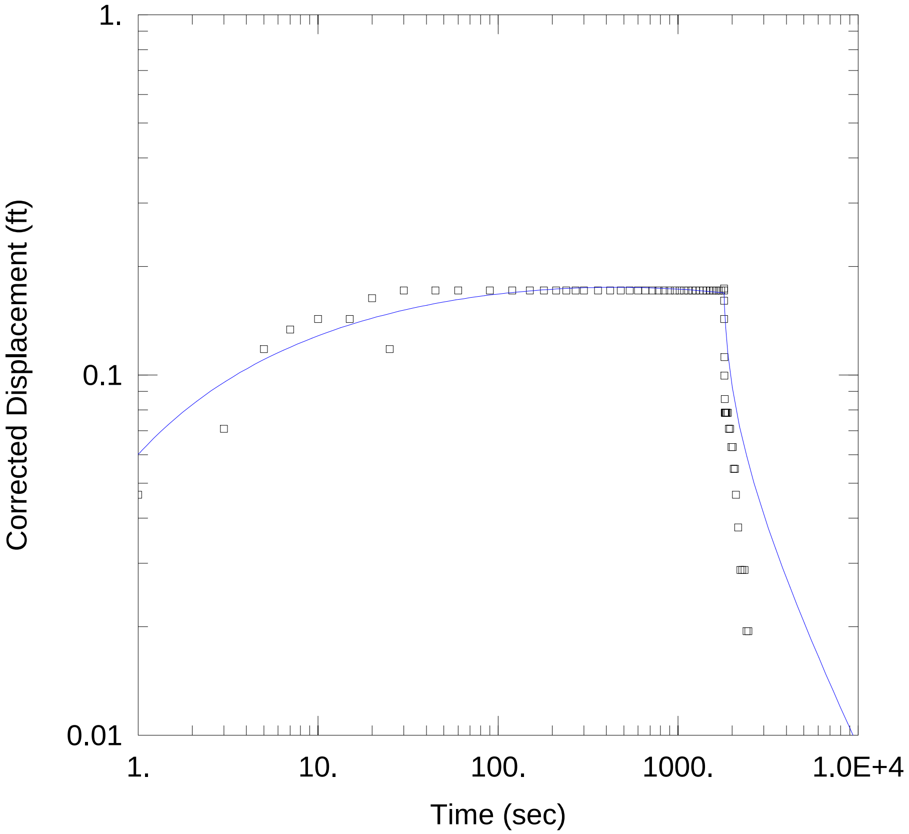
K = 1.451 ft/day
y0 = 0.5468 ft

AQUIFER DATA

Saturated Thickness: 21. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-05D)

Initial Displacement: 0.6971 ft
Total Well Penetration Depth: 30.45 ft
Casing Radius: 0.083 ft
Static Water Column Height: 30.45 ft
Screen Length: 20. ft
Well Radius: 0.4167 ft



PUMPING TEST FOR CTMW-06S (0.5 L/MIN)

Data Set: \...\CTMW-06S 0.5.aqt
Date: 10/25/17 Time: 14:19:13

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-06S
Test Date: 10/9/2017

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 41.83 ft^2/day
S = 0.001815
Kz/Kr = 0.1
b = 0.35 ft

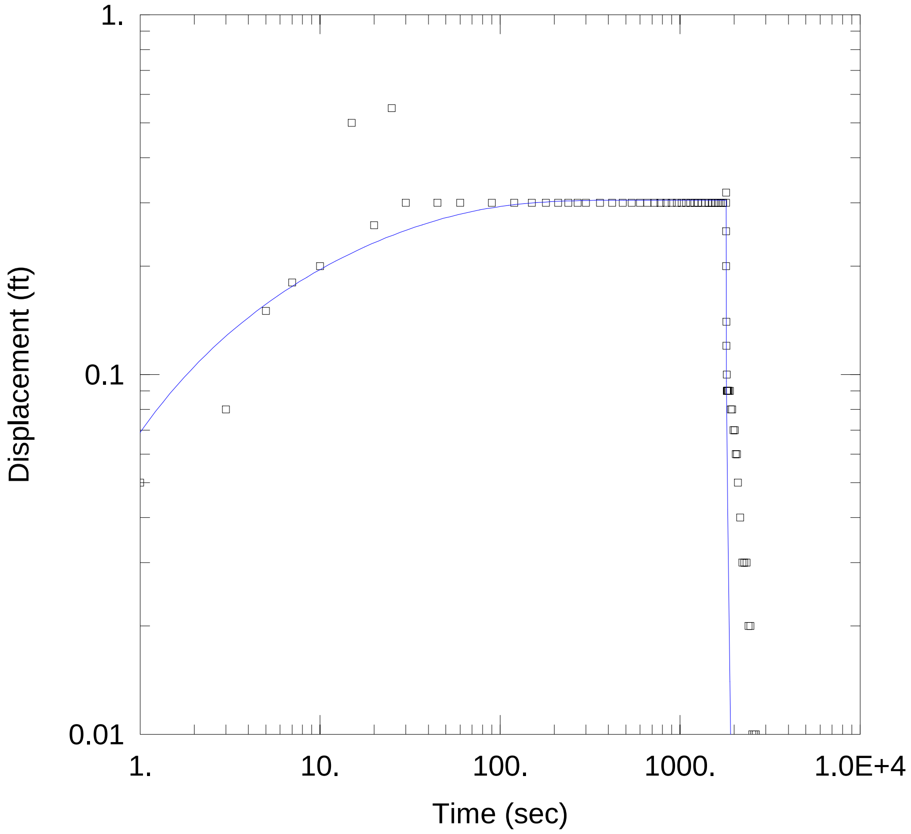
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTMW-06S	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTMW-06S	0	0



PUMPING TEST FOR CTMW-06S (0.5 L/MIN)

Data Set: \...\CTMW-06S 0.5_Hantush-Jacob.aqt
Date: 10/25/17 Time: 14:19:24

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-06S
Test Date: 10/9/2017

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 31.71 ft^2/day
S = 0.001962
r/B = 0.1
Kz/Kr = 0.1
b = 0.35 ft

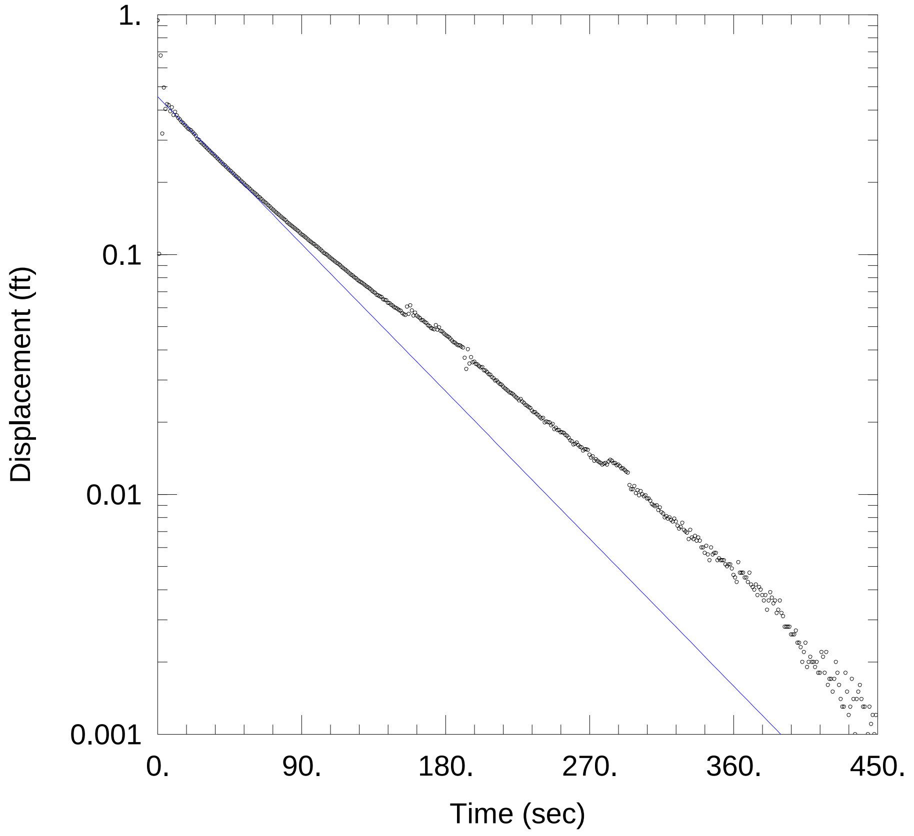
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
CTMW-06S	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ CTMW-06S	0	0



CTMW-06D SLUG IN 1

Data Set: \...\CTMW_06D_slugin_1.aqt
Date: 10/23/17 Time: 09:41:54

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-06D
Test Date: 10/04/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.9758 ft/day
y0 = 0.4551 ft

AQUIFER DATA

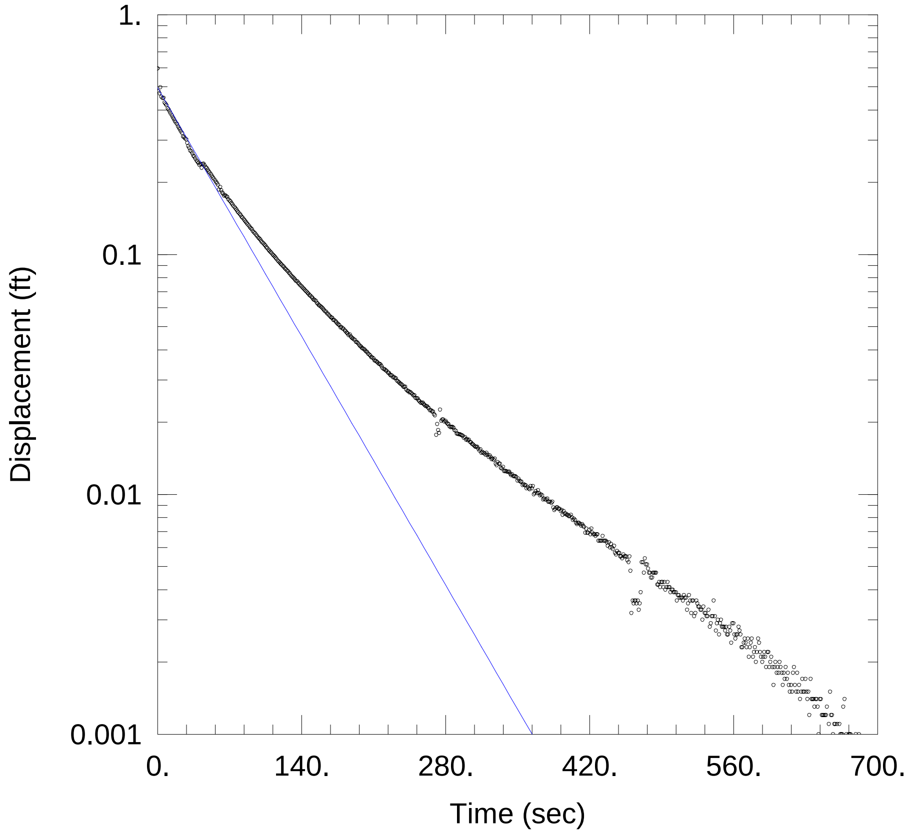
Saturated Thickness: 21. ft

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-06D)

Initial Displacement: 0.9452 ft
Total Well Penetration Depth: 31.01 ft
Casing Radius: 0.083 ft

Static Water Column Height: 31.01 ft
Screen Length: 20. ft
Well Radius: 0.4167 ft



CTMW-06D SLUG OUT 1

Data Set: \...\CTMW_06D_slugout_1.aqt
Date: 10/23/17 Time: 09:42:06

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: CTMW-06D
Test Date: 10/04/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 1.059 ft/day
y0 = 0.4958 ft

AQUIFER DATA

Saturated Thickness: 21. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (CTMW-06D)

Initial Displacement: 0.5969 ft
Total Well Penetration Depth: 31.01 ft
Casing Radius: 0.083 ft
Static Water Column Height: 31.01 ft
Screen Length: 20. ft
Well Radius: 0.4167 ft

Chemical Reduction Study

TECHNICAL MEMORANDUM

To:	**Arul Ayyaswami, Tetra Tech**
Cc:	Carl Lenker and Mike Crews, Tetra Tech
From:	Sonya Cadle, Chris Gutmann, and Ellyn Swenson, Tetra Tech
Date:	October 26, 2017
Subject:	Aquifer Testing Results – AP Area Treatability Study

1.0 INTRODUCTION

This technical memorandum presents the results of the aquifer slug testing and specific capacity tests performed as part of the NERT AP Area Treatability Study hydrogeological evaluation. The slug tests were conducted in the intermediate ("I") and deep ("D") wells, since there was insufficient water in the shallow ("S") wells to permit slug testing. Specific capacity tests were conducted in primarily shallow wells and used to estimate aquifer parameters; one intermediate well was also tested in a similar way to allow direct comparison to slug testing results.

The locations of the wells are shown below. The objective of the aquifer slug and pump testing was to estimate aquifer hydraulic conductivity (K) in the study area before injection testing. Because the shallow alluvial wells had extremely small saturated thicknesses (often less than a foot), the aquifer parameter estimates were extremely dependent on the exact saturated thickness. Hence, these estimates were not considered representative of the overall K of the alluvium but proved useful in estimating potential injection rates.

2.0 SLUG TESTS

Slug testing was performed in August/September 2016, April 2017, and October/November 2017. Well construction information is provided in Table 1. The tests consisted of monitoring water level displacements caused by the insertion or removal of a solid slug from a well. Water level displacement was measured using a Solinst Levelogger Gold M5 pressure transducer, which was programmed to collect data at one-half second time intervals. When the rate of recovery allowed multiple tests, several tests were performed at each well. The size of the slug was selected to be consistent with the diameter of the well.

The slug test data were downloaded from the transducer and the drawdown was calculated from the downloaded data. Several slug tests were selected for analysis from each well. Slug test analysis was performed using the commercially-available AQTESOLV software (HydroSOLVE 2007). The Bouwer and Rice (1976) method for analyzing slug tests in an unconfined aquifer was used to estimate hydraulic conductivity. The AQTESOLV interpretation plots are provided as Attachment A. Table 2 summarizes the results of the slug test analysis; the K values provided for each well represent a mean of the K estimates obtained from individual tests at that well. Water levels measured during the testing events are summarized in Table 3.

All tested wells were screened in the Upper Muddy Creek Formation (UMCf). The estimated Ks are generally consistent with the logged lithology of the screened interval of the wells, which was primarily silty sand to sandy silt. Prior estimates of the hydraulic conductivity for the UMCf have ranged from less than 0.01 feet per day (ft/day) to more than 10 ft/day. The estimates from the AP Area slug tests ranged from 0.1 to 15 ft/day, which is consistent with the previous range. In addition, data from the injection testing in the AP Area confirmed that many of the wells were capable of sustaining injection rates of 1-3 gallons per minute each. This injection rate would be consistent with the hydraulic conductivity range estimated from slug testing.

In some of the wells tested, the screened interval included both coarser- and finer-grained zones. Because the lithology at the tested wells was logged by collecting 1.5 feet of core for every 5 feet of hole, it is also possible that coarser-grained zones were present in other wells but were not encountered in the sampled material. In cases where both zones of fine- and coarse-grained material were present, the coarser zones would be expected to be the primary flow zones and to dominate the K estimates.

Many factors can affect slug test results. In considering whether the K from a slug test is representative of the overall formation K, the values estimated from slug tests are strongly influenced by factors such as a low-K well skin, drilling-induced disturbances, highly anisotropic formations, and the quality of well development (Butler 1998, Hyder and Butler 1995). Other possible factors could include non-instantaneous or incomplete slug removal, accidental transducer or slug movement after the test began, and others. However, in general, the individual slug tests analyzed were very consistent within each well.

3.0 SPECIFIC CAPACITY TESTS

Specific capacity tests were performed in several shallow wells with saturated thicknesses that were too thin to test using a solid slug. In addition, a specific capacity test was performed in one intermediate well for comparison with the slug test results. Each well was pumped for 20-30 minutes and then allowed to recover. Because of pump limitations, the pumping rate varied somewhat during the test. Table 4 provides a summary of specific capacity test analytical results, and the AQTESOLV printouts are provided in Attachment A.

The specific capacity test performed in intermediate well UFIW-06I was analyzed using the Theis (1935) method for the drawdown and the Hantush (1960) leaky aquifer solution for recovery. Comparison between Tables 2 and 4 shows that the values of K obtained from the specific capacity tests and slug tests at this location were similar.

Most specific capacity tests were analyzed using the Theis (1935) method, Hantush (1960) leaky aquifer solution, or Cooper-Jacob (1946) unconfined solution. The very low saturated thickness at these locations means that the resulting K estimates only apply to the small saturated zone of alluvium immediately overlying the UMCf; they are not likely to be representative of the overall K of the alluvium. In fact, at one well (UFIW-04S) the saturated thickness was so small that the water level drew down to the pump intake within the first couple seconds and then sustained that level with a tiny flow rate for the next 30 minutes. The resulting data could not be analyzed because there were only a couple data points documenting the drawdown and recovery.

4.0 COMPARISON BEFORE AND AFTER INJECTIONS

Treatability study-related injections began after the August/September 2016 aquifer testing event was completed. Several wells were tested in April and October/November 2017 after all injections were completed in order to assess whether the injections had potentially influenced K. The K estimates from the pre-injection (August/September 2016) and post-injection (April and October/November 2017) tests are provided in Table 2.

Based on the data collected before and after injection, a decrease in K occurred in several injection wells tested:

- UFIW-01I and UFIW-04I showed a decrease in K of about an order of magnitude.
- UFIW-05I and UFIW-08I showed a small potential decrease in K, but by less than an order of magnitude.

However, monitoring wells tested before and after injection showed no significant changes in the estimated K; in fact, the K estimates were nearly identical in many cases. Thus, any decrease in K associated with injection testing was very likely limited to the immediate vicinity of the injection wells.

5.0 REFERENCES

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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, Am. Geophys. Union Trans., vol. 16, pp. 519-524

Table 1: Well Construction Information AP Area Treatability Study, Henderson, Nevada

Well ID	UMCf Contact (feet bgs)	Screened Interval (feet bgs)	Top of Casing (feet amsl)	Well Diameter (inches)	Slug Dimensions	
					Diameter (inches)	Length (feet)
UFIW-01S	28	23 - 28	1,755.11	2	--	--
UFIW-01I	28	33 - 38	1,755.08	2	1.66	5
UFIW-01D	28	43 - 48	1,755.21	2	1.66	5
UFIW-02S	28	23 - 28	1,754.97	2	--	--
UFIW-02I	28	31 - 41	1,754.85	2	1.66	5
UFIW-02D	28	43 - 48	1,755.01	2	1.66	5
UFIW-03S	30	25 - 30	1,755.22	2	--	--
UFIW-03I	30	35 - 40	1,754.89	2	1.66	5
UFIW-03D	30	45 - 50	1,755.38	2	1.66	5
UFIW-04S	28	23 - 28	1,755.28	2	--	--
UFIW-04I	28	33 - 38	1,755.33	2	1.66	5
UFIW-04D	28	43 - 48	1,755.39	2	1.66	5
UFIW-05S	29.5	24.5 - 29.5	1,759.63	2	--	--
UFIW-05I	29.5	34.5 - 39.5	1,759.71	2	1.66	5
UFIW-05D	29.5	44.5 - 49.5	1,759.78	2	1.66	5
UFIW-06S	32	27 - 32	1,759.76	2	--	--
UFIW-06I	32	35 - 45	1,759.71	2	1.66	5
UFIW-06D	32	47 - 52	1,759.85	2	1.66	5
UFIW-07S	31	26 - 31	1,759.76	2	--	--
UFIW-07I	31	36 - 41	1,759.63	2	1.66	5
UFIW-07D	31	46 - 51	1,759.79	2	1.66	5
UFIW-08S	30	25 - 30	1,759.60	2	--	--
UFIW-08I	30	35 - 40	1,759.61	2	1.66	5
UFIW-08D	30	46-51	1,759.77	2	1.66	5
UFMW-01S	29	24 - 29	1,755.07	2	--	--
UFMW-01I	29	34 - 39	1,755.03	2	1.66	5
UFMW-01D	29	44 - 49	1,755.12	2	1.66	5
UFMW-02S	29	24 - 29	1,755.02	2	--	--
UFMW-02I	29	34 - 39	1,755.05	2	1.66	5
UFMW-02D	29	44 - 49	1,755.02	2	1.66	5
UFMW-03S	26	21 - 26	1,754.68	2	--	--
UFMW-03I	26	30 - 40	1,754.70	2	1.66	5
UFMW-03D	26	45 - 50	1,754.77	2	1.66	5
UFMW-04S	29	24 - 29	1,758.79	2	--	--
UFMW-04I	29	34 - 39	1,758.84	2	1.66	5
UFMW-04D	29	44 - 49	1,758.83	2	1.66	5
UFMW-05S	30	25 - 30	1,758.94	2	--	--
UFMW-05I	30	35 -40	1,758.92	2	1.66	5
UFMW-05D	30	45 - 50	1,758.91	2	1.66	5
UFMW-06S	30	25 - 30	1,758.74	2	--	--
UFMW-06I	30	35 -40	1,758.71	2	1.66	5
UFMW-06D	30	45 - 50	1,758.76	2	1.66	5
E1-1	27	22 - 47	1,754.43	6	4.5	6.3
E1-2	27.5	22.5 - 47.5	1,754.46	6	4.5	6.3
E1-3	27	22 - 47	1,754.62	6	4.5	6.3
E2-1	31	26 - 51	1,757.32	6	4.5	6.3
E2-2	33	28 - 53	1,757.62	6	4.5	6.3
E2-3	32	27 - 52	1,758.05	6	4.5	6.3
E2-4	29	24 - 49	1,758.11	6	4.5	6.3
E2-5	34	28 - 53	1,758.12	6	4.5	6.3

Notes:

Shallow "S" wells were not tested because the saturated thickness was too small to support slug testing.

bgs - below ground surface

amsl - above mean sea level

UMCf - Upper Muddy Creek Formation

Table 2: Slug Test Results AP Treatability Study, Henderson, Nevada

Well	Date	Mean Hydraulic Conductivity		Logged Lithology of Screened Interval
		(feet/day)	(cm/sec)	
UFIW-01I	8/16/2016	9.7	3.43E-03	Sandy silt, fine to medium sand
	4/11/2017	0.3	1.15E-04	Sandy silt, fine to medium sand
	11/2/2017	1.4	5.01E-04	Sandy silt, fine to medium sand
UFIW-01D	8/16/2016	1.9	6.61E-04	Sandy silt, fine sand, small caliche nodules
UFIW-02I	8/17/2016	1.0	3.40E-04	Sandy silt, fine sand, silt nodule
UFIW-02D	8/16/2016	1.4	4.81E-04	Sandy silt, fine sand
UFIW-03I	8/17/2016	11.3	3.97E-03	Sandy silt, fine sand
UFIW-03D	8/17/2016	7.3	2.58E-03	Sandy silt, fine sand
UFIW-04I	8/17/2016	12.9	4.54E-03	Sandy silt, fine sand
	4/11/2017	1.3	4.41E-04	Sandy silt, fine sand
	11/2/2017	1.9	6.80E-04	Sandy silt, fine sand
UFIW-04D	8/17/2016	4.6	1.62E-03	Sandy silt, fine sand
UFIW-05I	8/18/2016	4.9	1.72E-03	Sandy silt, fine sand
	4/11/2017	2.2	7.61E-04	Sandy silt, fine sand
	11/2/2017	0.9	3.10E-04	Sandy silt, fine sand
UFIW-05D	8/18/2016	0.5	1.75E-04	Silt with clay, some sand
UFIW-06I	8/18/2016	2.5	8.96E-04	Sandy silt, fine sand
UFIW-06D	8/18/2016	0.9	3.31E-04	Silt with sand, very fine sand
UFIW-07I	8/18/2016	3.7	1.31E-03	Silt with sand, fine grained sand
UFIW-07D	8/18/2016	2.1	7.23E-04	Silt with sand, fine sand
UFIW-08I	8/18/2016	2.7	9.39E-04	Silty sand, fine sand, some small caliche chunks
	4/11/2017	0.4	1.54E-04	Silty sand, fine sand, some small caliche chunks
	11/2/2017	0.3	1.19E-04	Silty sand, fine sand, some small caliche chunks
UFIW-08D	8/29/2016	1.2	4.06E-04	Silt with sand and caliche; silt
UFMW-01I	8/17/2016	1.3	4.53E-04	Sandy silt, fine sand
	4/11/2017	1.9	6.70E-04	Sandy silt, fine sand
	10/6/2017	1.9	6.78E-04	Sandy silt, fine sand
UFMW-01D	8/17/2016	1.8	6.46E-04	Sandy silt, fine sand
	10/6/2017	3.0	1.04E-03	Sandy silt, fine sand
UFMW-02I	8/17/2016	1.0	3.57E-04	Sandy silt, fine sand
	10/6/2017	1.1	3.98E-04	Sandy silt, fine sand
UFMW-02D	8/17/2016	1.1	3.83E-04	Sandy silt, increasing sand content
	10/6/2017	1.4	4.78E-04	Sandy silt, increasing sand content
UFMW-03I	8/17/2016	1.8	6.31E-04	Sandy silt, fine sand
	4/11/2017	1.6	5.79E-04	Sandy silt, fine sand
	10/6/2017	1.8	6.32E-04	Sandy silt, fine sand
UFMW-03D	8/17/2016	1.5	5.17E-04	Sandy silt, fine sand
	10/6/2017	1.8	6.18E-04	Sandy silt, fine sand
UFMW-04I	8/29/2016	2.6	9.30E-04	Silty sand, fine sand
	4/11/2017	3.4	1.20E-03	Silty sand, fine sand
	10/5/2017	4.8	1.69E-03	Silty sand, fine sand
UFMW-04D	8/29/2016	4.6	1.63E-03	Silty sand, fine sand, caliche nodules
	10/5/2017	5.4	1.92E-03	Silty sand, fine sand, caliche nodules
UFMW-05I	8/29/2016	1.1	3.97E-04	Sandy silt, fine sand, little caliche nodules
	10/6/2017	1.9	6.78E-04	Sandy silt, fine sand, little caliche nodules
UFMW-05D	8/19/2016	4.3	1.51E-03	Sandy silt, fine sand
	10/6/2017	5.1	1.80E-03	Sandy silt, fine sand
UFMW-06I	8/29/2016	3.2	1.12E-03	Sandy silt, fine sand
	4/11/2017	3.1	1.11E-03	Sandy silt, fine sand
	10/5/2017	4.8	1.70E-03	Sandy silt, fine sand
UFMW-06D	8/29/2016	1.2	4.20E-04	Sandy silt, fine sand
	10/5/2017	1.0	3.40E-04	Sandy silt, fine sand
E1-1	8/30/2016	2.0	7.09E-04	Sand and sand with gravel (4 ft); sandy silt (21 ft)
E1-2	8/30/2016	0.5	1.92E-04	Sand and sand with gravel (5 ft); sandy silt (20 ft)
E1-3	8/30/2016	0.4	1.57E-04	Silty sand (5 ft); sandy silt (20 ft)
E2-1	8/30/2016	2.0	6.97E-04	Silty sand (5 ft); silt (20 ft)
E2-2	8/30/2016	2.3	8.24E-04	Silty sand (5 ft); silt to sandy silt (20 ft)
E2-3	8/30/2016	3.7	1.31E-03	Silty sand (5 ft); silt (19 ft); sand (1 ft)
E2-4	8/30/2016	2.7	9.61E-04	Silty sand (5 ft); silt (20 ft)
E2-5	8/30/2016	0.7	2.50E-04	Silty sand (5 ft); silt (20 ft)

Notes:

cm/sec - centimeters per second

Table 3: Water Levels AP Area Treatability Study, Henderson, Nevada

Well ID	Date	Total Depth (feet btoc)	Water Level (feet btoc)
UFIW-01I	8/16/2016	36.00	27.54
	4/11/2017	38.15	27.2
	11/2/2017	38.15	29.23
UFIW-01D	8/16/2016	48.09	27.83
UFIW-02I	8/17/2016	41.1	27.18
UFIW-02D	8/16/2016	48.55	27.45
UFIW-03I	8/17/2016	40	27.00
UFIW-03D	8/17/2016	50.35	27.43
UFIW-04I	8/17/2016	38.21	27.44
	4/11/2017	38.4	26.49
	11/2/2017	38.4	28.79
UFIW-04D	8/17/2016	47.97	27.49
UFIW-05I	8/18/2016	39.13	28.07
	4/11/2017	39.31	27.11
	11/2/2017	39.31	28.27
UFIW-05D	8/18/2016	49.47	28.48
UFIW-06I	8/18/2016	44.73	28.15
UFIW-06D	8/18/2016	51.55	28.70
UFIW-07I	8/18/2016	41.12	28.03
UFIW-07D	8/18/2016	51.20	28.38
UFIW-08I	8/18/2016	39.75	28.05
	4/11/2017	40	27.17
	11/2/2017	40	28.18
UFIW-08D	8/29/2016	50	28.27
UFMW-01I	8/17/2016	39.24	27.81
	4/11/2017	39.3	28.43
	10/6/2017	--	29.57
UFMW-01D	8/17/2016	49.00	28.08
	10/6/2017	--	29.7
UFMW-02I	8/17/2016	38.99	27.75
	10/6/2017	--	30.41
UFMW-02D	8/17/2016	48.96	27.98
	10/6/2017	--	30.47
UFMW-03I	8/17/2016	40.27	27.05
	4/11/2017	40.25	26.39
	10/6/2017	--	28.75
UFMW-03D	8/17/2016	50.36	27.32
	10/6/2017	--	28.77
UFMW-04I	8/29/2016	39.51	27.74
	4/11/2017	39.6	26.7
	10/5/2017	--	28.61
UFMW-04D	8/29/2016	49.55	27.77
	10/5/2017		28.75
UFMW-05I	8/29/2016	39.69	27.85
	10/6/2017	--	29.03
UFMW-05D	8/19/2016	49.67	27.75
	10/6/2017	--	28.83
UFMW-06I	8/29/2016	39.82	27.49
	4/1/2017	39.9	26.56
	10/5/2017	--	28.57
UFMW-06D	8/29/2016	49.81	27.76
	10/5/2107	--	28.95
E1-1	8/30/2016	45.56	27.7
E1-2	8/30/2016	47.52	27.61
E1-3	8/30/2016	46.72	27.64
E2-1	8/30/2016	51.58	26.93
E2-2	8/30/2016	52.12	26.98
E2-3	8/30/2016	49.12	27.32
E2-4	8/30/2016	48.43	27.4
E2-5	8/30/2016	55.25	27.71

Notes:

btoc - below top of casing

Table 4: Specific Capacity Test Results, AP Area Treatability Study, Henderson, Nevada

Well	Date	Analysis Type	Estimated Hydraulic Conductivity			Logged Lithology of Screened Interval
			Saturated Thickness (ft)	(feet/day)	(cm/sec)	
UFIW-06S	9/15/2016	Theis, Unconfined	3.41	11	4.03E-03	Sand with gravel and silt
	9/15/2016	Theis, Unconfined	3.41	4.5	1.59E-03	Sand with gravel and silt
UFIW-06I	9/15/2016	Hantush-Jacob, Leaky	11	1.0	3.64E-04	Sandy silt, fine sand
	9/15/2016	Theis, Unconfined	11	0.6	2.01E-04	Sandy silt, fine sand
UFMW-05S	10/10/2017	Cooper-Jacob, Unconfined	1.22	16.8	5.93E-03	Silty sand within screened interval, some variance between silty sand with gravel and silty sand with fine sand
UFMW-06S	10/10/2017	Cooper-Jacob, Unconfined	1.71	15.6	5.50E-03	Silty sand with interbedded sand

Notes:

cm/sec - centimeters per second

Imagery Sources: Esri World Map, June 2015.

\\GEOS051FS1\GEOLVVOL1\PROJECTS\DATA\NERT\M02\FEBRUARY MEETING\FIGURES\MXD\REVISIONS\042617\FIGURE01_SITELOCATION.MXD

TETRA TECH
www.tetratech.com

150 S. 4th Street, Unit A
Henderson, Nevada 89015
PHONE: (702) 854-2293

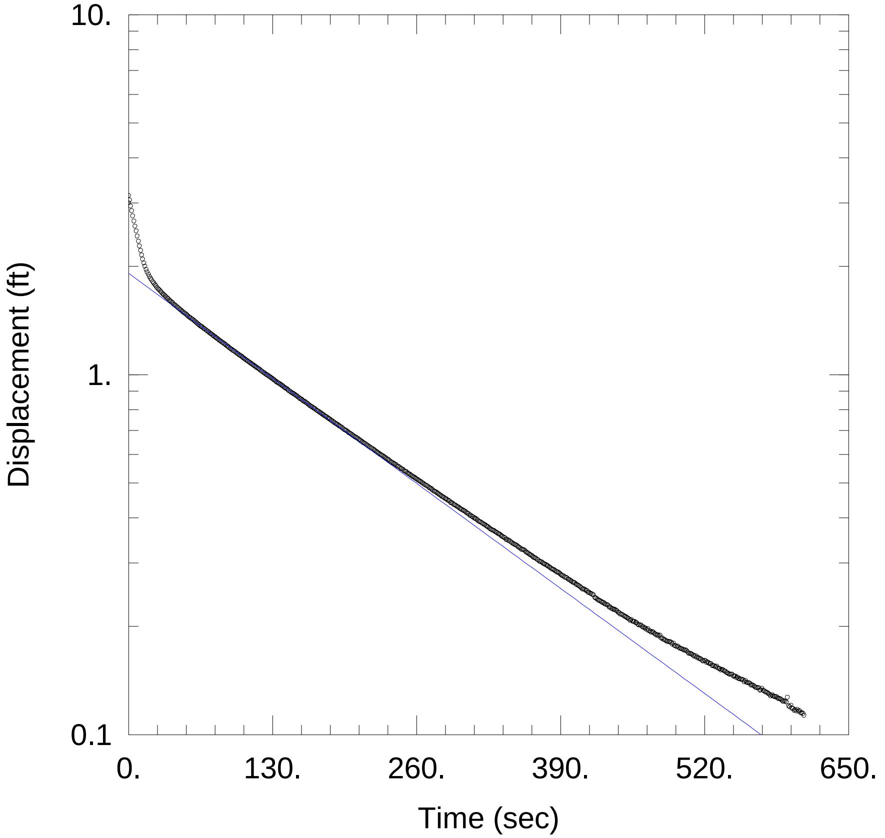
NEVADA ENVIRONMENTAL RESPONSE TRUST SITE

AP AREA SLUG AND SPECIFIC CAPACITY TESTS
HENDERSON, NEVADA

WELL LOCATIONS

Project No.:	117-7502017
Date:	OCTOBER 26, 2017
Designed By:	ES

Figure No.
1



E1-1 SLUG OUT 1

Data Set: T:\...\E1-1_slugout_1.aqt
Date: 05/04/17 Time: 09:19:10

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: E1-1
Test Date: 8/30/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

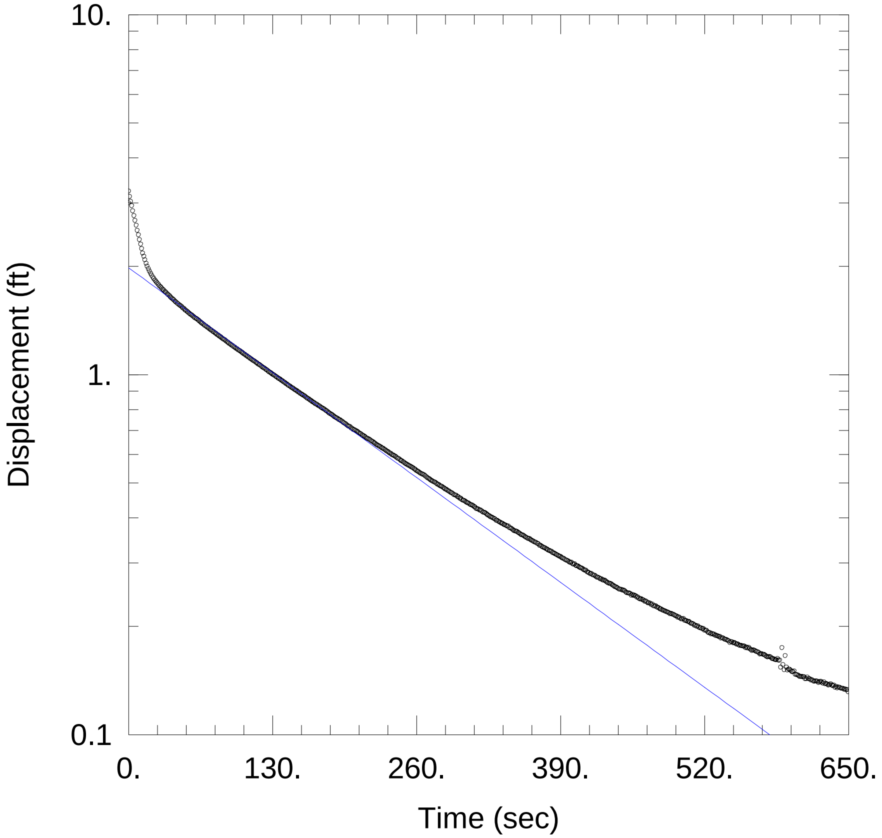
K = 2.011 ft/day
y0 = 1.911 ft

AQUIFER DATA

Saturated Thickness: 19.3 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (E1-1)

Initial Displacement: 3. ft
Total Well Penetration Depth: 19.3 ft
Casing Radius: 0.25 ft
Static Water Column Height: 17.9 ft
Screen Length: 19.3 ft
Well Radius: 0.5 ft



E1-1 SLUG OUT 2

Data Set: T:\...\E1-1_slugout_2.aqt
Date: 05/04/17 Time: 09:19:25

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: E1-1
Test Date: 8/30/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

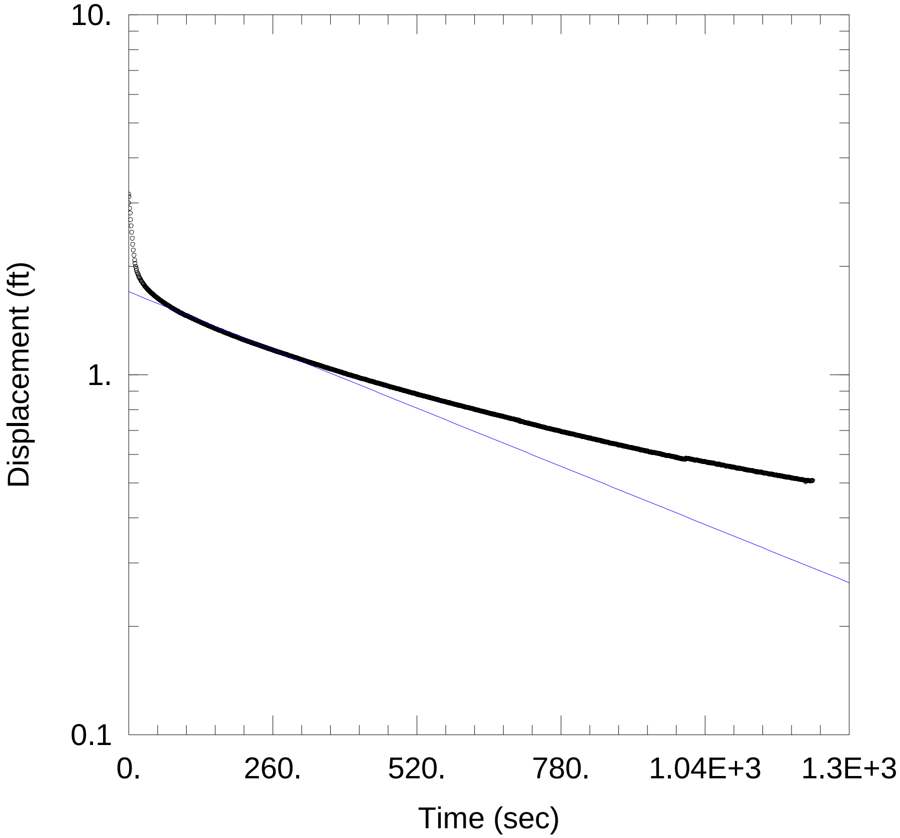
K = 2.009 ft/day
y0 = 1.981 ft

AQUIFER DATA

Saturated Thickness: 19.3 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (E1-1)

Initial Displacement: 3. ft
Total Well Penetration Depth: 19.3 ft
Casing Radius: 0.25 ft
Static Water Column Height: 17.9 ft
Screen Length: 19.3 ft
Well Radius: 0.5 ft



E1-2 SLUG OUT 1

Data Set: T:\...\E1-2_slugout_1.aqt
Date: 05/04/17
Time: 09:19:35

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: E1-2
Test Date: 8/30/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

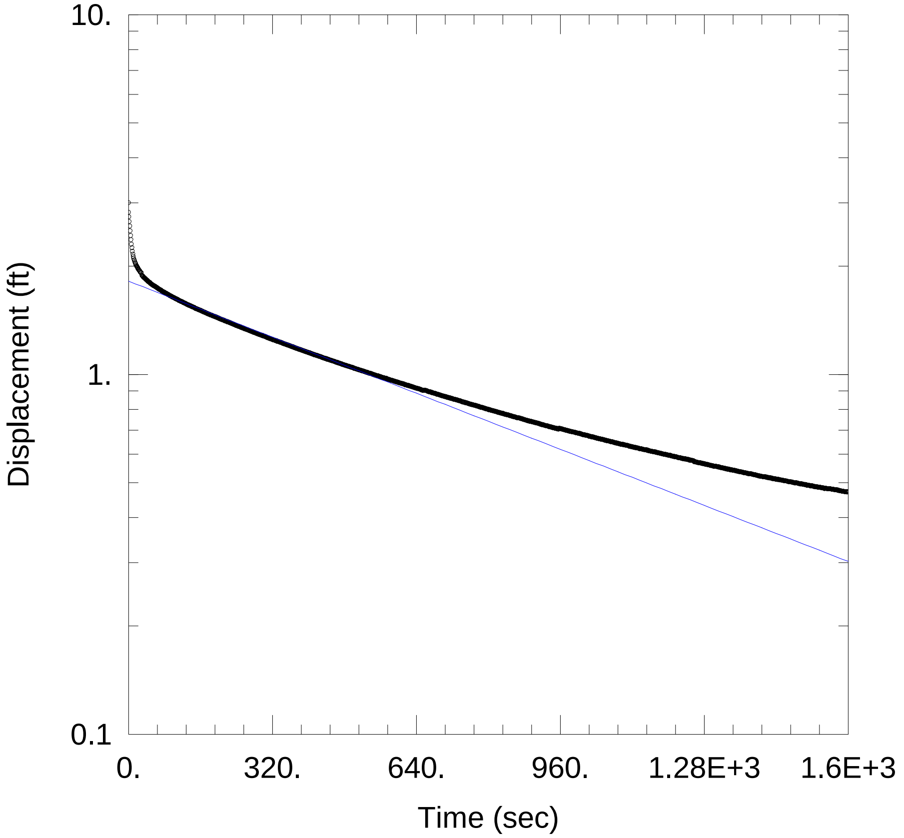
K = 0.5456 ft/day
y0 = 1.7 ft

AQUIFER DATA

Saturated Thickness: 19.89 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (E1-2)

Initial Displacement: 3. ft
Total Well Penetration Depth: 19.89 ft
Casing Radius: 0.25 ft
Static Water Column Height: 19.9 ft
Screen Length: 19.89 ft
Well Radius: 0.5 ft



E1-3 SLUG OUT 1

Data Set: T:\...\E1-3_slugout_1.aqt
Date: 05/04/17 Time: 09:19:43

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: E1-3
Test Date: 8/30/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

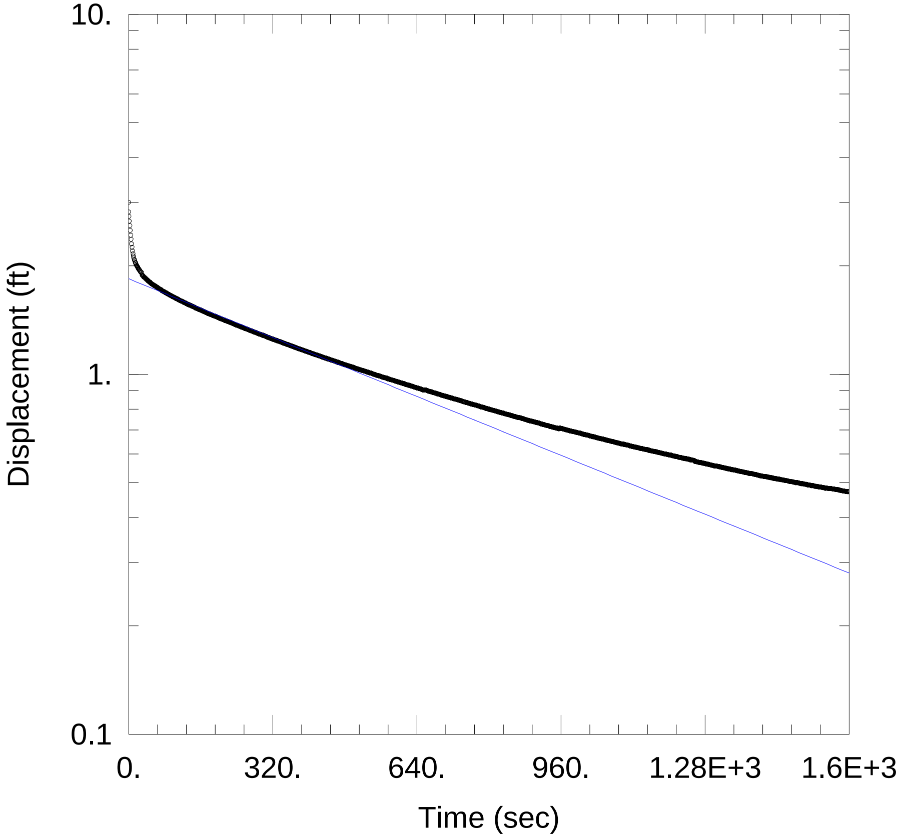
K = 0.4355 ft/day
y0 = 1.817 ft

AQUIFER DATA

Saturated Thickness: 19.36 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (E1-3)

Initial Displacement: 3. ft
Total Well Penetration Depth: 19.36 ft
Casing Radius: 0.25 ft
Static Water Column Height: 19.1 ft
Screen Length: 19.36 ft
Well Radius: 0.5 ft



E1-3 SLUG OUT 1

Data Set: T:\...\E1-3_slugout_2.aqt
Date: 05/04/17 Time: 09:19:52

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: E1-3
Test Date: 8/30/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

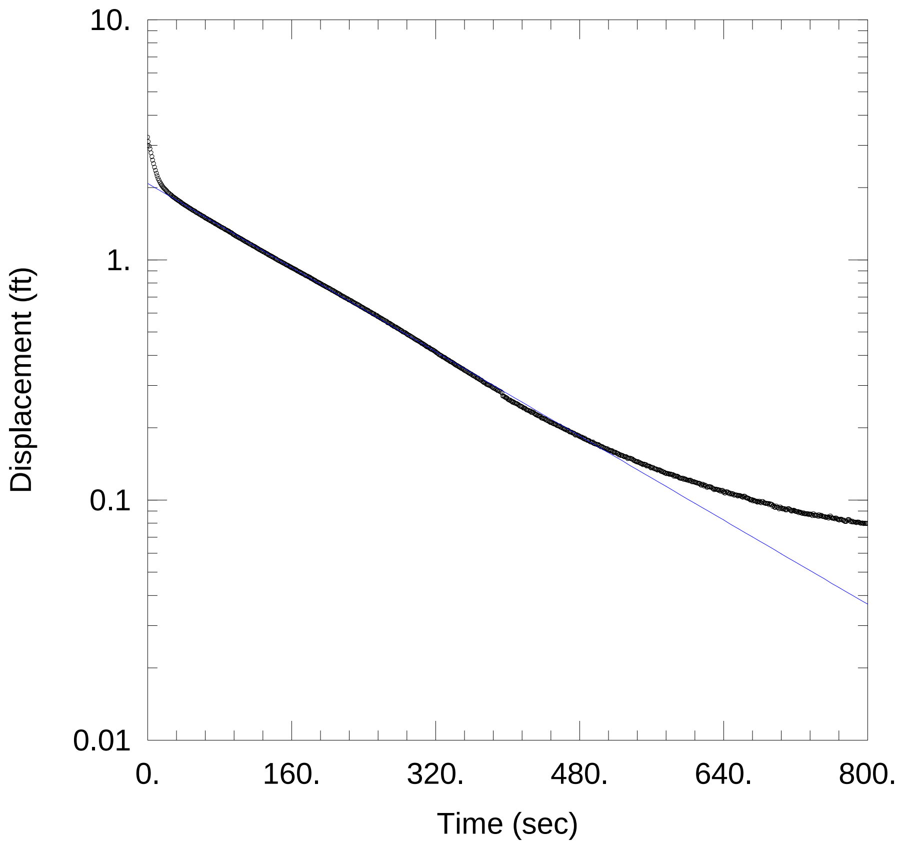
K = 0.457 ft/day
y0 = 1.841 ft

AQUIFER DATA

Saturated Thickness: 19.36 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (E1-3)

Initial Displacement: 3. ft
Total Well Penetration Depth: 19.36 ft
Casing Radius: 0.25 ft
Static Water Column Height: 19.1 ft
Screen Length: 19.36 ft
Well Radius: 0.5 ft



E2-1 SLUG OUT 1

Data Set: T:\...\E2-1_slugout_1.aqt
Date: 05/04/17 Time: 09:20:01

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: E2-1
Test Date: 8/30/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

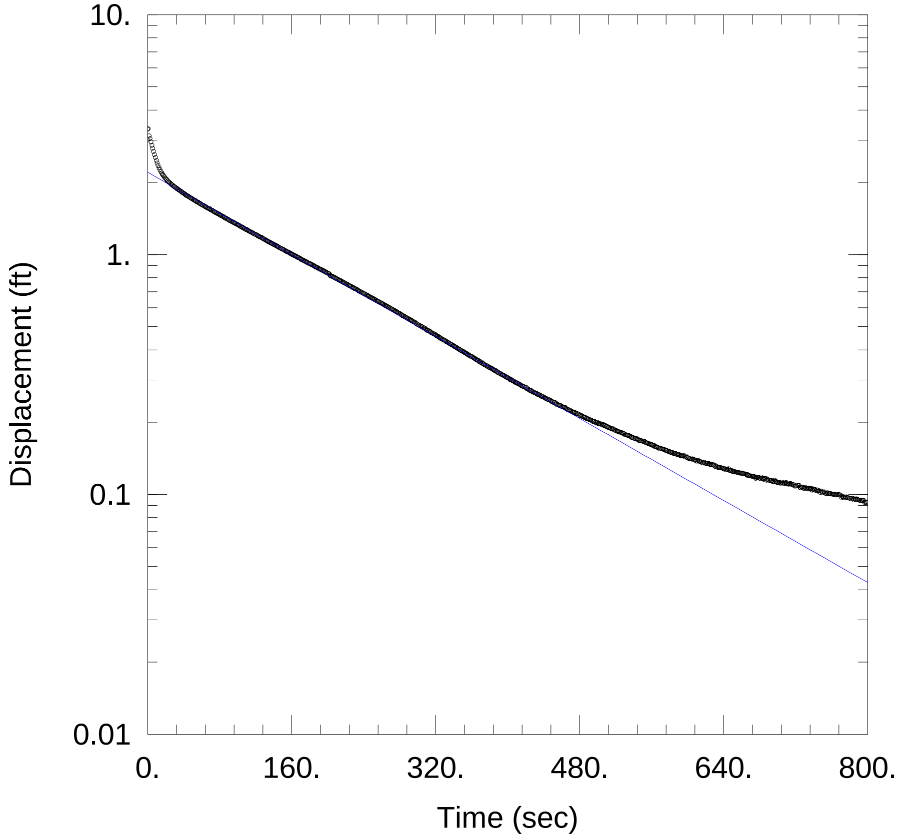
K = 2.318 ft/day
y0 = 2.081 ft

AQUIFER DATA

Saturated Thickness: 24.1 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (E2-1)

Initial Displacement: 3. ft
Total Well Penetration Depth: 24.07 ft
Casing Radius: 0.25 ft
Static Water Column Height: 24.7 ft
Screen Length: 24.07 ft
Well Radius: 0.5 ft



E2-1 SLUG OUT 2

Data Set: T:\...\E2-1_slugout_2.aqt
Date: 05/04/17 Time: 09:20:15

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: E2-1
Test Date: 8/30/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

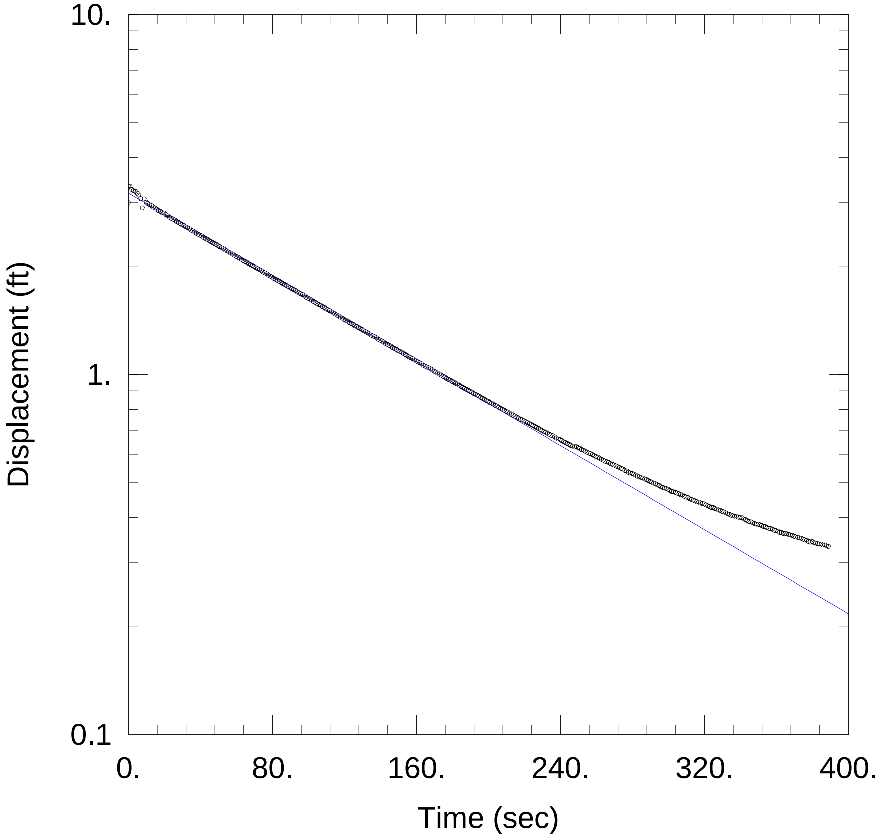
K = 1.636 ft/day
y0 = 2.201 ft

AQUIFER DATA

Saturated Thickness: 24.07 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (E2-1)

Initial Displacement: 3. ft
Total Well Penetration Depth: 24.07 ft
Casing Radius: 0.25 ft
Static Water Column Height: 24.7 ft
Screen Length: 24.07 ft
Well Radius: 0.5 ft



E2-2 SLUG IN 1

Data Set: T:\...\E2-2_slugin_1.aqt
Date: 05/04/17 Time: 09:20:29

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: E2-2
Test Date: 8/30/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

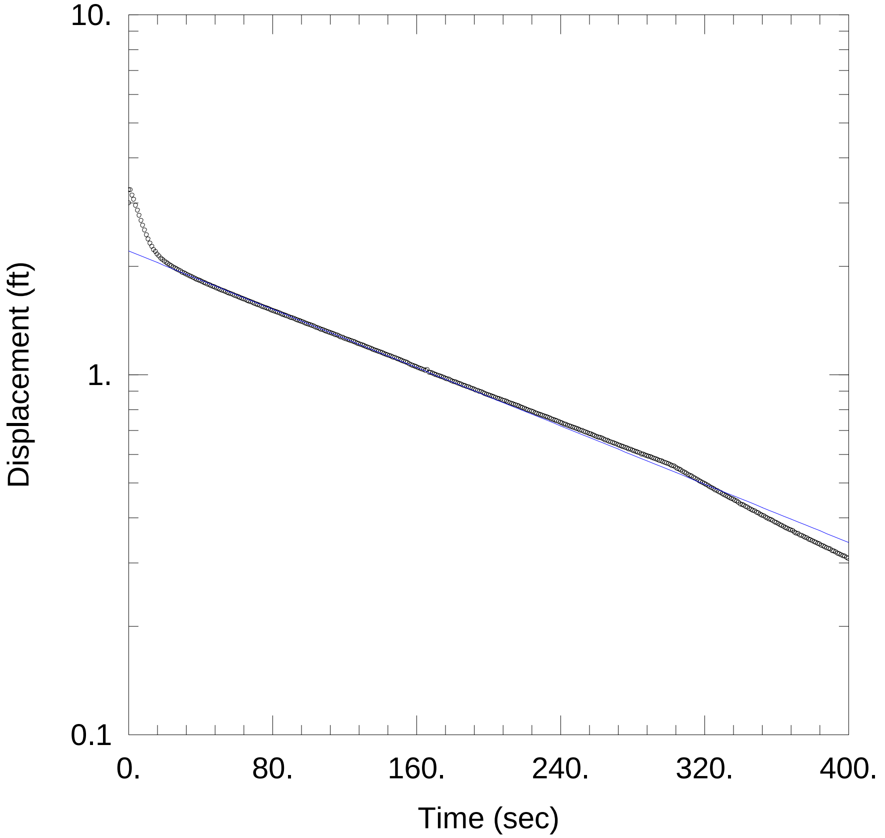
K = 2.869 ft/day
y0 = 3.19 ft

AQUIFER DATA

Saturated Thickness: 26.02 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (E2-2)

Initial Displacement: 3. ft
Total Well Penetration Depth: 26.02 ft
Casing Radius: 0.25 ft
Static Water Column Height: 25.1 ft
Screen Length: 25. ft
Well Radius: 0.5 ft



E2-2 SLUG OUT 1

Data Set: T:\...\E2-2_slugout_1.aqt
Date: 05/04/17 Time: 09:20:40

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: E2-2
Test Date: 8/30/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

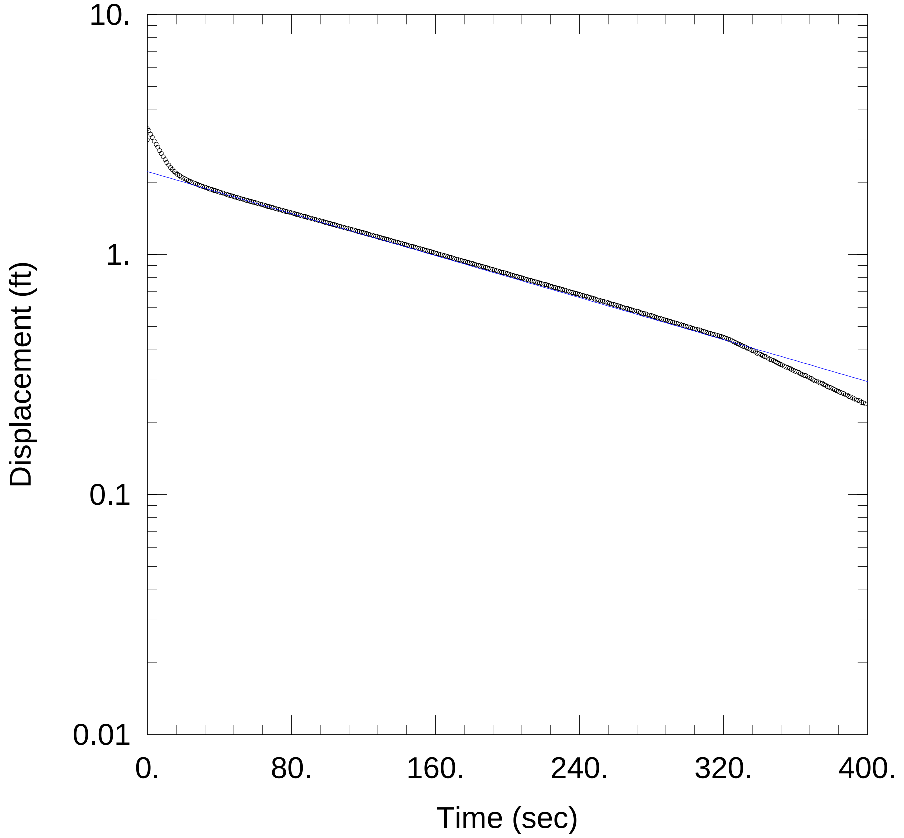
K = 1.988 ft/day
y0 = 2.206 ft

AQUIFER DATA

Saturated Thickness: 26.02 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (E2-2)

Initial Displacement: 3. ft
Total Well Penetration Depth: 26.02 ft
Casing Radius: 0.25 ft
Static Water Column Height: 25.1 ft
Screen Length: 25. ft
Well Radius: 0.5 ft



E2-2 SLUG OUT 2

Data Set: T:\...\E2-2_slugout_2.aqt
Date: 05/04/17 Time: 09:20:52

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: E2-2
Test Date: 8/30/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

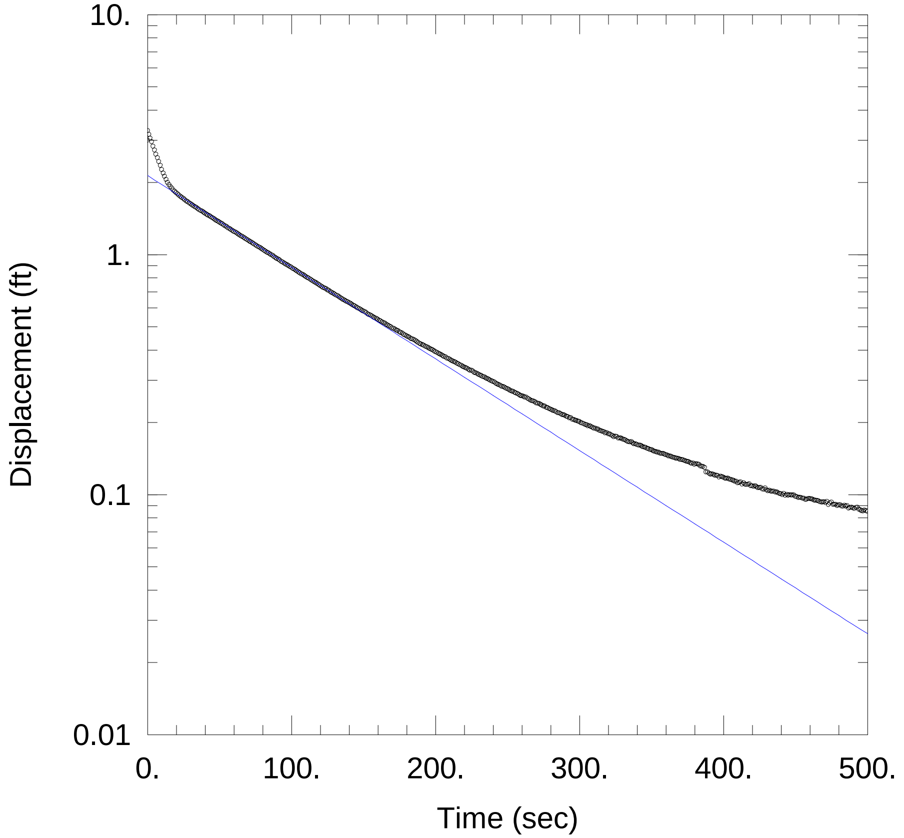
K = 2.148 ft/day
y0 = 2.214 ft

AQUIFER DATA

Saturated Thickness: 26.02 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (E2-2)

Initial Displacement: 3. ft
Total Well Penetration Depth: 26.02 ft
Casing Radius: 0.25 ft
Static Water Column Height: 25.1 ft
Screen Length: 25. ft
Well Radius: 0.5 ft



E2-3 SLUG OUT 1

Data Set: T:\...\E2-3_slugout_1.aqt
Date: 05/04/17 Time: 09:34:15

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: E2-3
Test Date: 8/30/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

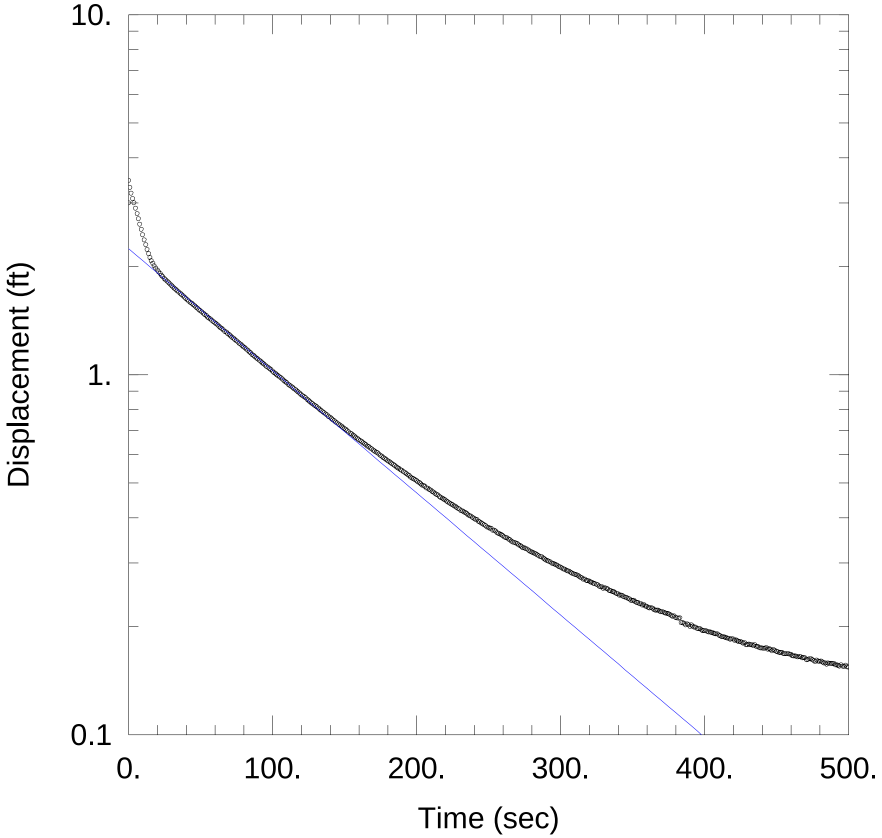
K = 3.855 ft/day
y0 = 2.135 ft

AQUIFER DATA

Saturated Thickness: 24.7 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (E2-3)

Initial Displacement: 3. ft
Total Well Penetration Depth: 24.6 ft
Casing Radius: 0.25 ft
Static Water Column Height: 21.8 ft
Screen Length: 24.6 ft
Well Radius: 0.5 ft



E2-3 SLUG OUT 2

Data Set: T:\...\E2-3_slugout_2.aqt
Date: 05/04/17 Time: 09:34:30

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: E2-3
Test Date: 8/30/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

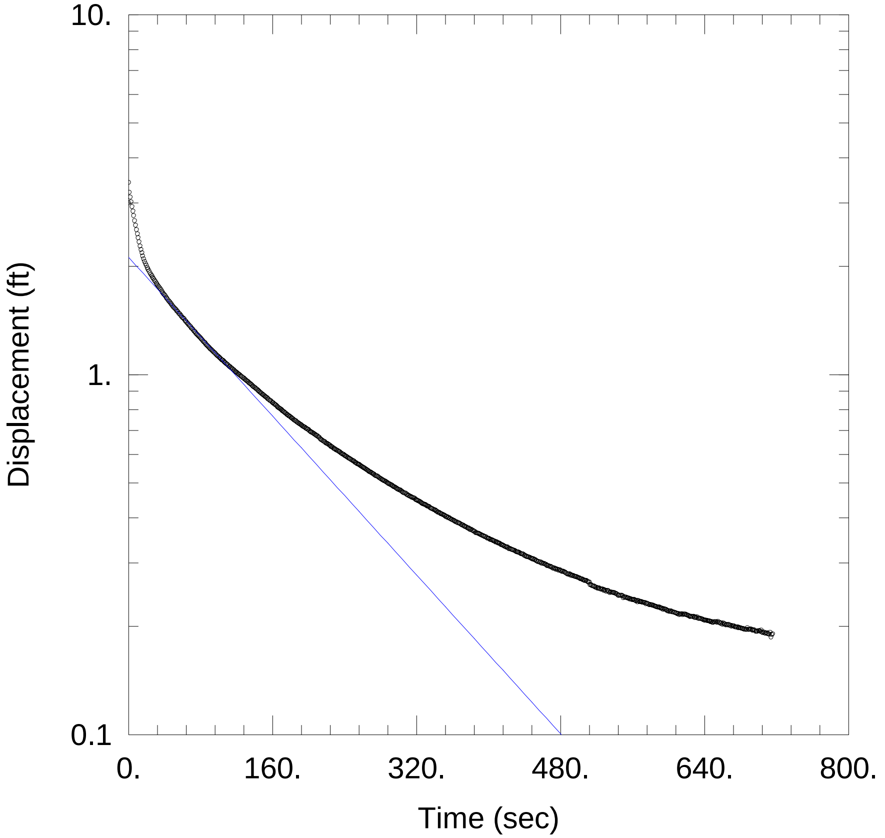
K = 3.559 ft/day
y0 = 2.239 ft

AQUIFER DATA

Saturated Thickness: 24.7 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (E2-3)

Initial Displacement: 3. ft
Total Well Penetration Depth: 24.68 ft
Casing Radius: 0.25 ft
Static Water Column Height: 21.8 ft
Screen Length: 24.68 ft
Well Radius: 0.5 ft



E2-4 SLUG OUT 1

Data Set: T:\...\E2-4_slugout_1.aqt
Date: 05/04/17 Time: 09:34:43

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: E2-4
Test Date: 8/30/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

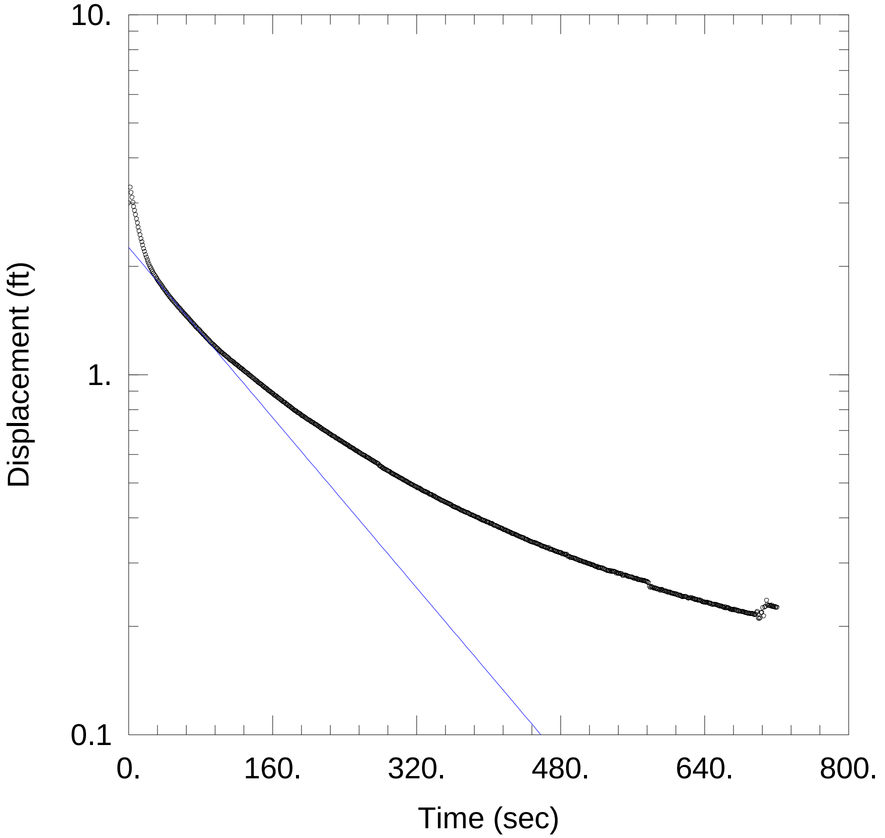
K = 3.001 ft/day
y0 = 2.118 ft

AQUIFER DATA

Saturated Thickness: 21.6 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (E2-4)

Initial Displacement: 3. ft
Total Well Penetration Depth: 21. ft
Casing Radius: 0.25 ft
Static Water Column Height: 21. ft
Screen Length: 21. ft
Well Radius: 0.5 ft



E2-4 SLUG OUT 2

Data Set: T:\...\E2-4_slugout_2.aqt
Date: 05/04/17 Time: 09:34:52

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: E2-4
Test Date: 8/30/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

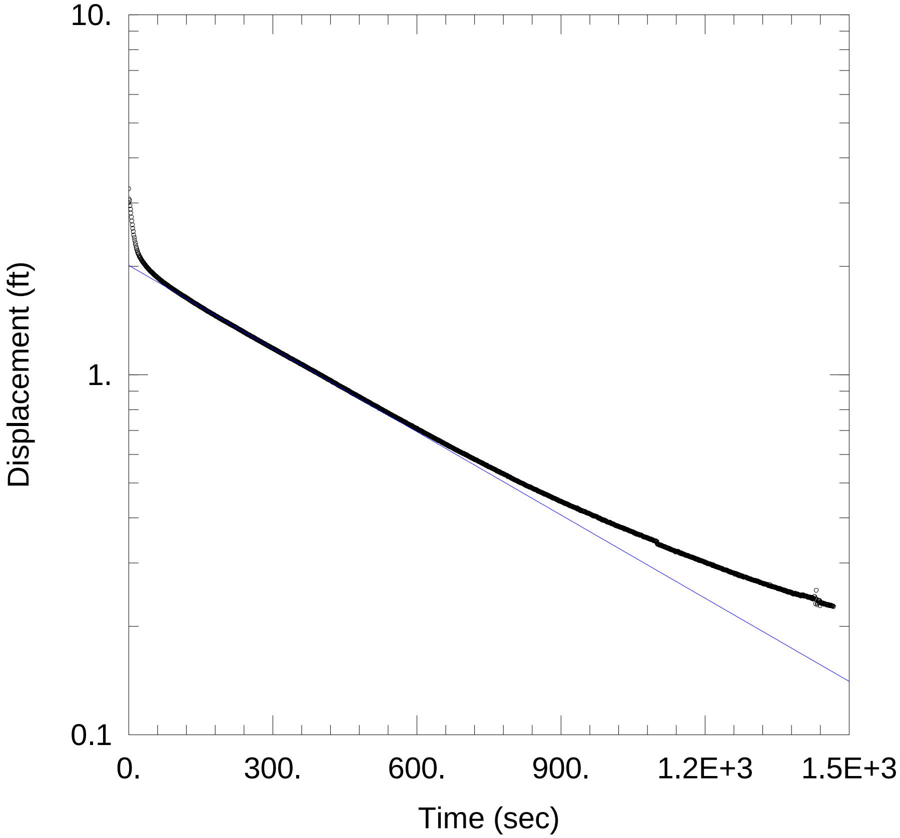
K = 2.446 ft/day
y0 = 2.257 ft

AQUIFER DATA

Saturated Thickness: 21.6 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (E2-4)

Initial Displacement: 3. ft
Total Well Penetration Depth: 21.6 ft
Casing Radius: 0.25 ft
Static Water Column Height: 21. ft
Screen Length: 21.6 ft
Well Radius: 0.5 ft



E2-5 SLUG OUT 1

Data Set: T:\...\E2-5_slugout_1.aqt
Date: 05/04/17 Time: 09:35:03

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: E2-5
Test Date: 8/30/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

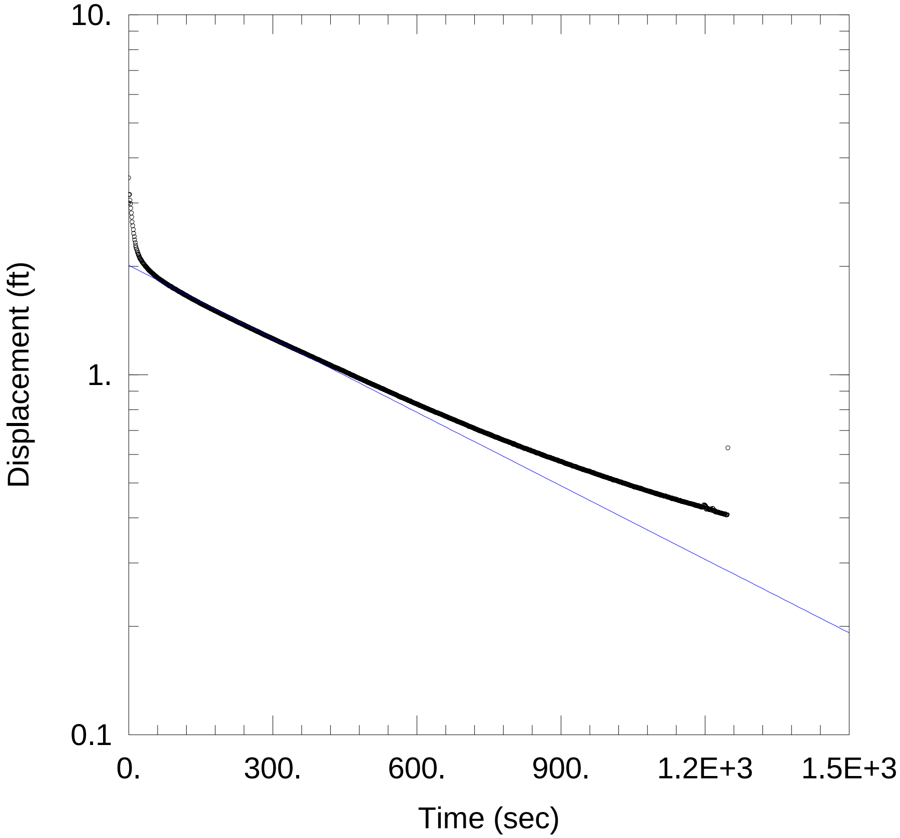
K = 0.7526 ft/day
y0 = 2.01 ft

AQUIFER DATA

Saturated Thickness: 25.3 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (E2-5)

Initial Displacement: 3. ft
Total Well Penetration Depth: 25.3 ft
Casing Radius: 0.25 ft
Static Water Column Height: 27.5 ft
Screen Length: 25. ft
Well Radius: 0.5 ft



E2-5 SLUG OUT 2

Data Set: T:\...\E2-5_slugout_2.aqt
Date: 05/04/17 Time: 09:35:13

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: E2-5
Test Date: 8/30/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

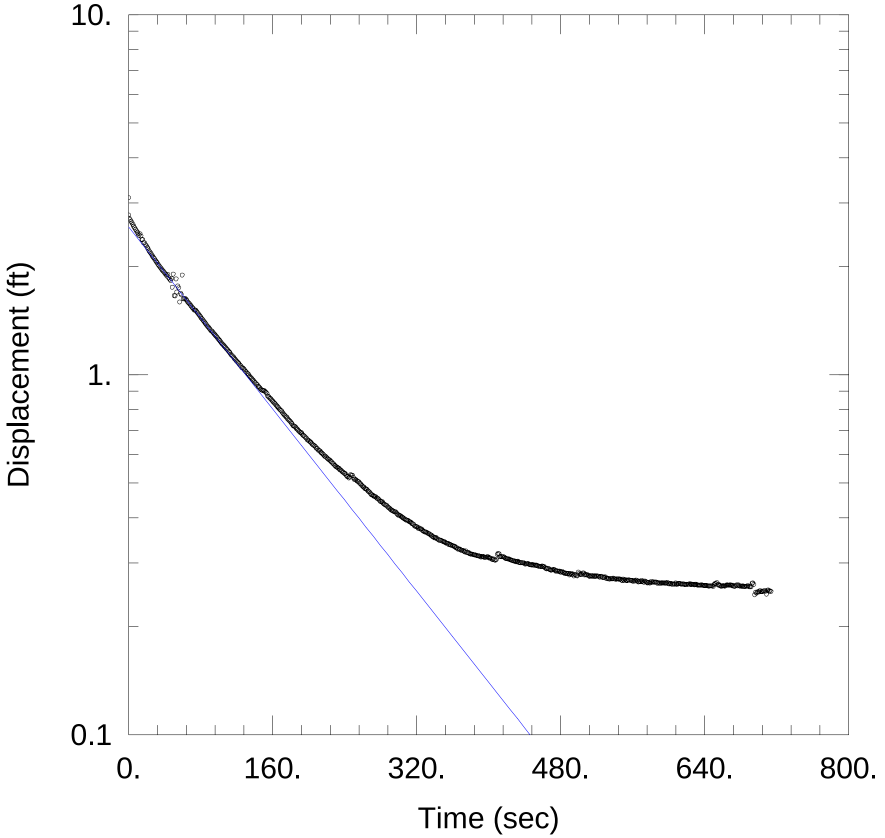
K = 0.6653 ft/day
y0 = 2.013 ft

AQUIFER DATA

Saturated Thickness: 25.29 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (E2-5)

Initial Displacement: 3. ft
Total Well Penetration Depth: 25.3 ft
Casing Radius: 0.25 ft
Static Water Column Height: 27.5 ft
Screen Length: 25. ft
Well Radius: 0.5 ft



UFIW-01D SLUG IN 1

Data Set: T:\...\UFIW-01D_slugin_1.aqt
Date: 05/04/17 Time: 09:37:23

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-01D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

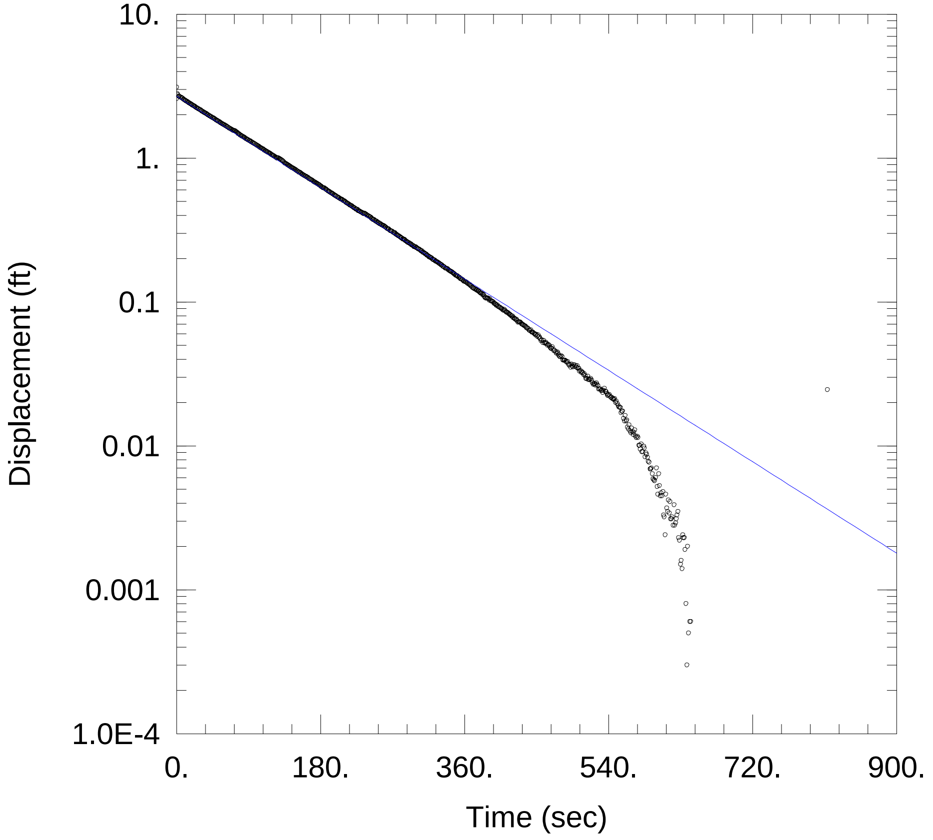
K = 1.649 ft/day
y0 = 2.574 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-01D)

Initial Displacement: 3.1 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20.3 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-01D SLUG IN 2

Data Set: T:\...\UFIW-01D_slugin_2.aqt
Date: 05/04/17 Time: 09:39:17

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-01D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 1.839 ft/day
y0 = 2.688 ft

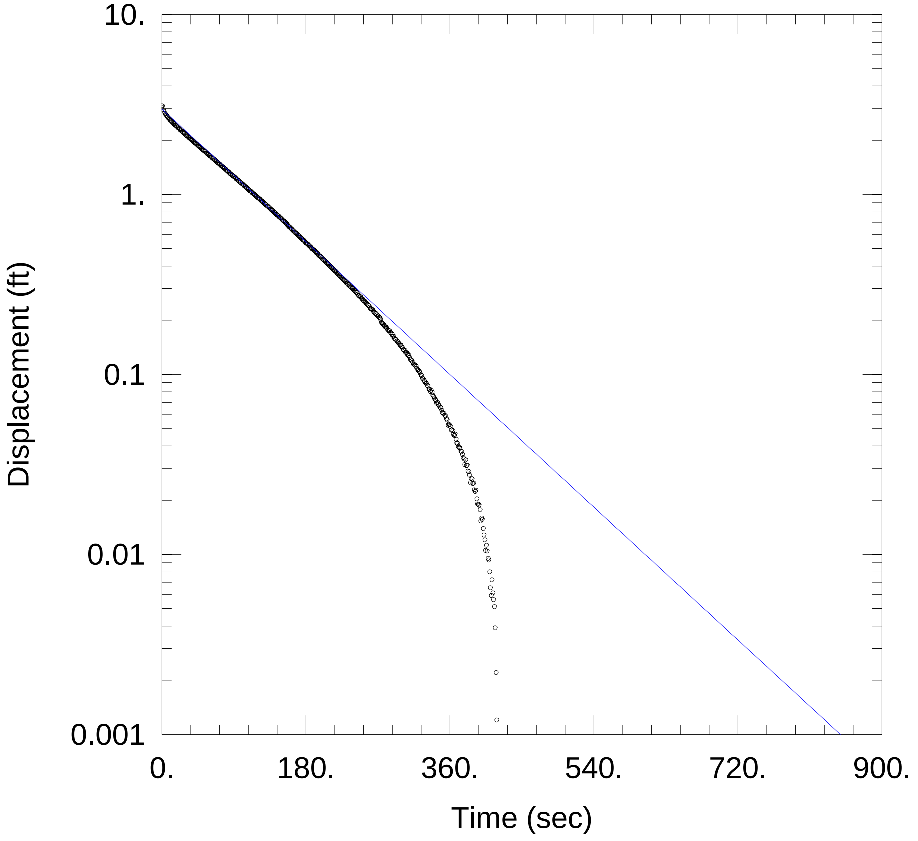
AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-01D)

Initial Displacement: 3.1 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft

Static Water Column Height: 20.3 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-01D SLUG OUT 1

Data Set: T:\...\UFIW-01D_slugout_1.aqt
Date: 05/04/17 Time: 09:40:57

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-01D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

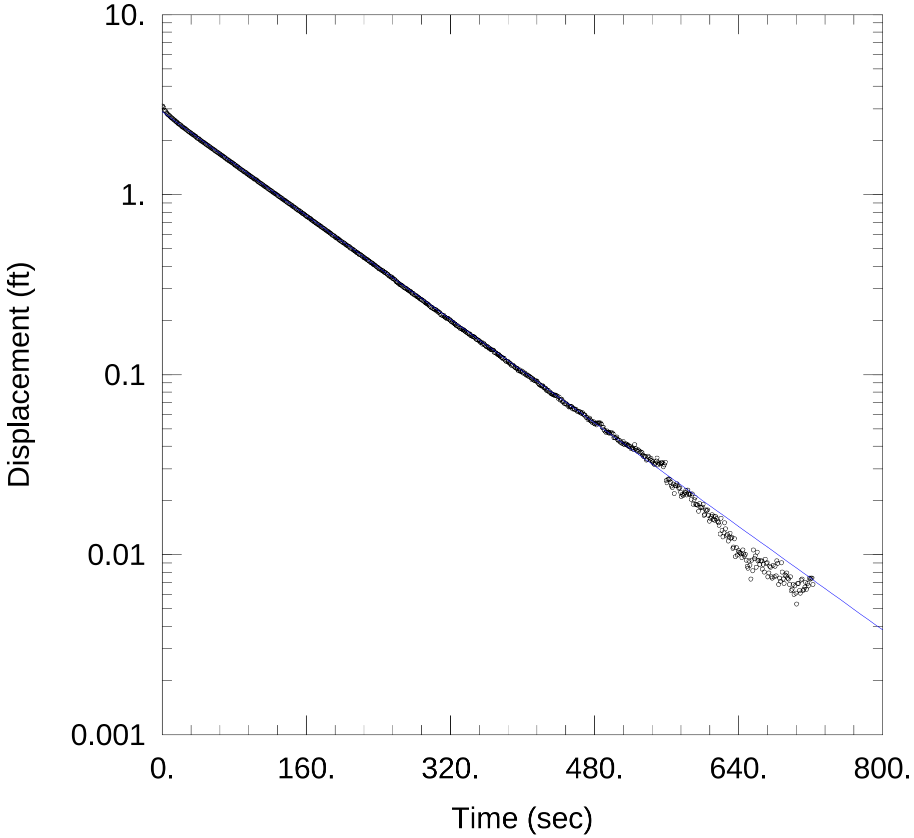
K = 2.136 ft/day
y0 = 2.985 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-01D)

Initial Displacement: 3.1 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20.3 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-01D SLUG OUT 2

Data Set: T:\...\UFIW-01D_slugout_2.aqt
Date: 05/04/17 Time: 09:41:08

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-01D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

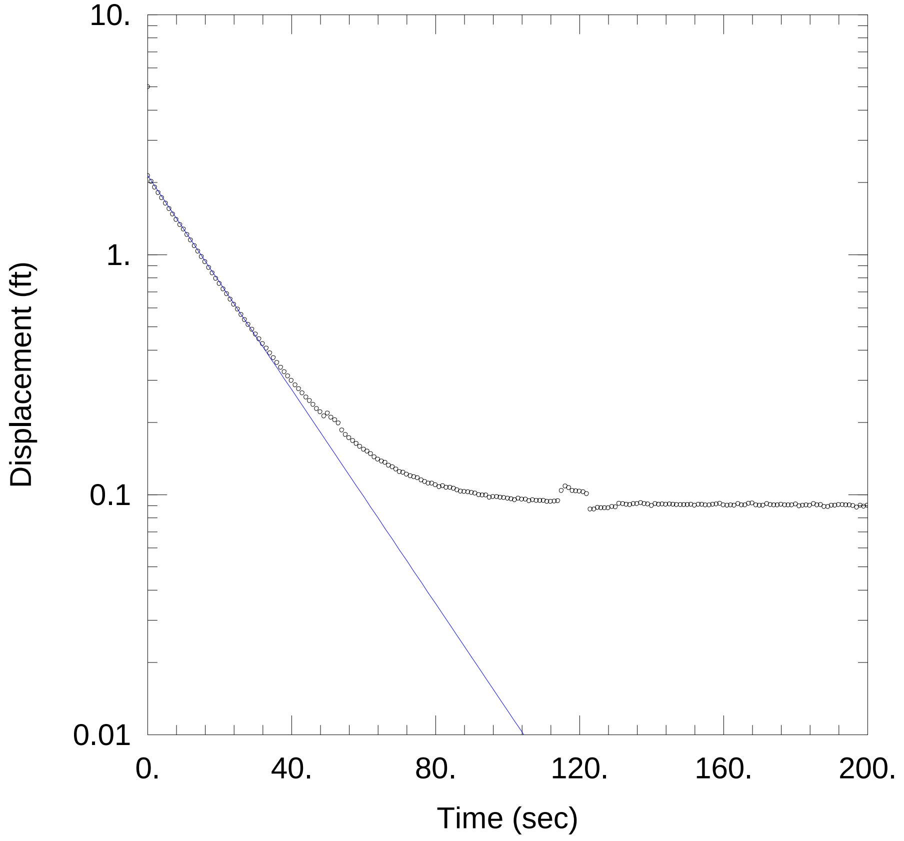
K = 1.876 ft/day
y0 = 2.884 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-01D)

Initial Displacement: 3.1 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20.3 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-01I SLUG IN 1

Data Set: T:\...\UFIW-01I_slugin_1_MBQC.aqt
Date: 05/04/17 Time: 09:41:48

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-01I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

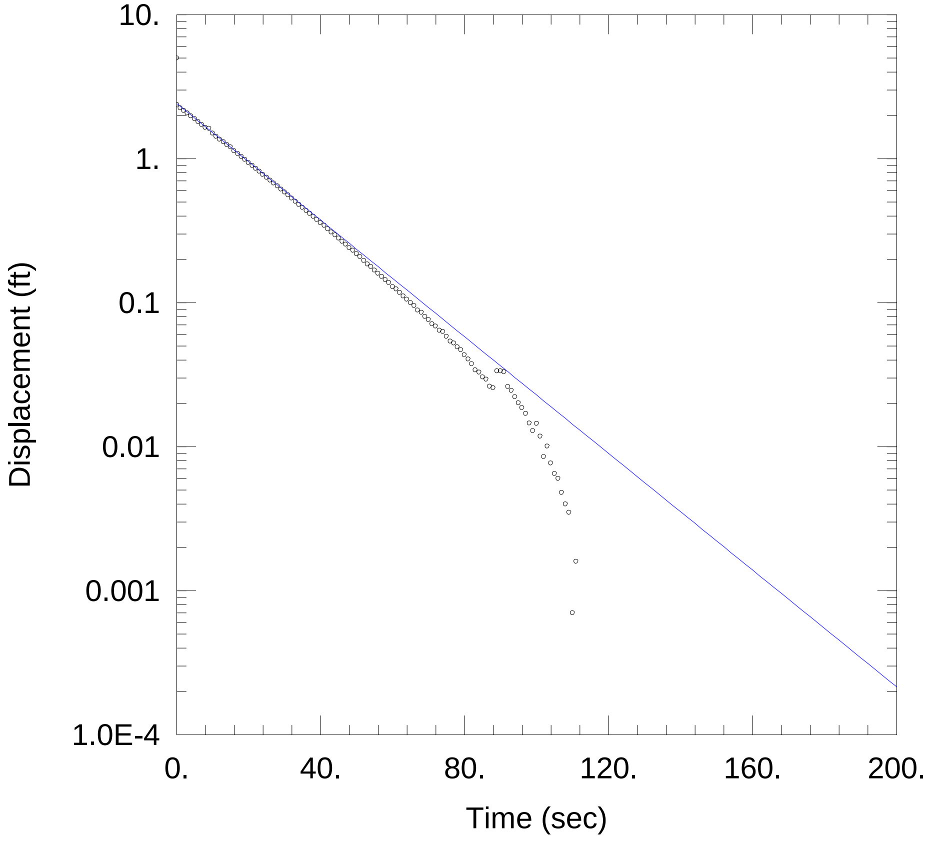
K = 10.37 ft/day
y0 = 2.139 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-01I)

Initial Displacement: 5. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 8.46 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-01I SLUG IN 2

Data Set: T:\...\UFIW-01I_slugin_2_MBQC.aqt
Date: 05/04/17 Time: 09:41:57

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-01I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

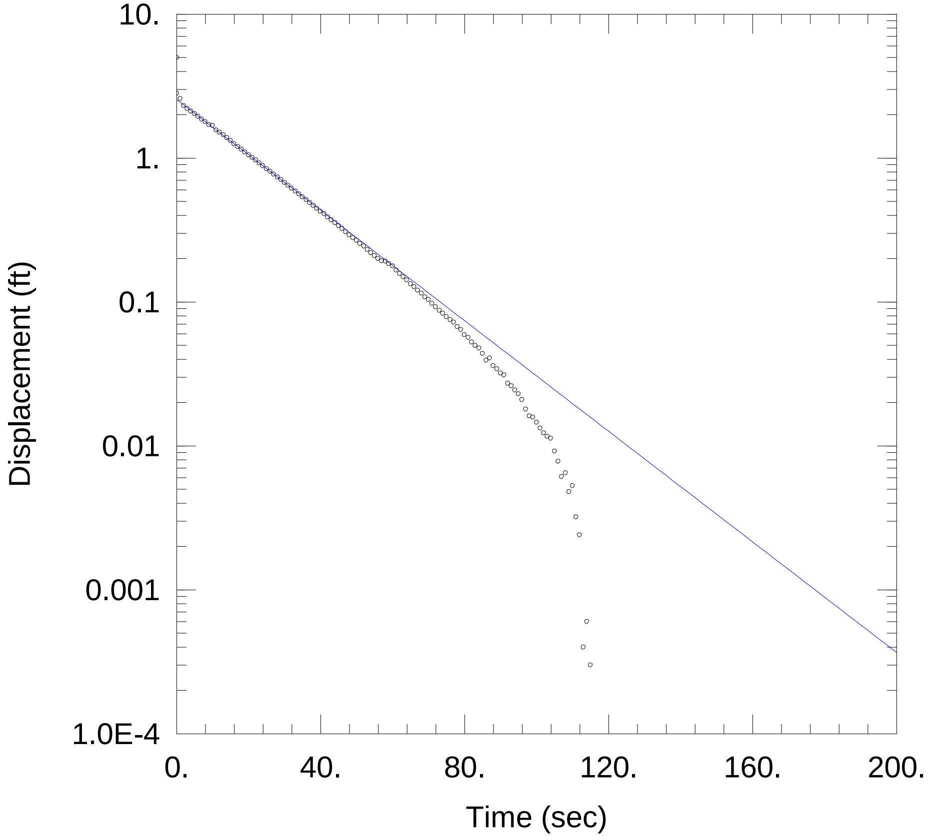
K = 9.421 ft/day
y0 = 2.419 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-01I)

Initial Displacement: 5. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 8.46 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-01I SLUG IN 3

Data Set: T:\...\UFIW-01I_slugin_3_MBQC.aqt
Date: 05/04/17 Time: 09:42:11

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-01I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 8.935 ft/day
y0 = 2.55 ft

AQUIFER DATA

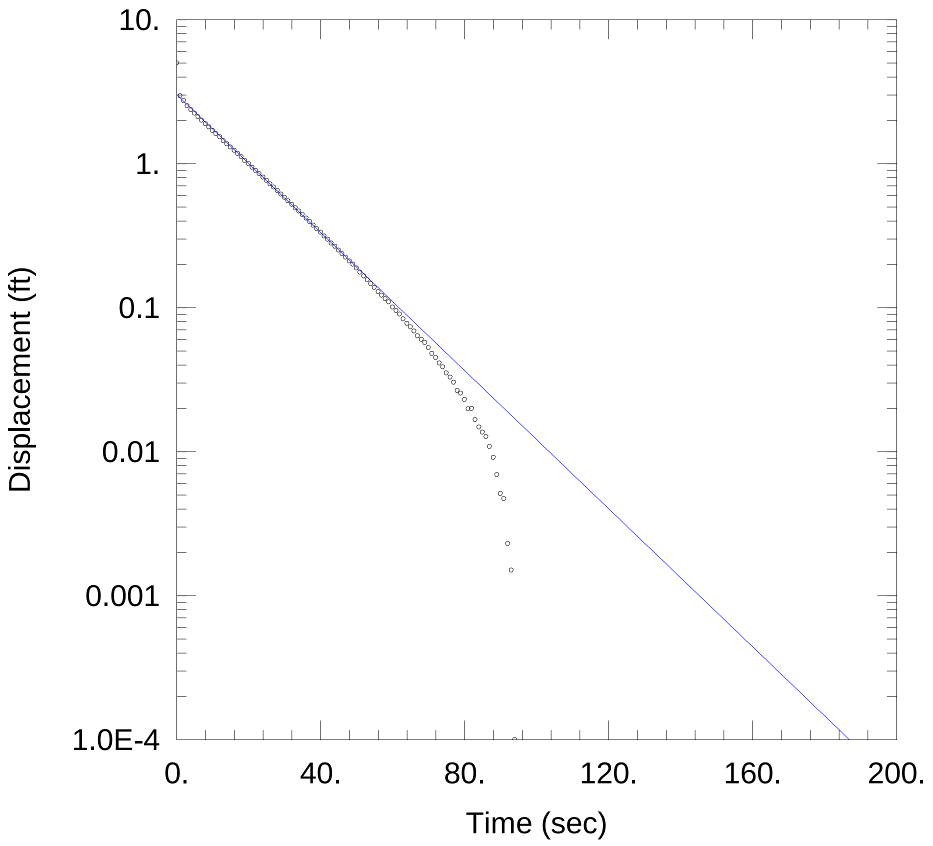
Saturated Thickness: 7. ft

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-01I)

Initial Displacement: 5. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft

Static Water Column Height: 8.46 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-01I SLUG OUT 1

Data Set: T:\...\UFIW-01I_slugout_1_MBQC.aqt
Date: 05/04/17 Time: 09:42:20

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-01I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

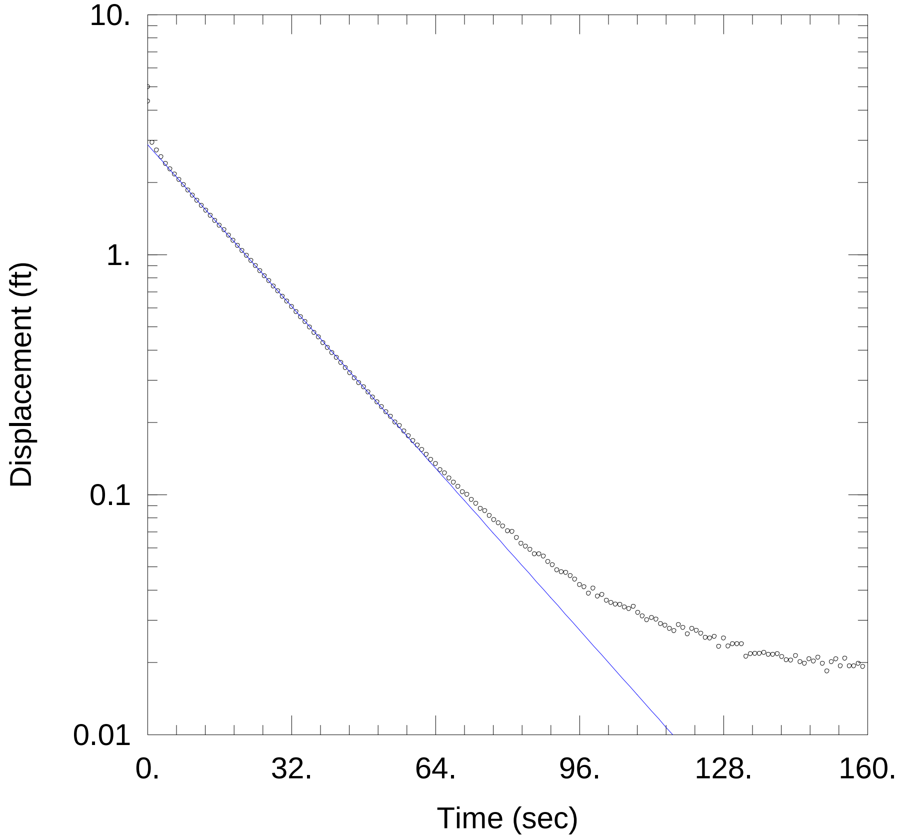
K = 11.15 ft/day
y0 = 3.024 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-01I)

Initial Displacement: 5. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 8.46 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-01I SLUG OUT 2

Data Set: T:\...\UFIW-01I_slugout_2_MBQC.aqt
Date: 05/04/17 Time: 09:42:30

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-01I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

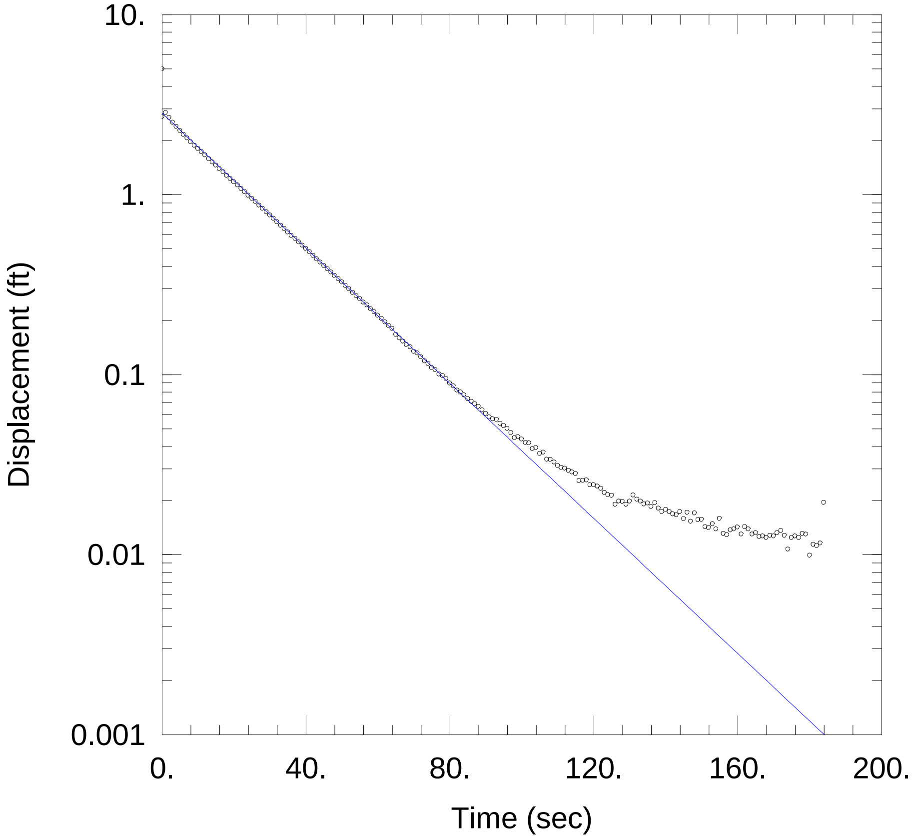
K = 9.795 ft/day
y0 = 2.872 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-01I)

Initial Displacement: 5. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 8.46 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-01I SLUG OUT 3

Data Set: T:\...\UFIW-01I_slugout_3_MBQC.aqt
Date: 05/04/17 Time: 09:42:44

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-01I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

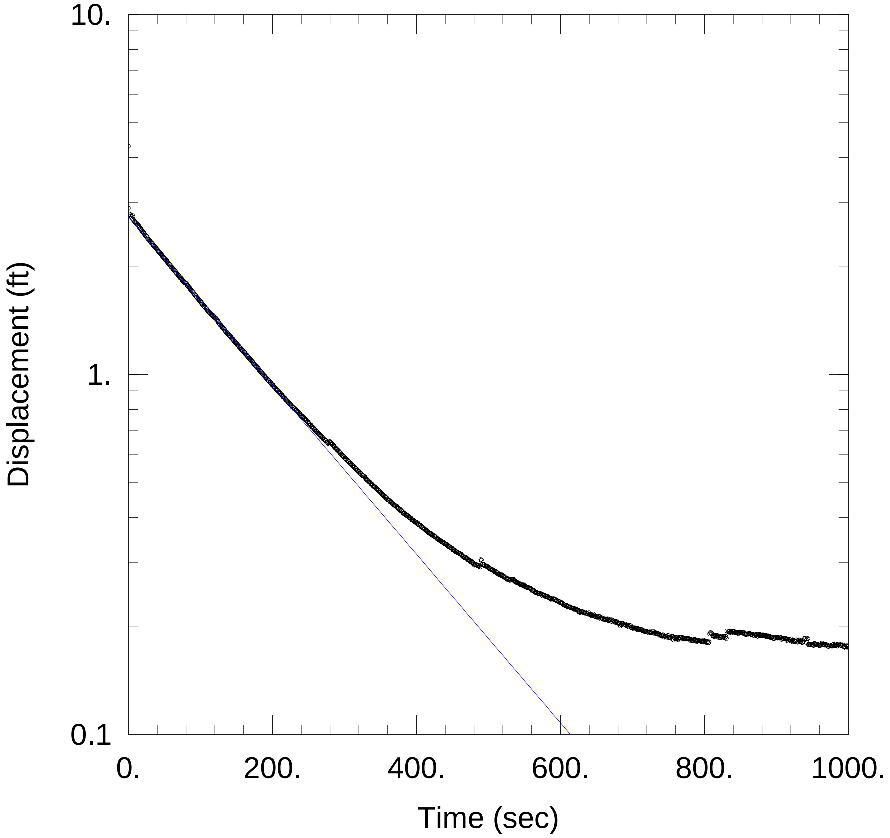
K = 8.726 ft/day
y0 = 2.837 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-01I)

Initial Displacement: 5. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 8.46 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-02D SLUG IN 1

Data Set: T:\...\UFIW-02D_slugin_1.aqt
Date: 05/04/17 Time: 09:42:54

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-01I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 1.221 ft/day
y0 = 2.739 ft

AQUIFER DATA

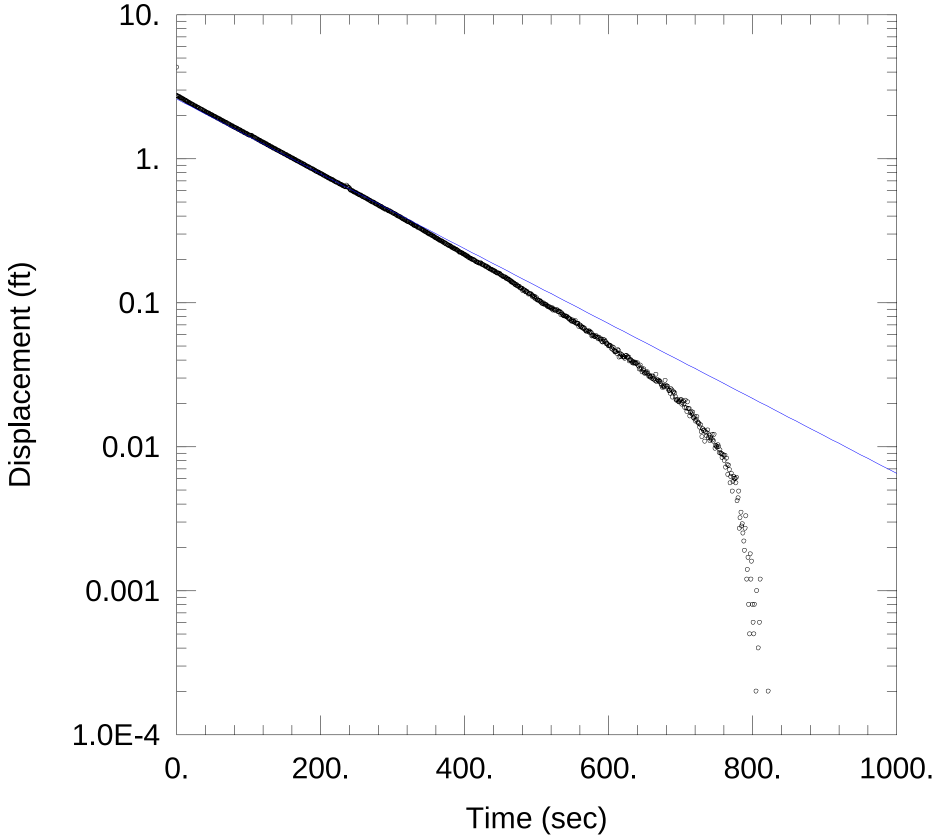
Saturated Thickness: 7. ft

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-02D)

Initial Displacement: 4.3 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft

Static Water Column Height: 21.1 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-02D SLUG IN 2

Data Set: T:\...\UFIW-02D_slugin_2.aqt
Date: 05/04/17 Time: 09:43:03

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-01I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 1.356 ft/day
y0 = 2.599 ft

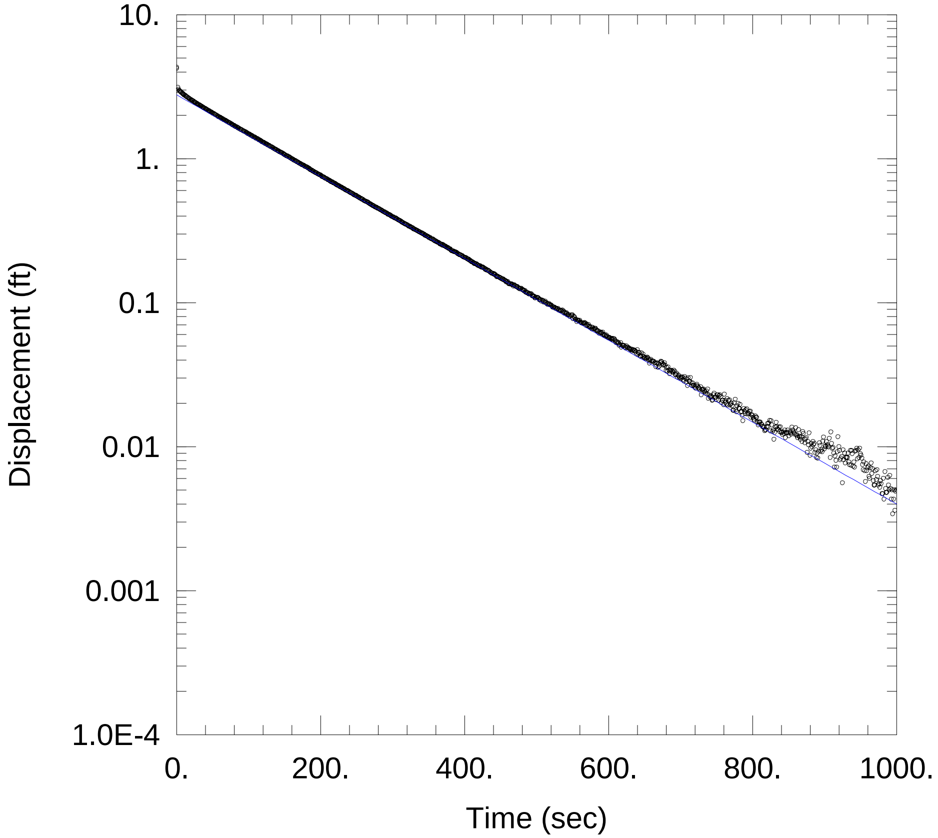
AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-02D)

Initial Displacement: 4.3 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft

Static Water Column Height: 21.1 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-02D SLUG OUT 1

Data Set: T:\...\UFIW-02D_slugout_1.aqt
Date: 05/04/17 Time: 09:43:14

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-01I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

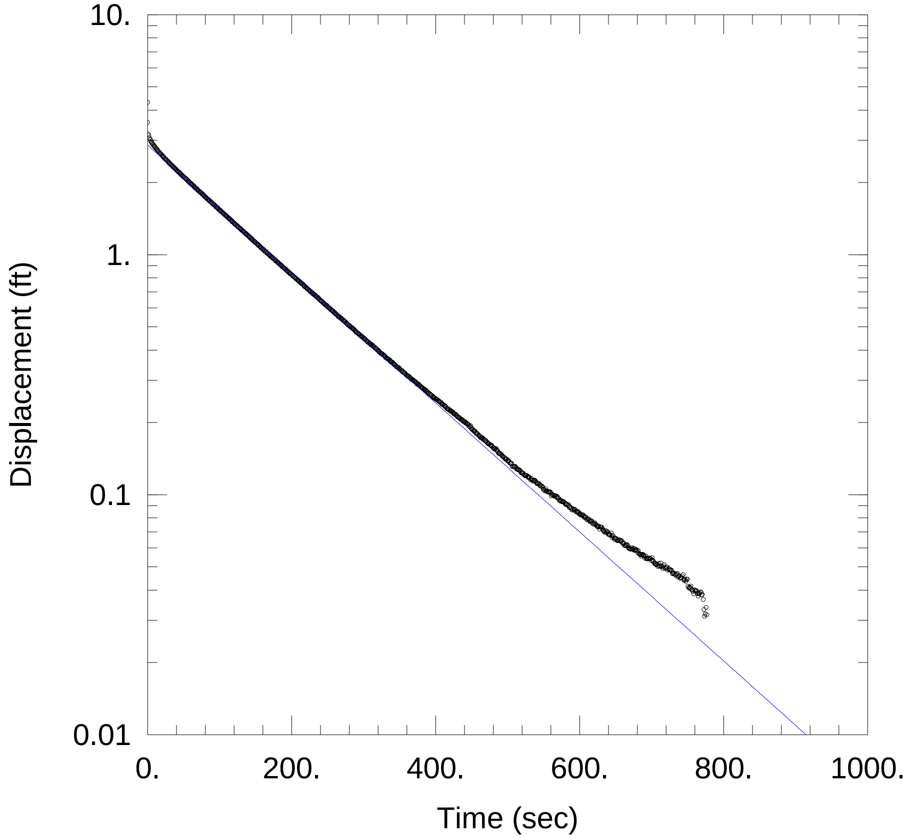
K = 1.482 ft/day
y0 = 2.775 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-02D)

Initial Displacement: 4.3 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 21.1 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-02D SLUG OUT 2

Data Set: T:\...\UFIW-02D_slugout_2.aqt
Date: 05/04/17 Time: 09:43:23

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-02D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

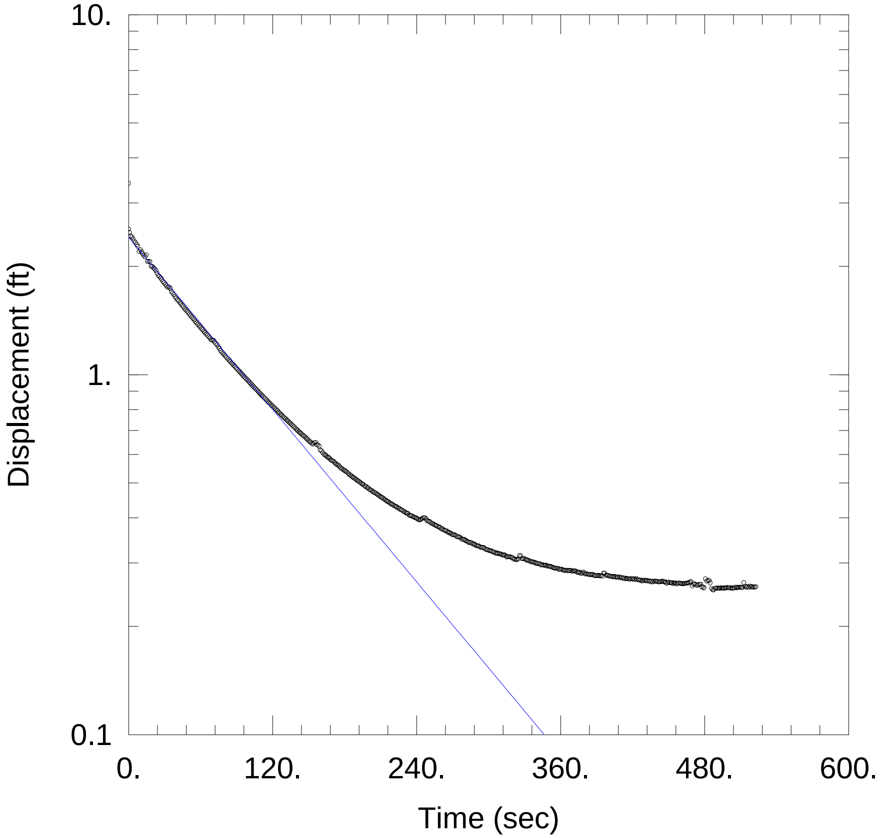
K = 1.401 ft/day
y0 = 2.866 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-02D)

Initial Displacement: 4.3 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 21.1 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-02I SLUG IN 1

Data Set: T:\...\UFIW-02I_slugin_1.aqt
Date: 05/04/17 Time: 09:43:32

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-02I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

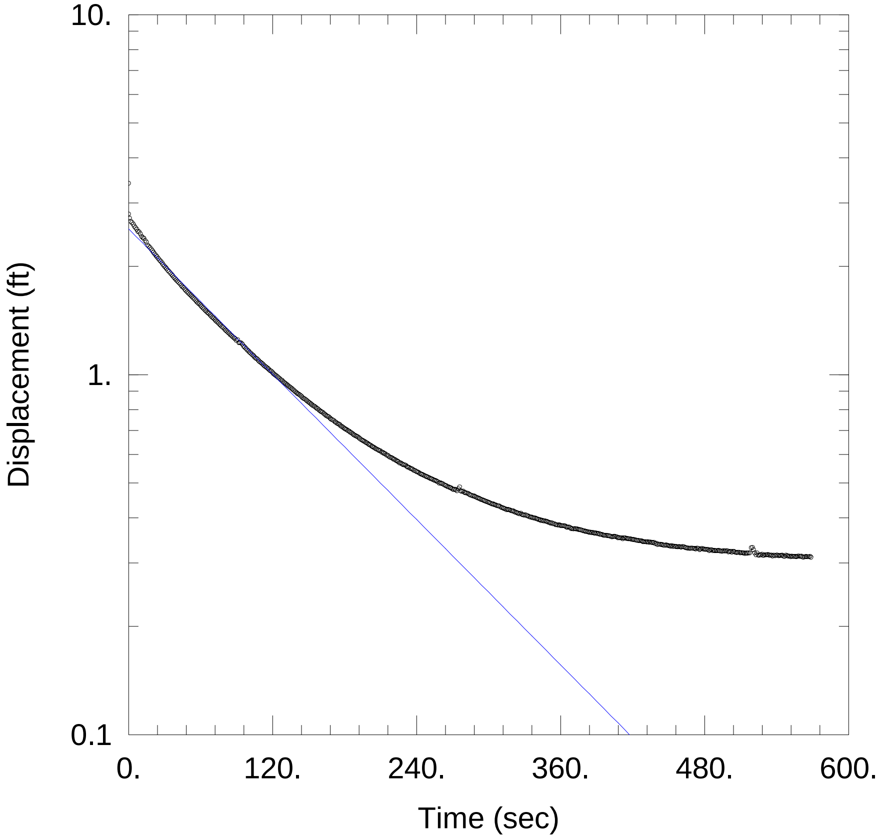
K = 1.006 ft/day
y0 = 2.409 ft

AQUIFER DATA

Saturated Thickness: 12. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-02I)

Initial Displacement: 3.4 ft
Total Well Penetration Depth: 13. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.92 ft
Screen Length: 10. ft
Well Radius: 0.33 ft



UFIW-02I SLUG IN 2

Data Set: T:\...\UFIW-02I_slugin_2.aqt
Date: 05/04/17 Time: 09:43:45

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-02I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

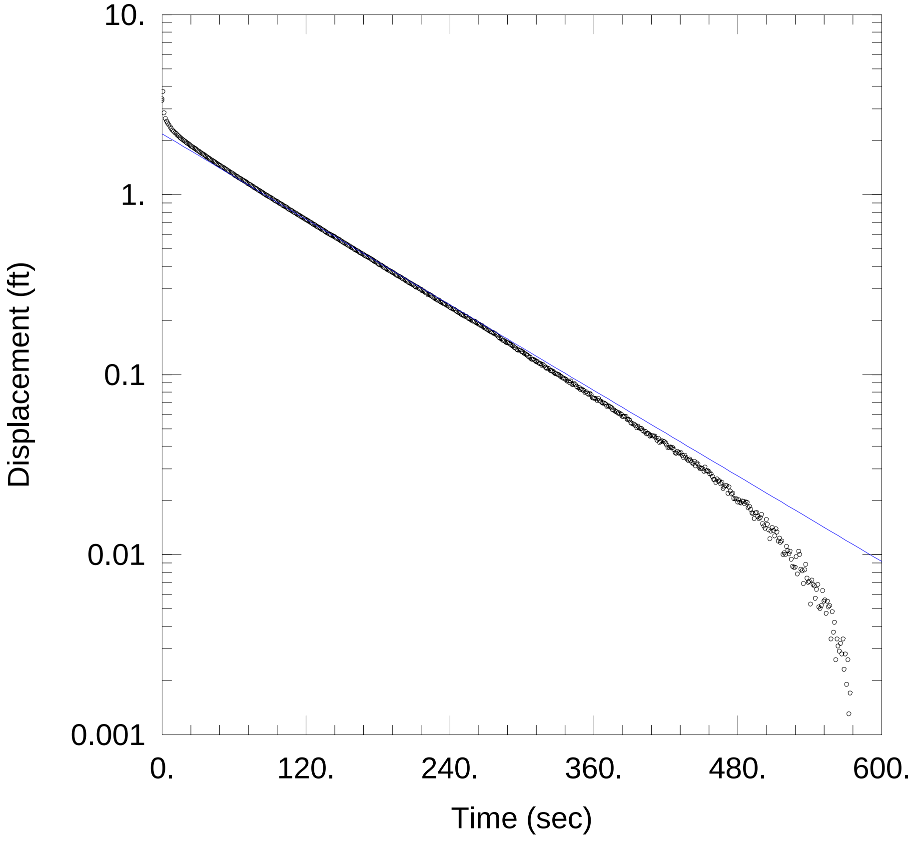
K = 0.8483 ft/day
y0 = 2.541 ft

AQUIFER DATA

Saturated Thickness: 12. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-02I)

Initial Displacement: 3.4 ft
Total Well Penetration Depth: 13. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.82 ft
Screen Length: 10. ft
Well Radius: 0.33 ft



UFIW-02I SLUG OUT 1

Data Set: T:\...\UFIW-02I_slugout_1.aqt
Date: 05/04/17 Time: 09:43:55

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-02I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.9988 ft/day
y0 = 2.18 ft

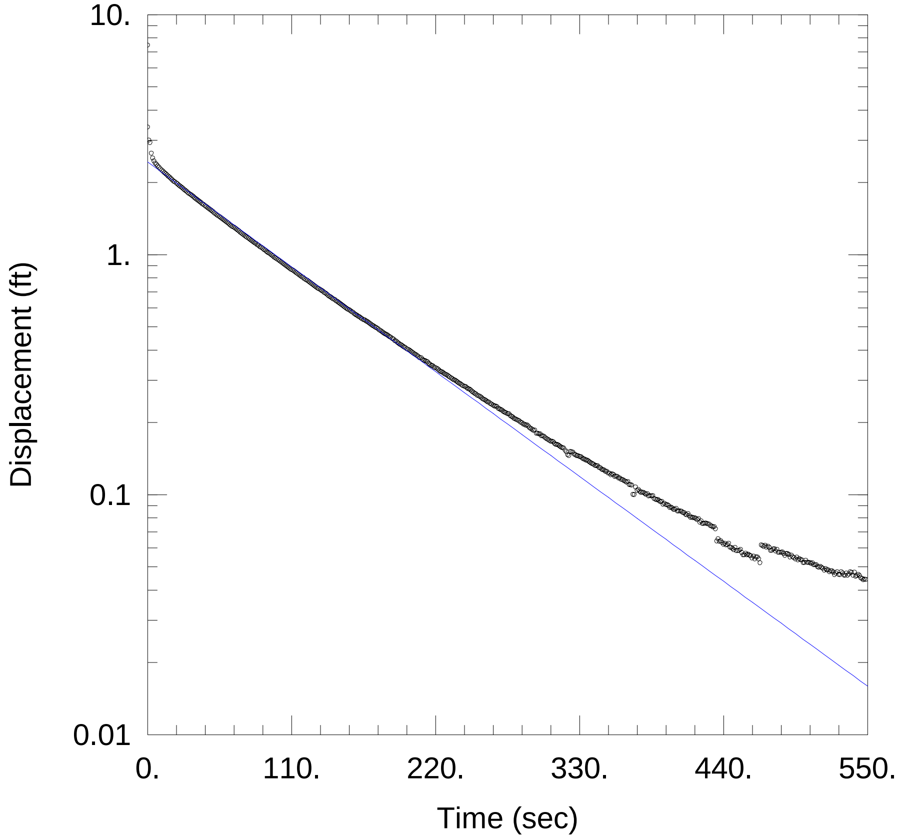
AQUIFER DATA

Saturated Thickness: 12. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-02I)

Initial Displacement: 3.4 ft
Total Well Penetration Depth: 13. ft
Casing Radius: 0.083 ft

Static Water Column Height: 13.82 ft
Screen Length: 10. ft
Well Radius: 0.33 ft



UFIW-02I SLUG OUT 2

Data Set: T:\...\UFIW-02I_slugout_2.aqt
Date: 05/04/17 Time: 09:44:05

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-02I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

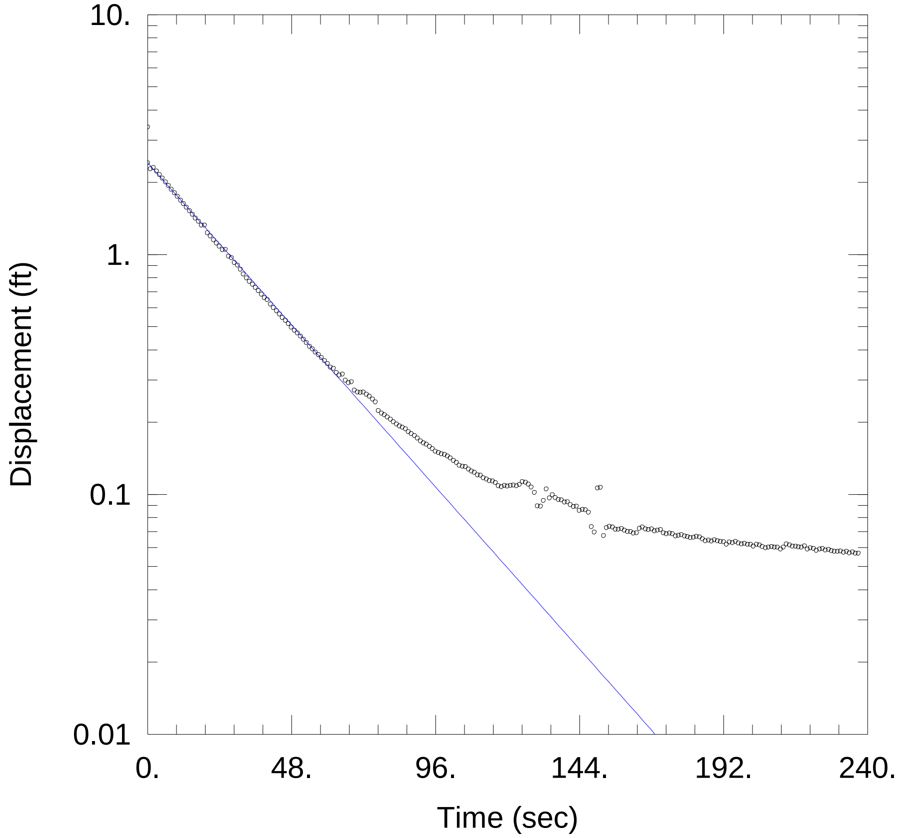
K = 1.001 ft/day
y0 = 2.432 ft

AQUIFER DATA

Saturated Thickness: 12. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-02I)

Initial Displacement: 3.4 ft
Total Well Penetration Depth: 13. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.82 ft
Screen Length: 10. ft
Well Radius: 0.33 ft



UFIW-03D SLUG IN 1

Data Set: T:\...\UFIW-03D_slugin_1.aqt
Date: 05/04/17 Time: 09:44:16

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-03D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

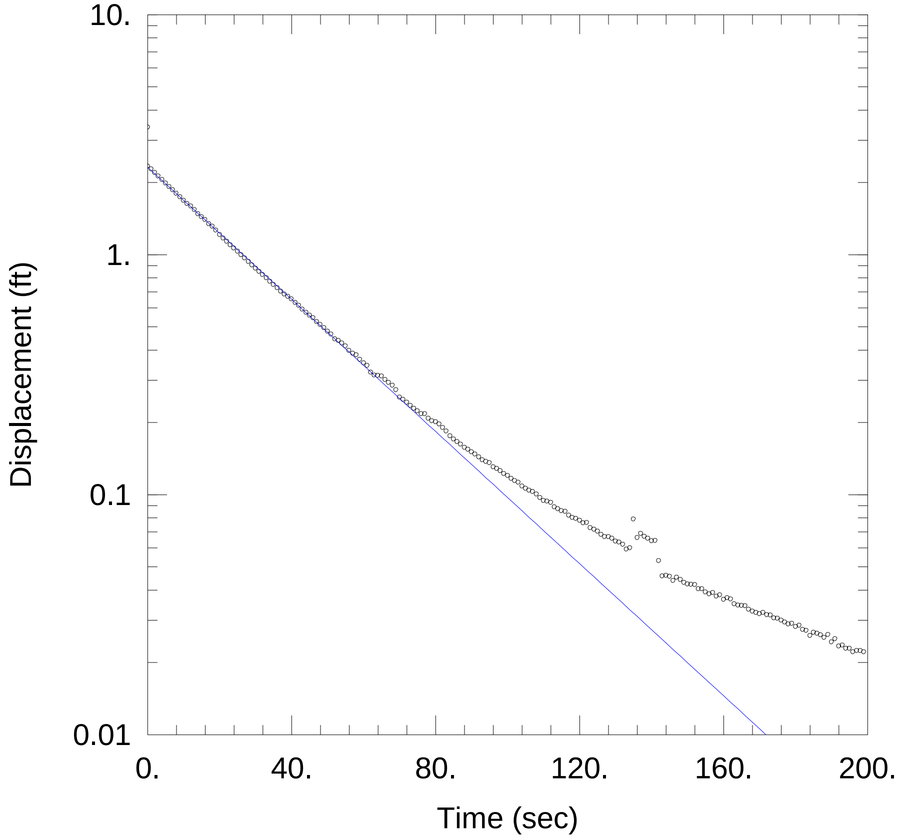
K = 7.343 ft/day
y0 = 2.414 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-03D)

Initial Displacement: 3.4 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.9 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-03D SLUG IN 2

Data Set: T:\...\UFIW-03D_slugin_2.aqt
Date: 05/04/17 Time: 09:44:26

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-03D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

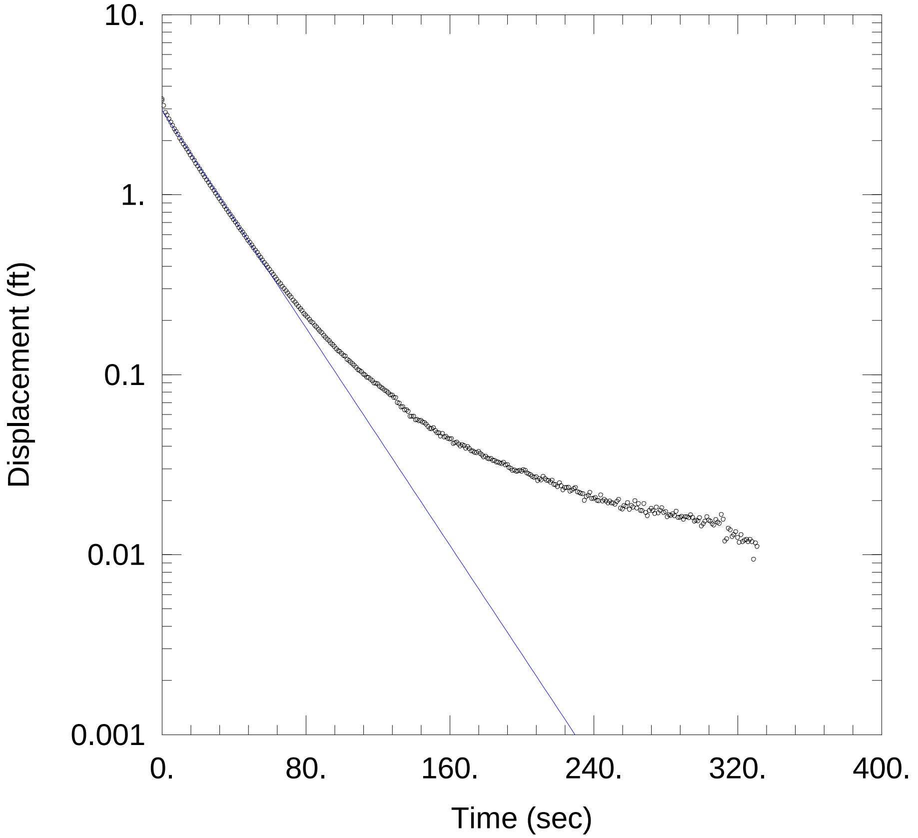
K = 7.176 ft/day
y0 = 2.314 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-03D)

Initial Displacement: 3.4 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.9 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-03D SLUG OUT 1

Data Set: T:\...\UFIW-03D_slugout_1.aqt
Date: 05/04/17 Time: 09:44:34

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-03D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

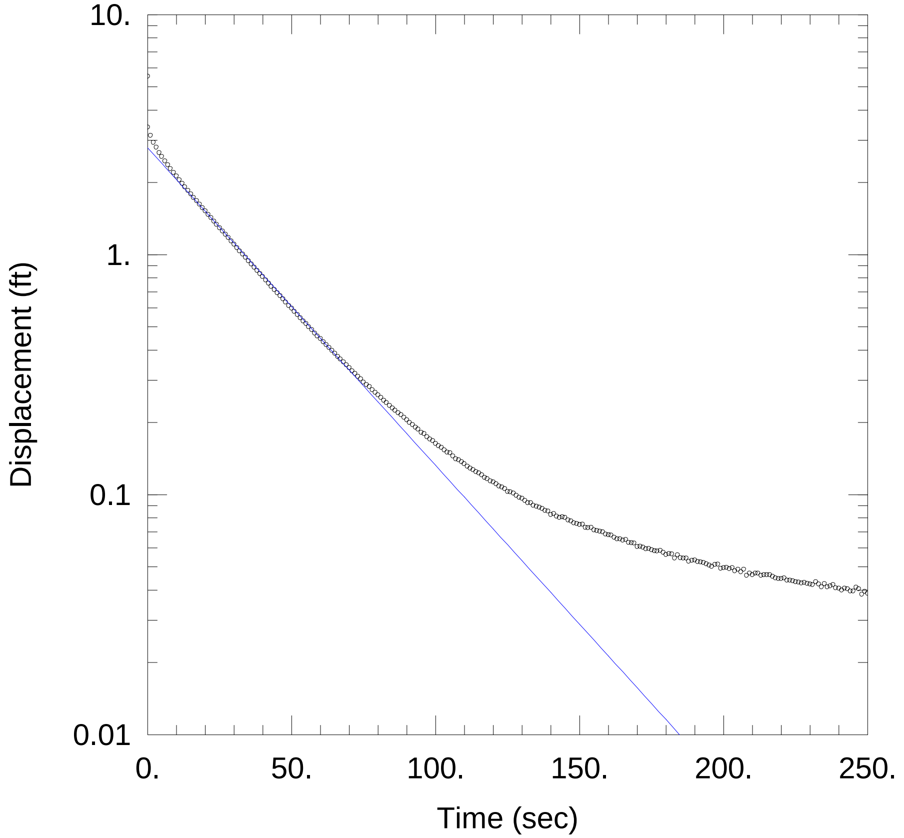
K = 7.875 ft/day
y0 = 2.942 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-03D)

Initial Displacement: 3.4 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.9 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-03D SLUG OUT 2

Data Set: T:\...\UFIW-03D_slugout_2.aqt
Date: 05/04/17 Time: 09:44:43

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-03D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

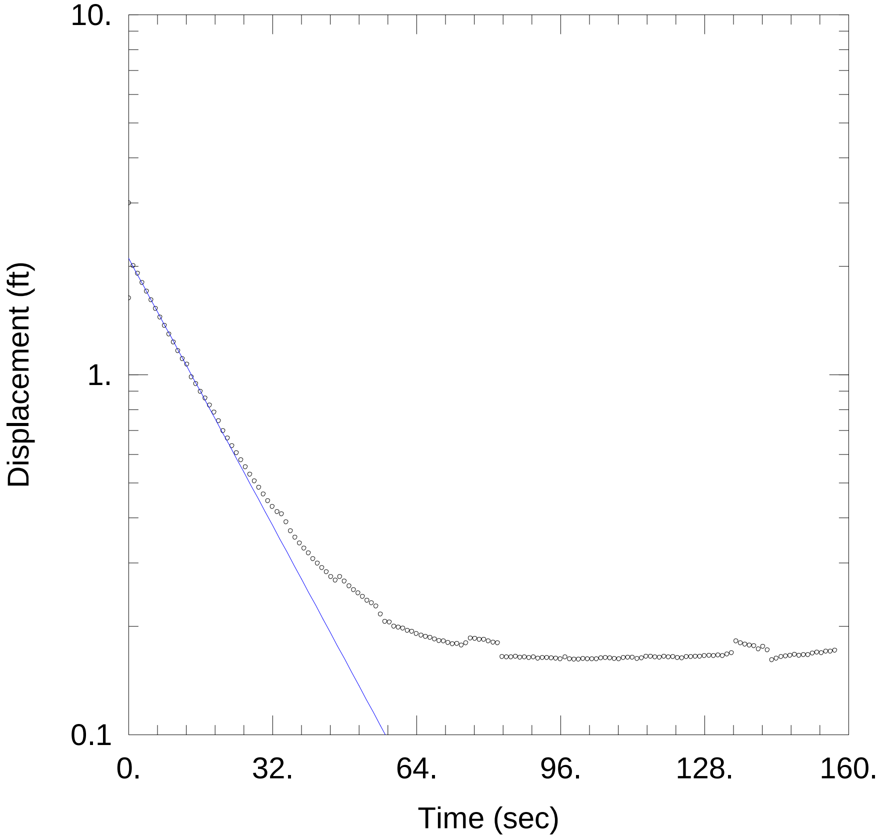
K = 6.9 ft/day
y0 = 2.788 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-03D)

Initial Displacement: 3.4 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.9 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-03I SLUG IN 1

Data Set: T:\...\UFIW-03I_slugin_1.aqt
Date: 05/04/17 Time: 09:44:52

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-03I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

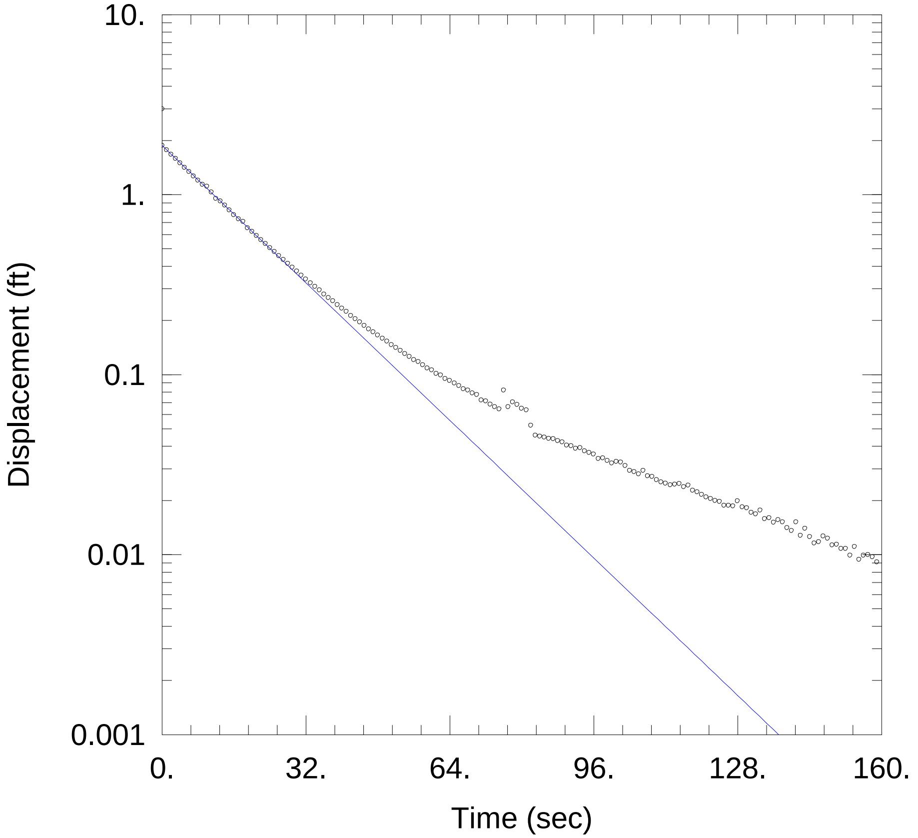
K = 10.79 ft/day
y0 = 2.105 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-03I)

Initial Displacement: 3. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13. ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-03I SLUG IN 2

Data Set: T:\...\UFIW-03I_slugin_2.aqt
Date: 05/04/17 Time: 09:45:02

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-03I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

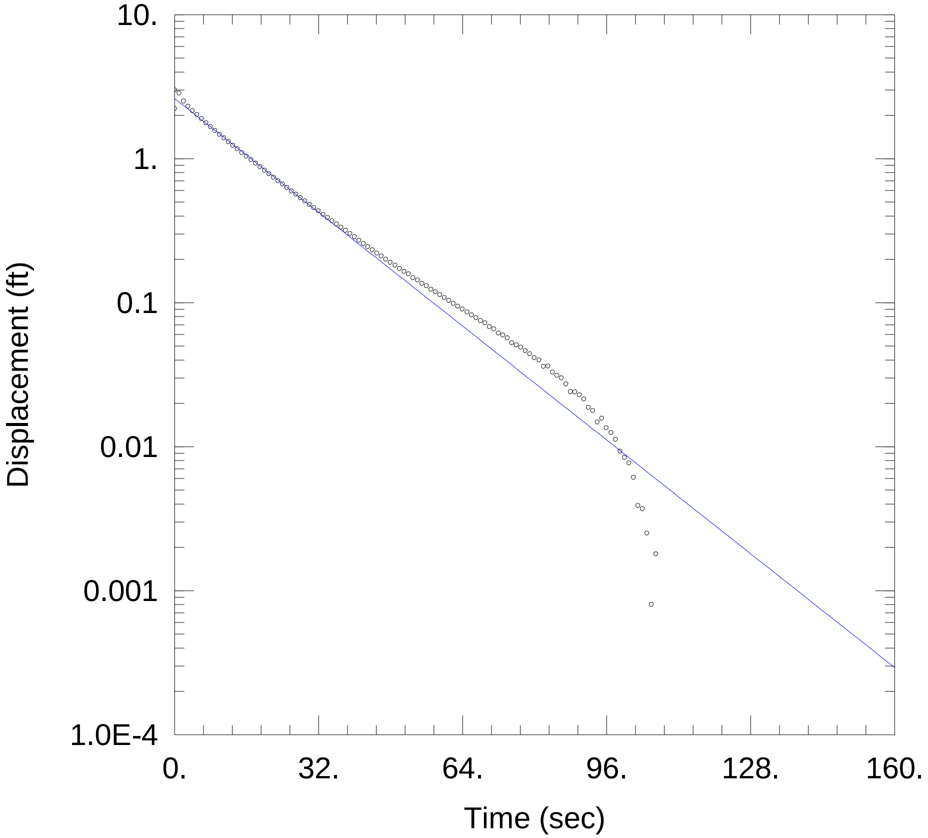
K = 11.1 ft/day
y0 = 1.876 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-03I)

Initial Displacement: 3. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13. ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-03I SLUG OUT 1

Data Set: T:\...\UFIW-03I_slugout_1.aqt
Date: 05/04/17 Time: 09:55:25

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-03I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

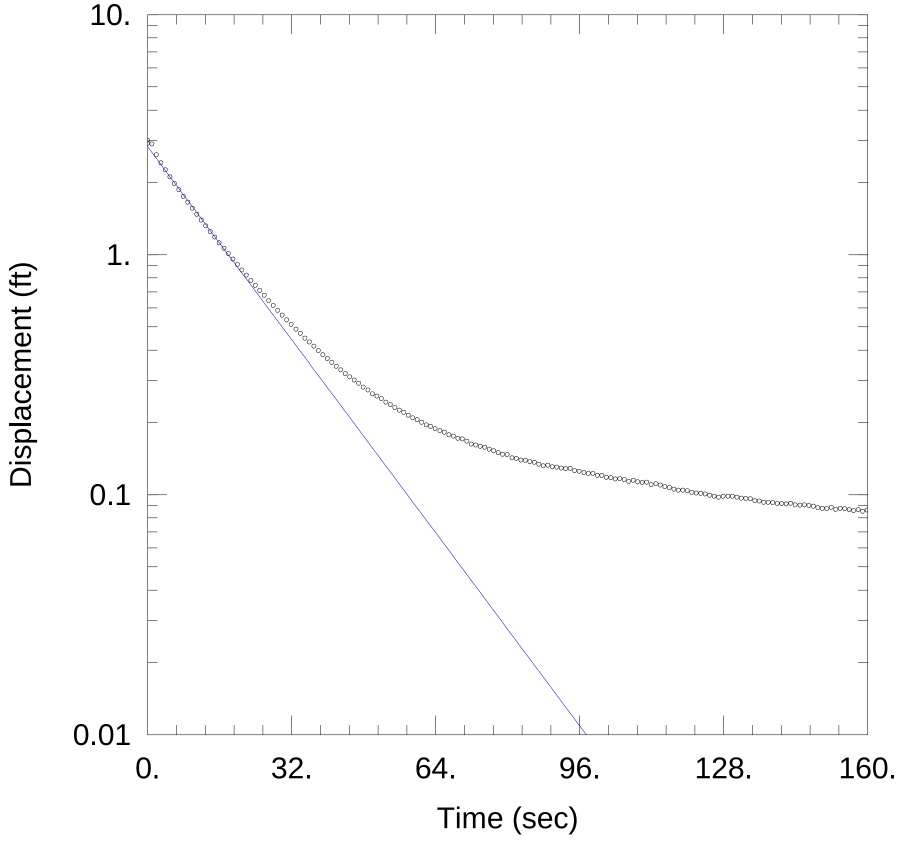
K = 11.48 ft/day
y0 = 2.617 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-03I)

Initial Displacement: 3. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13. ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-03I SLUG OUT 2

Data Set: T:\...\UFIW-03I_slugout_2.aqt
Date: 05/04/17 Time: 09:55:36

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-03I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

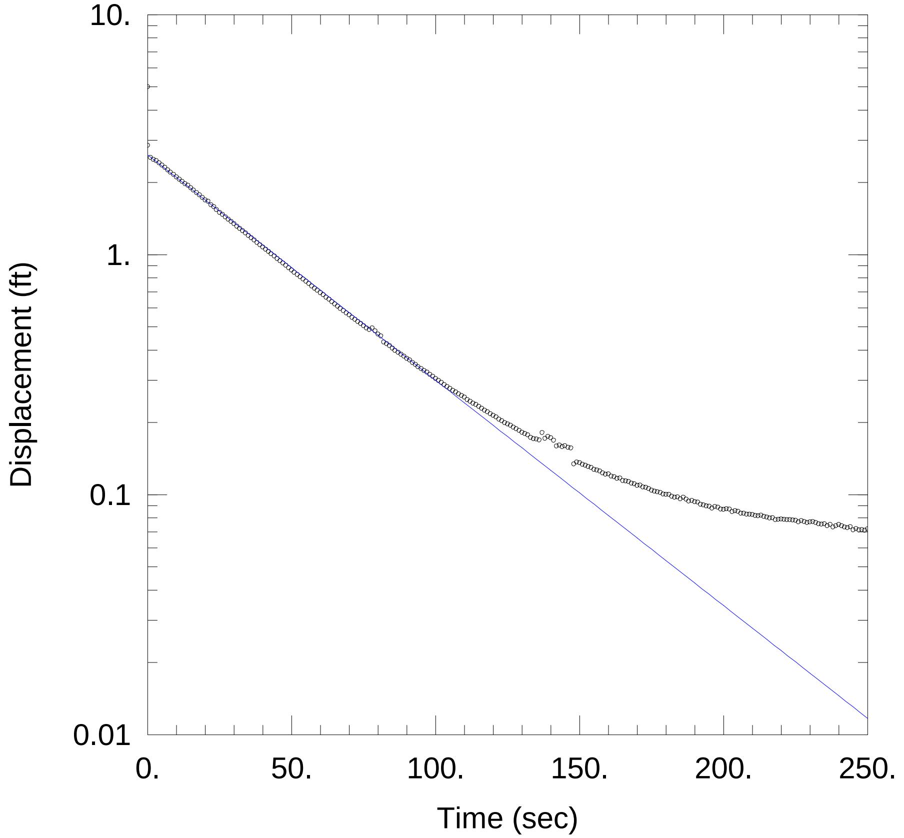
K = 11.68 ft/day
y0 = 2.816 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-03I)

Initial Displacement: 3. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13. ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-04D SLUG IN 1

Data Set: T:\...\UFIW-04D_slugin_1.aqt
Date: 05/04/17 Time: 09:55:44

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-04D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

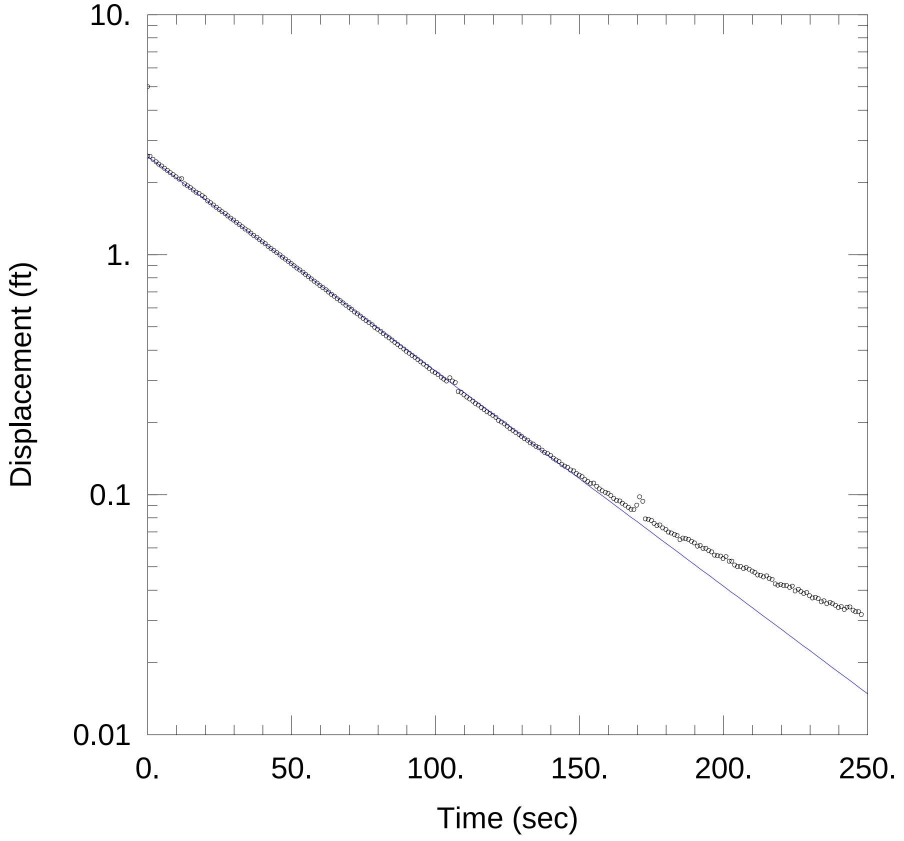
K = 4.895 ft/day
y0 = 2.603 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-04D)

Initial Displacement: 5. ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20.48 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-04D SLUG IN 2

Data Set: T:\...\UFIW-04D_slugin_2.aqt
Date: 05/04/17 Time: 09:55:54

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-04D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

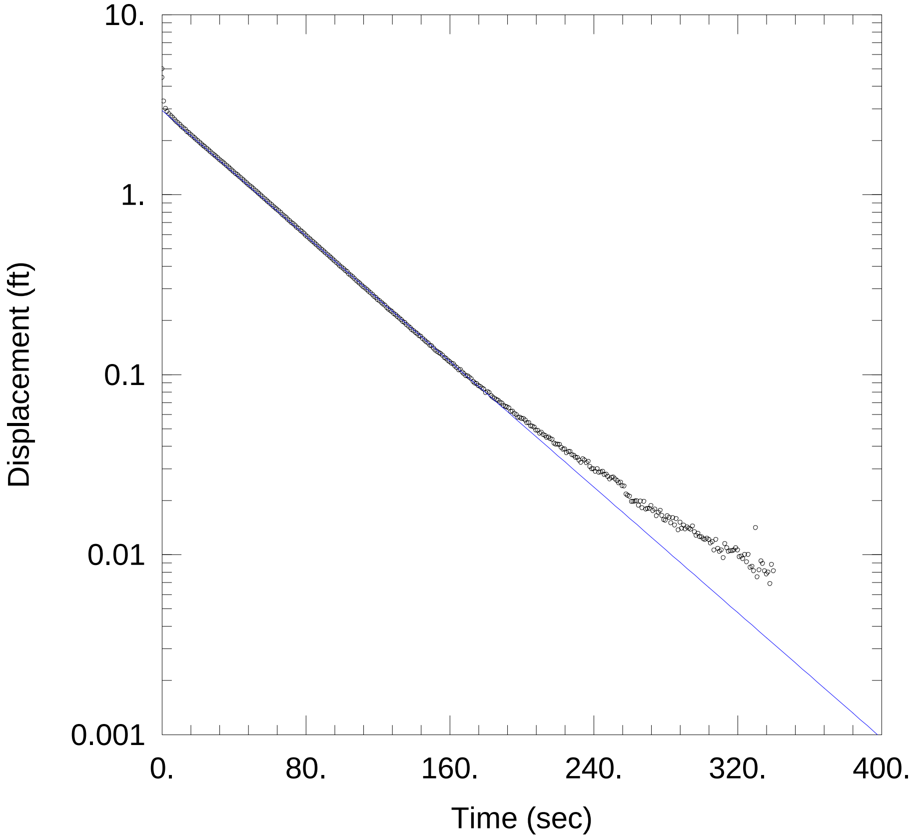
K = 4.669 ft/day
y0 = 2.566 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-04D)

Initial Displacement: 5. ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20.48 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-04D SLUG OUT 1

Data Set: T:\...\UFIW-04D_slugout_1.aqt
Date: 05/04/17 Time: 09:56:03

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-04D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

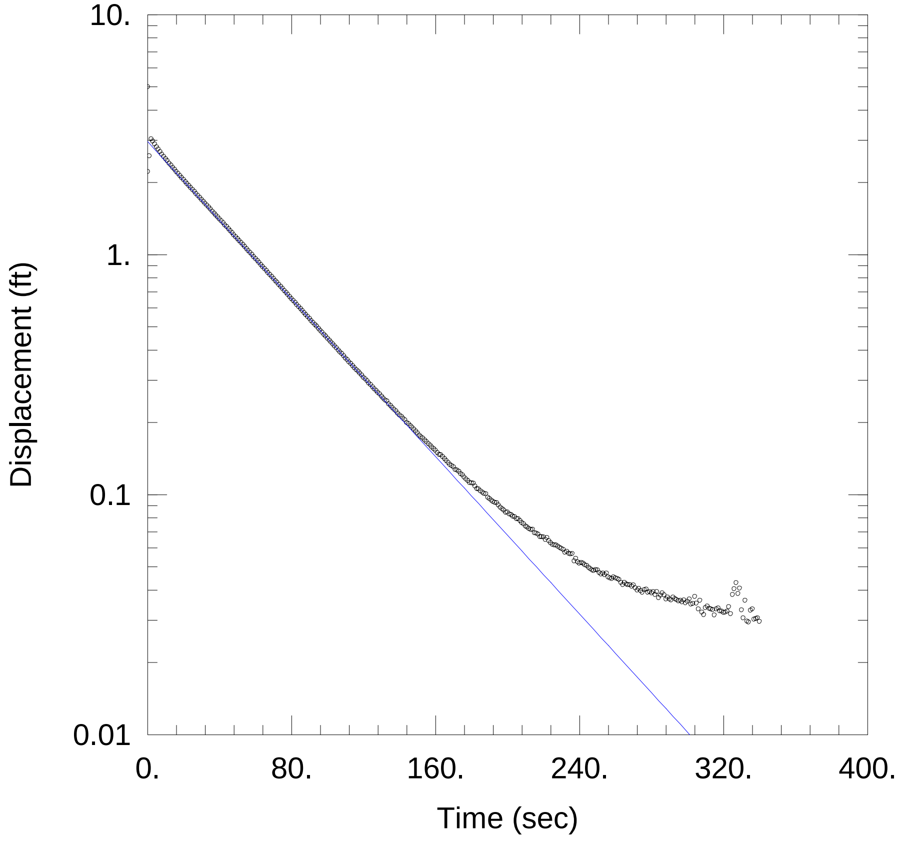
K = 4.546 ft/day
y0 = 2.939 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-04D)

Initial Displacement: 5. ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20.48 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-04D SLUG OUT 2

Data Set: T:\...\UFIW-04D_slugout_2.aqt
Date: 05/04/17 Time: 09:56:12

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-04D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

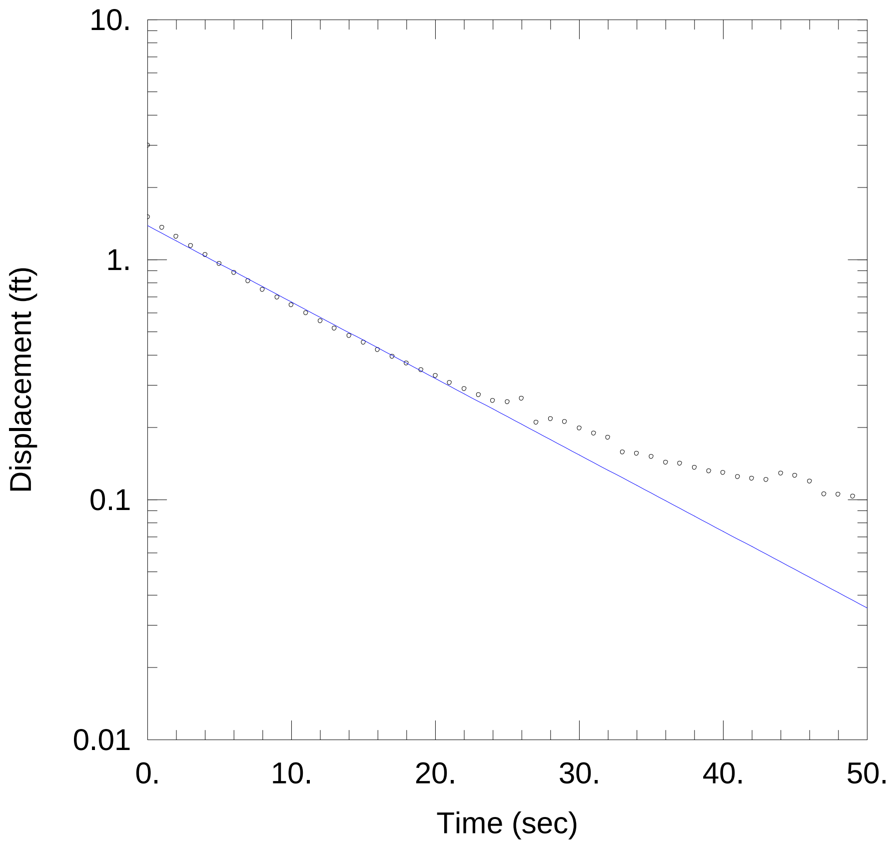
K = 4.276 ft/day
y0 = 2.956 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-04D)

Initial Displacement: 5. ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20.48 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-04I SLUG IN 1

Data Set: T:\...\UFIW-04I_slugin_1.aqt
Date: 05/04/17 Time: 09:56:39

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-04I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

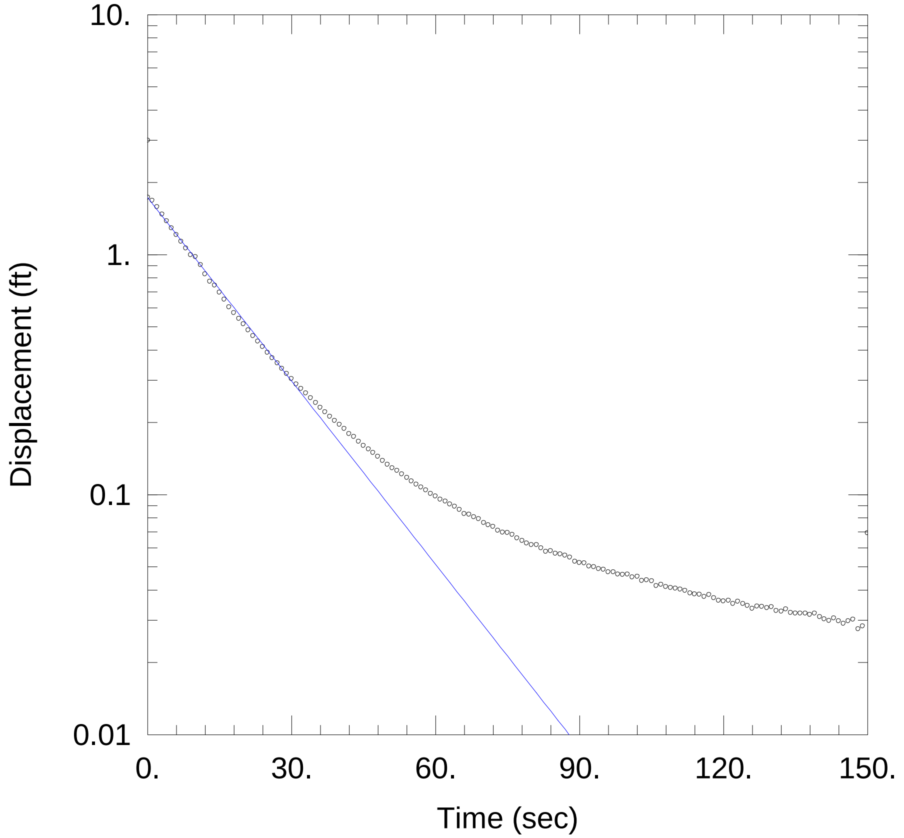
K = 14.81 ft/day
y0 = 1.386 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-04I)

Initial Displacement: 3. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.77 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-04I SLUG IN 1

Data Set: T:\...\UFIW-04I_slugin_2.aqt
Date: 05/04/17 Time: 09:56:47

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-04I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

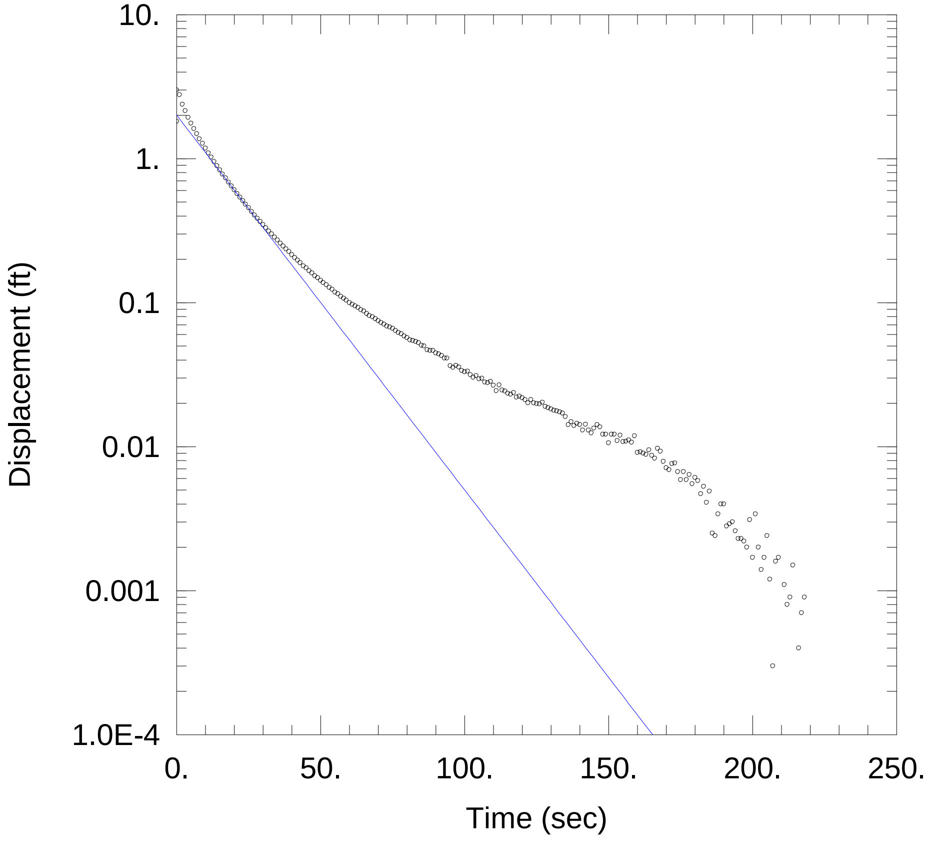
K = 11.85 ft/day
y0 = 1.727 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-04I)

Initial Displacement: 3. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.77 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-04I SLUG OUT 1

Data Set: T:\...\UFIW-04I_slugout_1.aqt
Date: 05/04/17 Time: 09:56:56

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-04I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

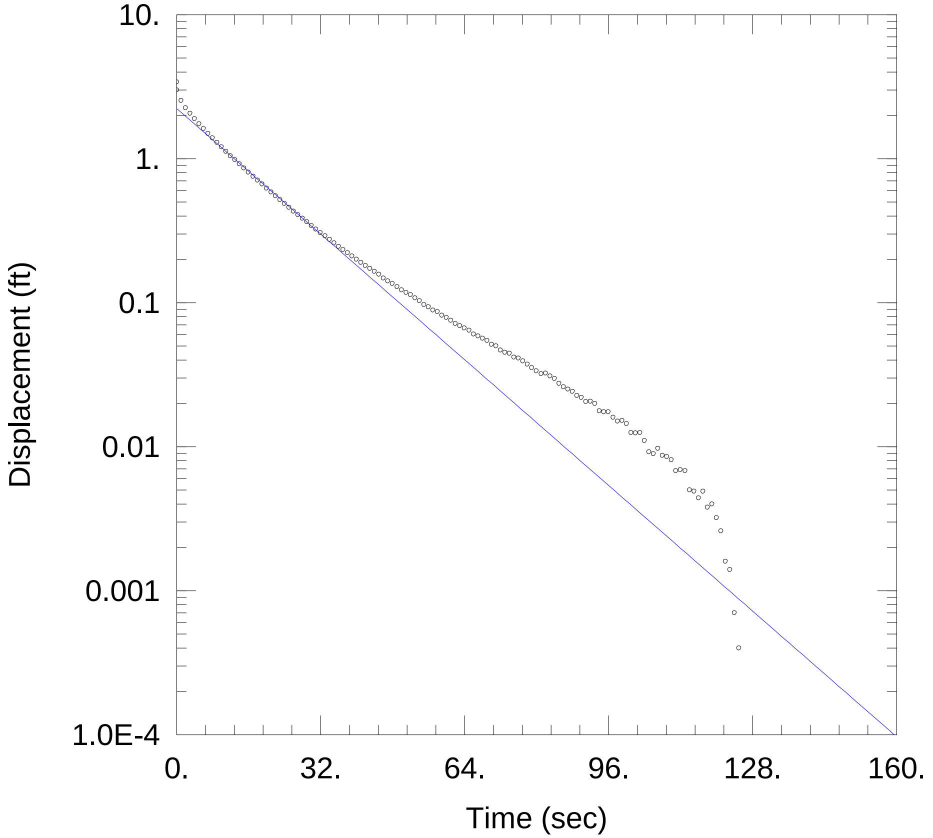
K = 12.11 ft/day
y0 = 2.008 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-04I)

Initial Displacement: 3. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.77 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-04I SLUG OUT 2

Data Set: T:\...\UFIW-04I_slugout_2.aqt
Date: 05/04/17 Time: 09:57:05

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-04I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

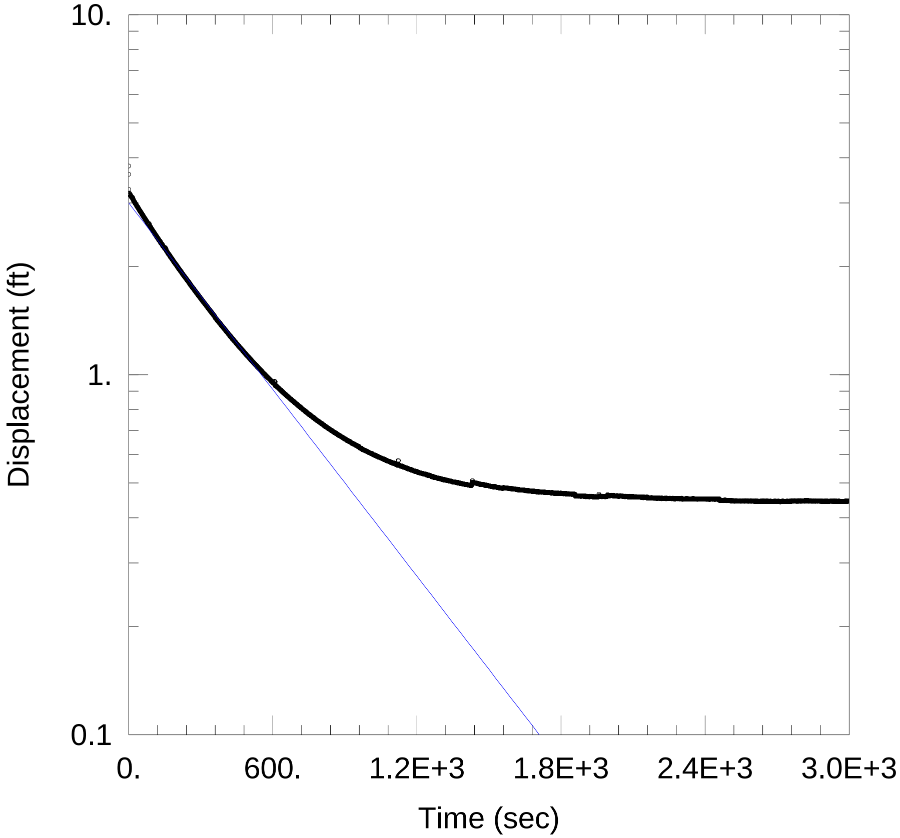
K = 12.68 ft/day
y0 = 2.232 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-04I)

Initial Displacement: 3. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.77 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-05D SLUG IN 1

Data Set: T:\...\UFIW-05D_slugin_1.aqt
Date: 05/04/17 Time: 09:57:14

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-05D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

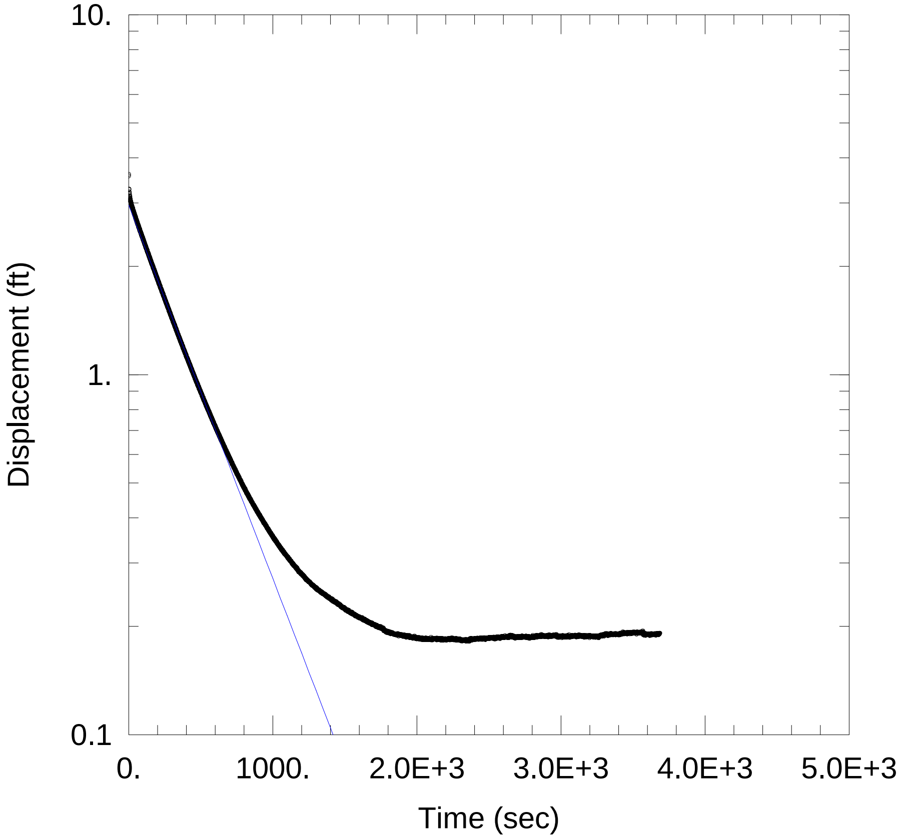
K = 0.4503 ft/day
y0 = 3. ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-05D)

Initial Displacement: 3.6 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20.99 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-05D SLUG OUT 1

Data Set: T:\...\UFIW-05D_slugout_1.aqt
Date: 05/04/17 Time: 09:57:23

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-05D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

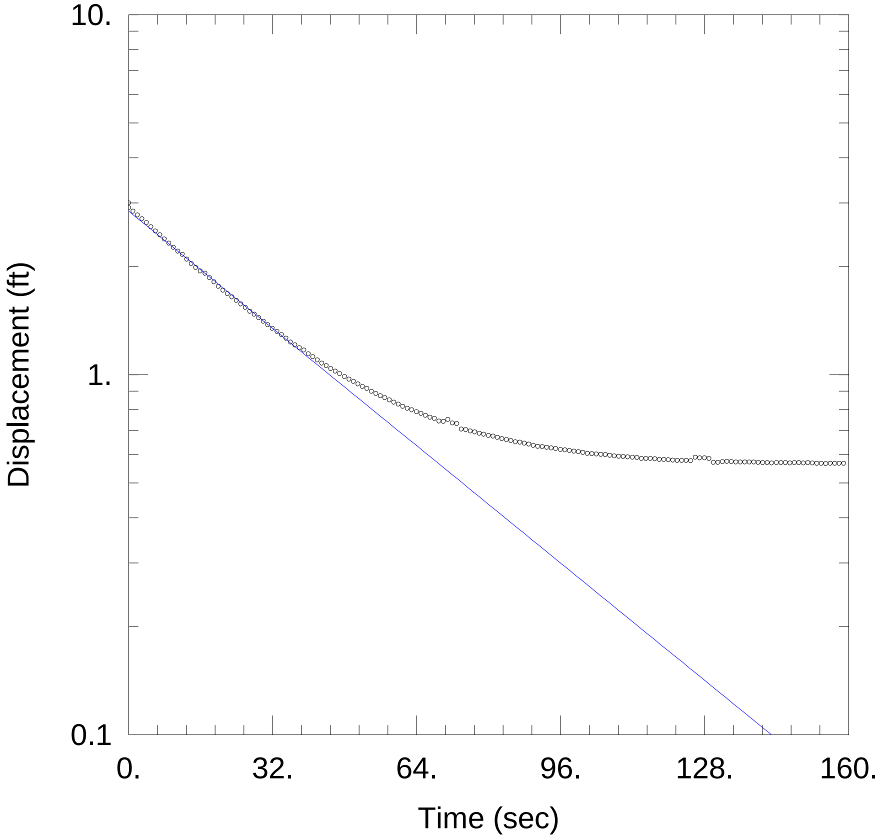
K = 0.5404 ft/day
y0 = 2.955 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-05D)

Initial Displacement: 3.6 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20.99 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-05I SLUG IN 1

Data Set: T:\...\UFIW-05I_slugin_1.aqt
Date: 05/04/17 Time: 09:57:32

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-05I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

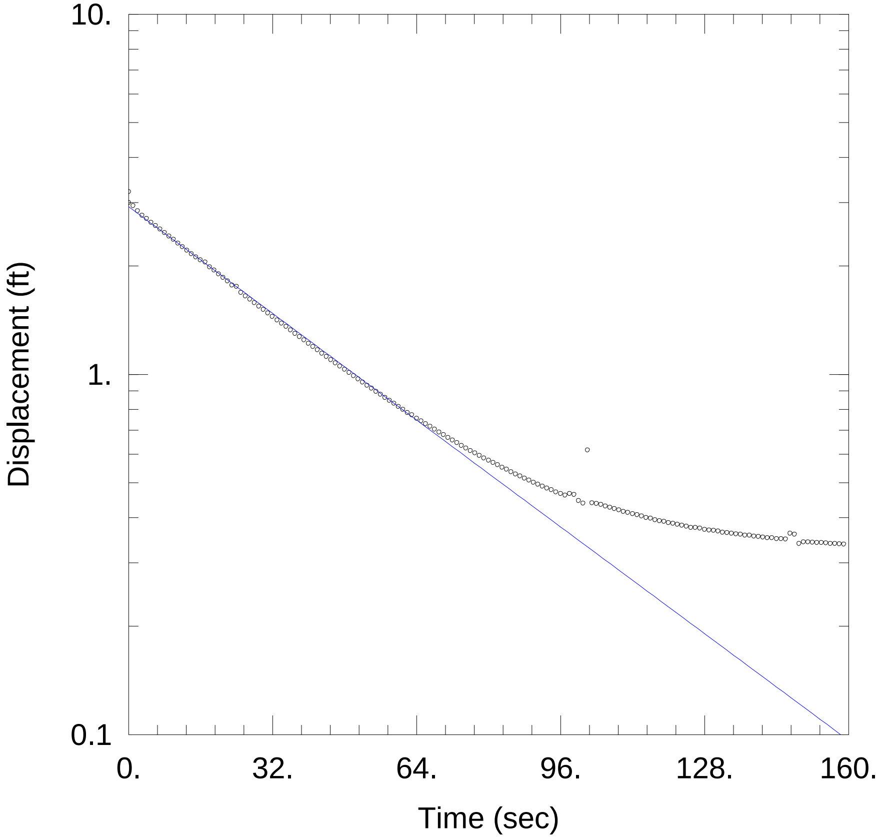
K = 4.735 ft/day
y0 = 2.846 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-05I)

Initial Displacement: 3. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.06 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-05I SLUG IN 2

Data Set: T:\...\UFIW-05I_slugin_2.aqt
Date: 05/04/17 Time: 09:57:40

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-05I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

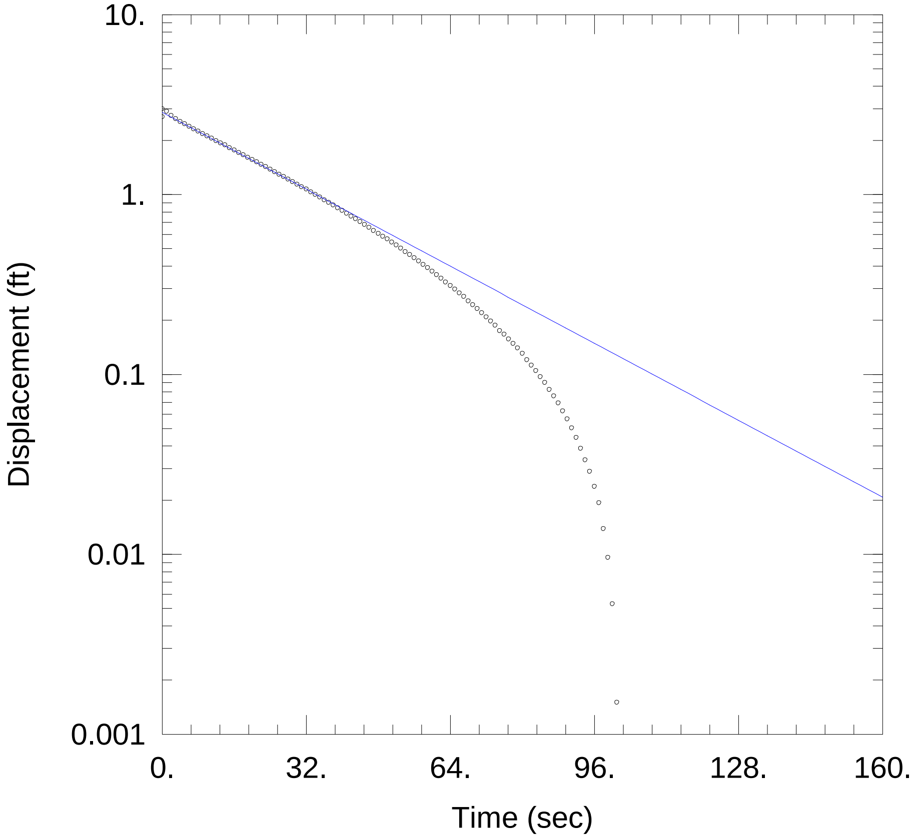
K = 4.306 ft/day
y0 = 2.921 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-05I)

Initial Displacement: 3. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.06 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-05I SLUG OUT 1

Data Set: T:\...\UFIW-05I_slugout_1.aqt
Date: 05/04/17 Time: 09:57:48

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-05I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

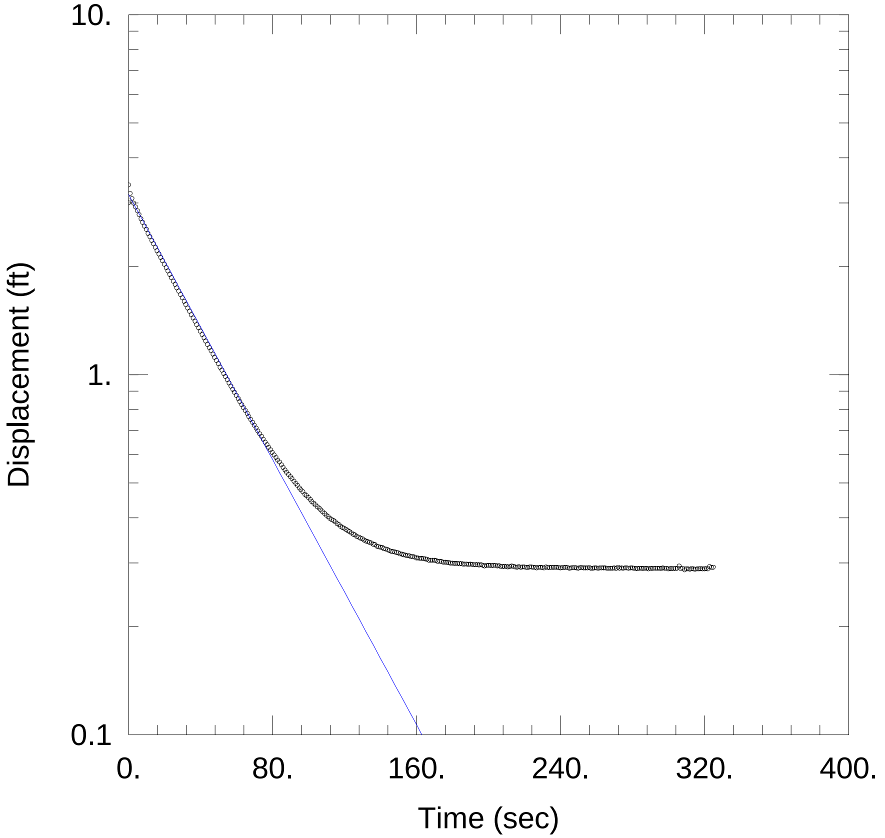
K = 6.22 ft/day
y0 = 2.867 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-05I)

Initial Displacement: 3. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.06 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-05I SLUG OUT 2

Data Set: T:\...\UFIW-05I_slugout_2.aqt
Date: 05/04/17 Time: 09:58:02

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-05I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

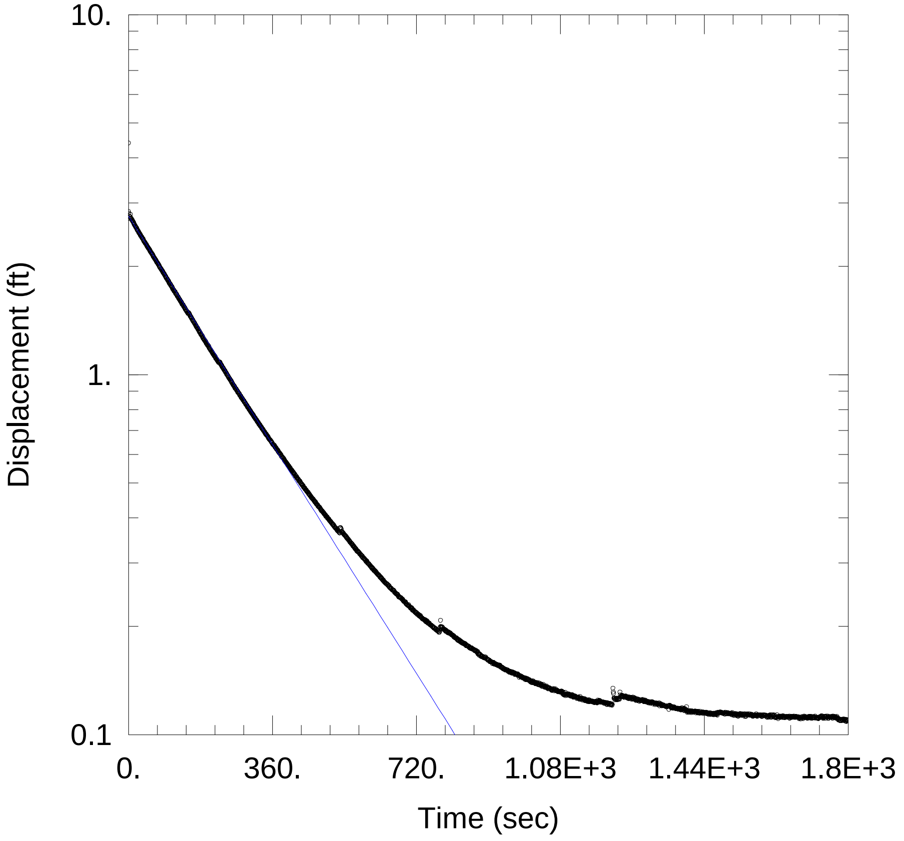
K = 4.282 ft/day
y0 = 3.165 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-05I)

Initial Displacement: 3. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.06 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-06D SLUG IN 1

Data Set: T:\...\UFIW-06D_slugin_1.aqt
Date: 05/04/17 Time: 09:58:10

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-06D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

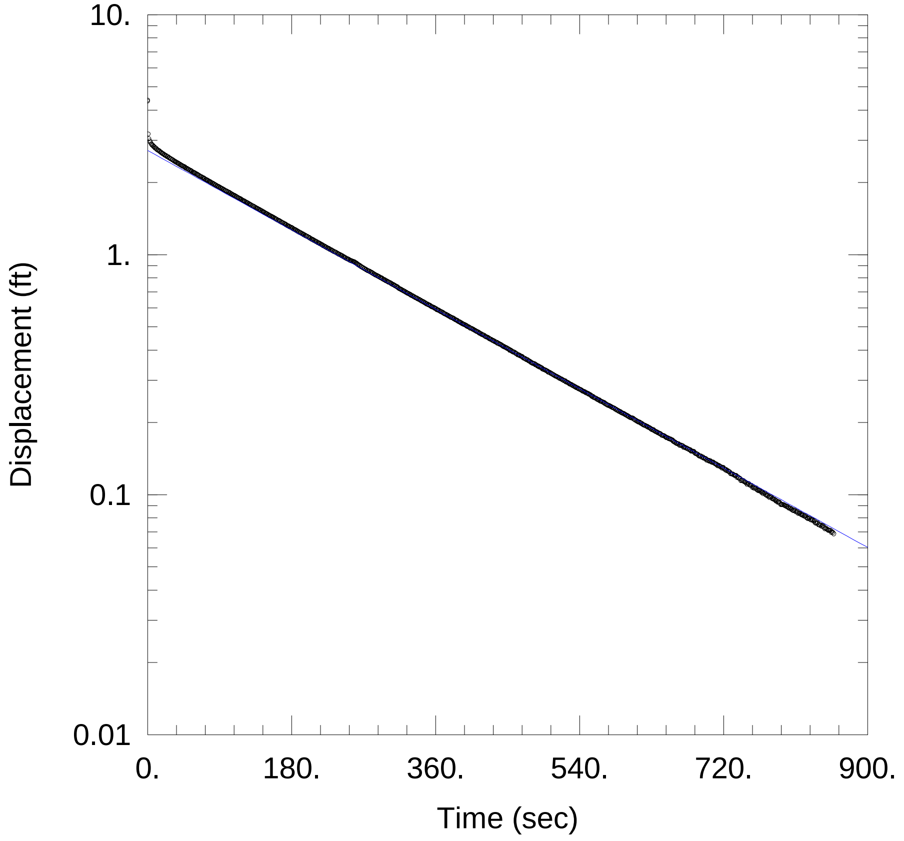
K = 0.9196 ft/day
y0 = 2.758 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-06D)

Initial Displacement: 4.4 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.85 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-06D SLUG OUT 1

Data Set: T:\...\UFIW-06D_slugout_1.aqt
Date: 05/04/17 Time: 09:58:19

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-06D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.9579 ft/day
y0 = 2.716 ft

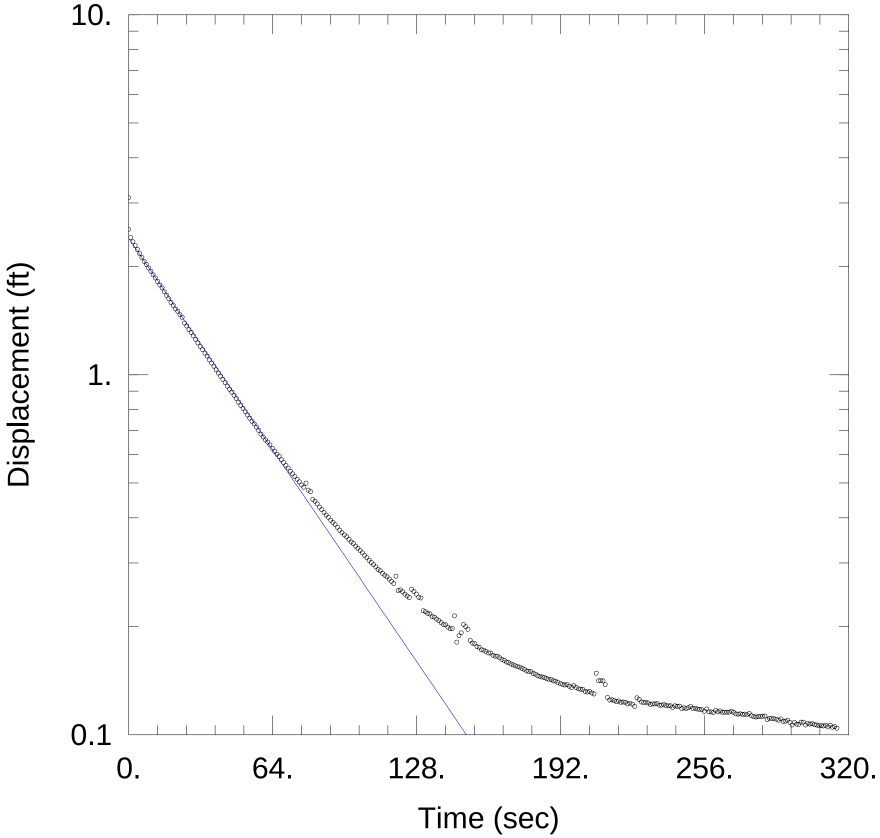
AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-06D)

Initial Displacement: 4.4 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft

Static Water Column Height: 22.85 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-06I SLUG IN 1

Data Set: T:\...\UFIW-06I_slugin_1.aqt
Date: 05/04/17 Time: 12:01:51

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-06I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

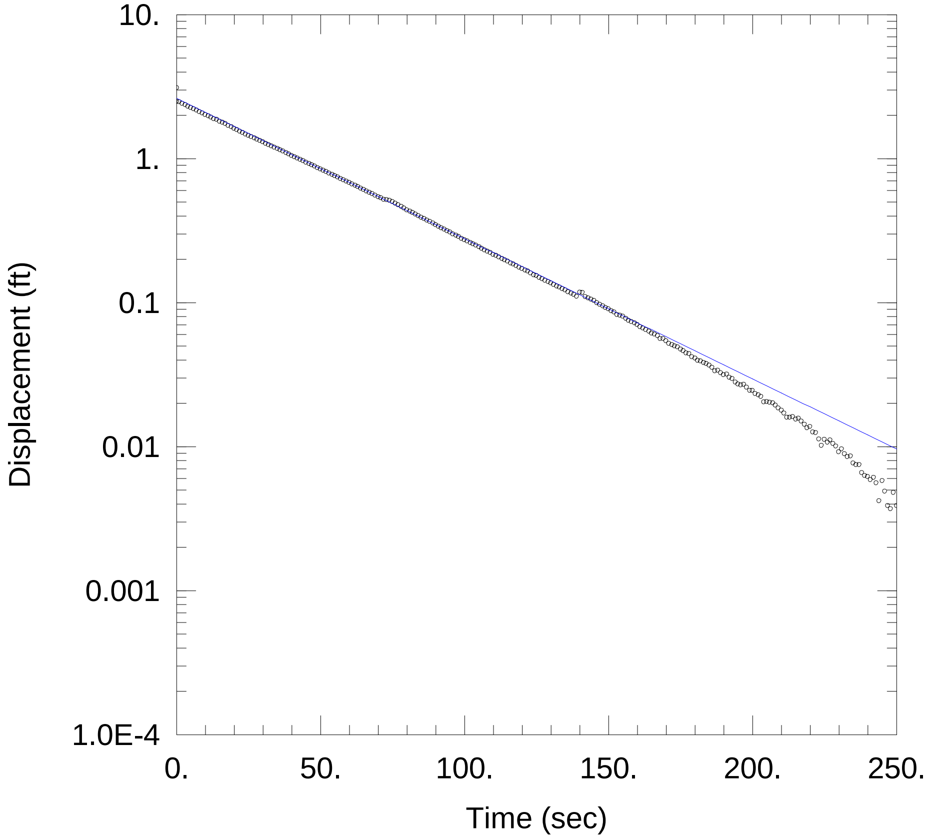
K = 2.317 ft/day
y0 = 2.394 ft

AQUIFER DATA

Saturated Thickness: 11. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-06I)

Initial Displacement: 3.1 ft
Total Well Penetration Depth: 13. ft
Casing Radius: 0.083 ft
Static Water Column Height: 16.58 ft
Screen Length: 10. ft
Well Radius: 0.33 ft



UFIW-06I SLUG IN 2

Data Set: T:\...\UFIW-06I_slugin_2.aqt
Date: 05/04/17 Time: 12:02:07

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-06I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

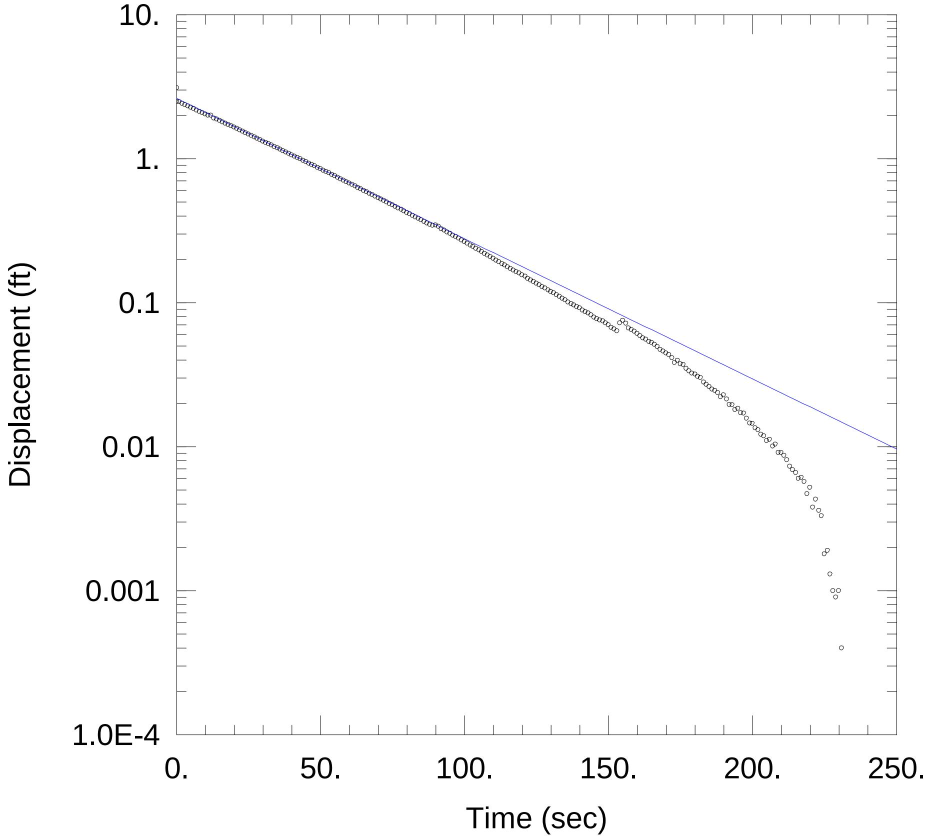
K = 2.455 ft/day
y0 = 2.617 ft

AQUIFER DATA

Saturated Thickness: 11. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-06I)

Initial Displacement: 3.1 ft
Total Well Penetration Depth: 13. ft
Casing Radius: 0.083 ft
Static Water Column Height: 16.58 ft
Screen Length: 10. ft
Well Radius: 0.33 ft



UFIW-06I SLUG IN 3

Data Set: T:\...\UFIW-06I_slugin_3.aqt
Date: 05/04/17 Time: 12:02:19

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-06I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

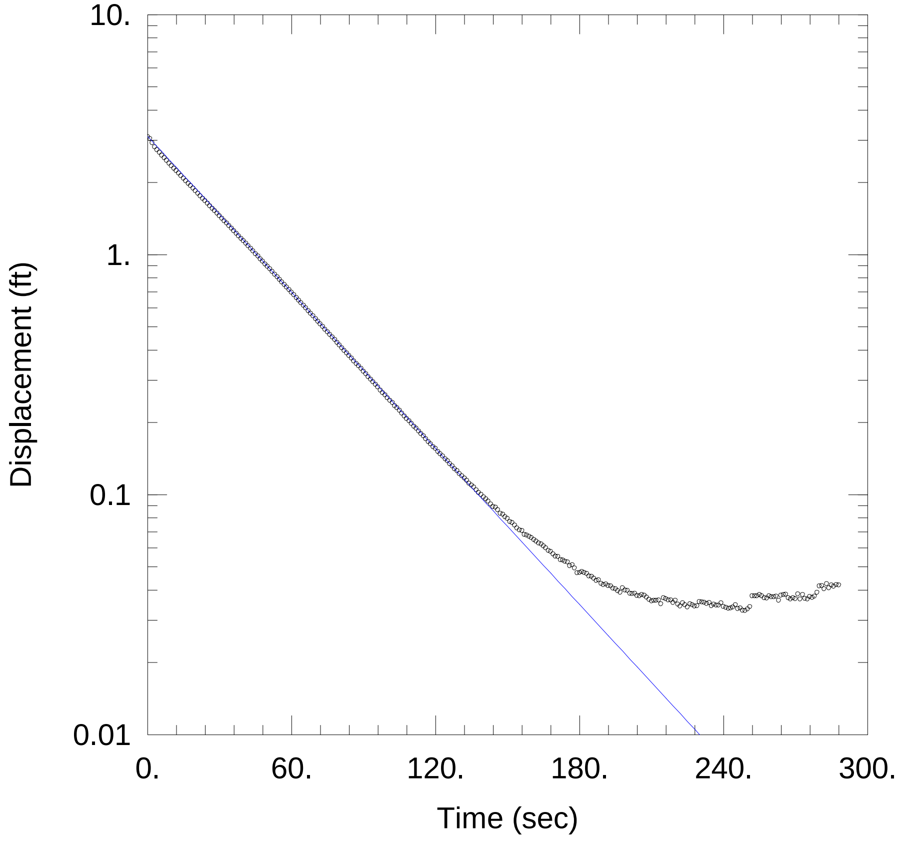
K = 2.455 ft/day
y0 = 2.617 ft

AQUIFER DATA

Saturated Thickness: 12. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-06I)

Initial Displacement: 3.1 ft
Total Well Penetration Depth: 13. ft
Casing Radius: 0.083 ft
Static Water Column Height: 16.58 ft
Screen Length: 10. ft
Well Radius: 0.33 ft



UFIW-06I SLUG OUT 1

Data Set: T:\...\UFIW-06I_slugout_1.aqt
Date: 05/04/17 Time: 12:02:29

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-06I
Test Date: 8/30/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

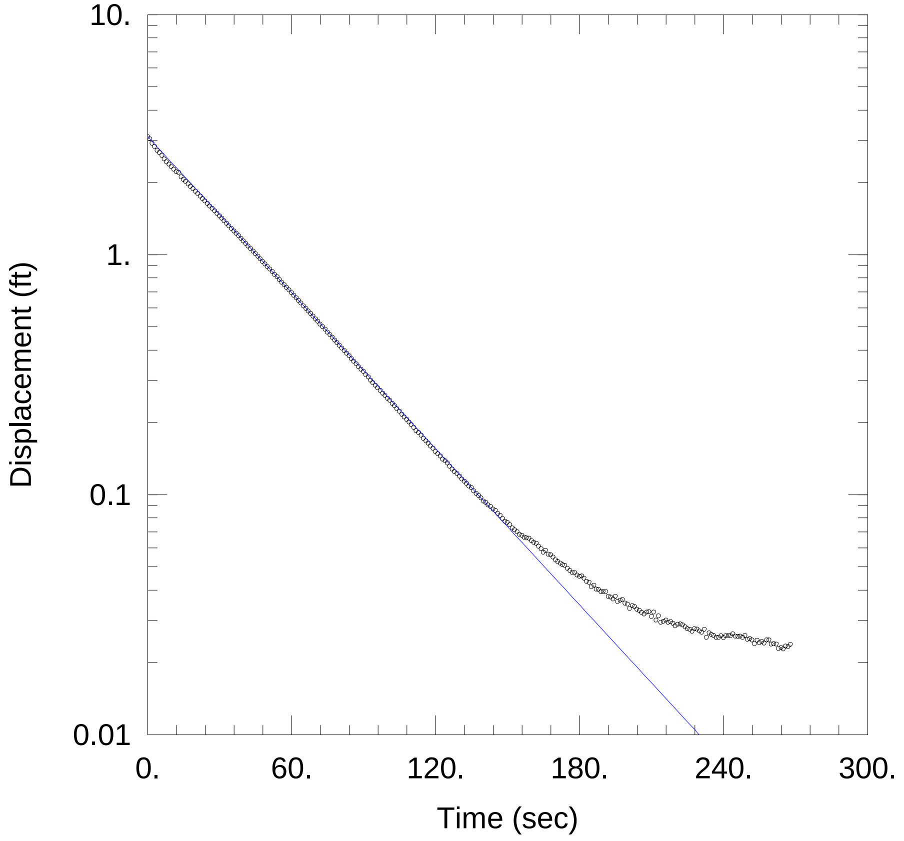
K = 2.733 ft/day
y0 = 3.113 ft

AQUIFER DATA

Saturated Thickness: 11. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-06I)

Initial Displacement: 3.1 ft
Total Well Penetration Depth: 13. ft
Casing Radius: 0.083 ft
Static Water Column Height: 16.58 ft
Screen Length: 10. ft
Well Radius: 0.33 ft



UFIW-06I SLUG OUT 2

Data Set: T:\...\UFIW-06I_slugout_2.aqt
Date: 05/04/17 Time: 12:02:41

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-06I
Test Date: 8/30/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

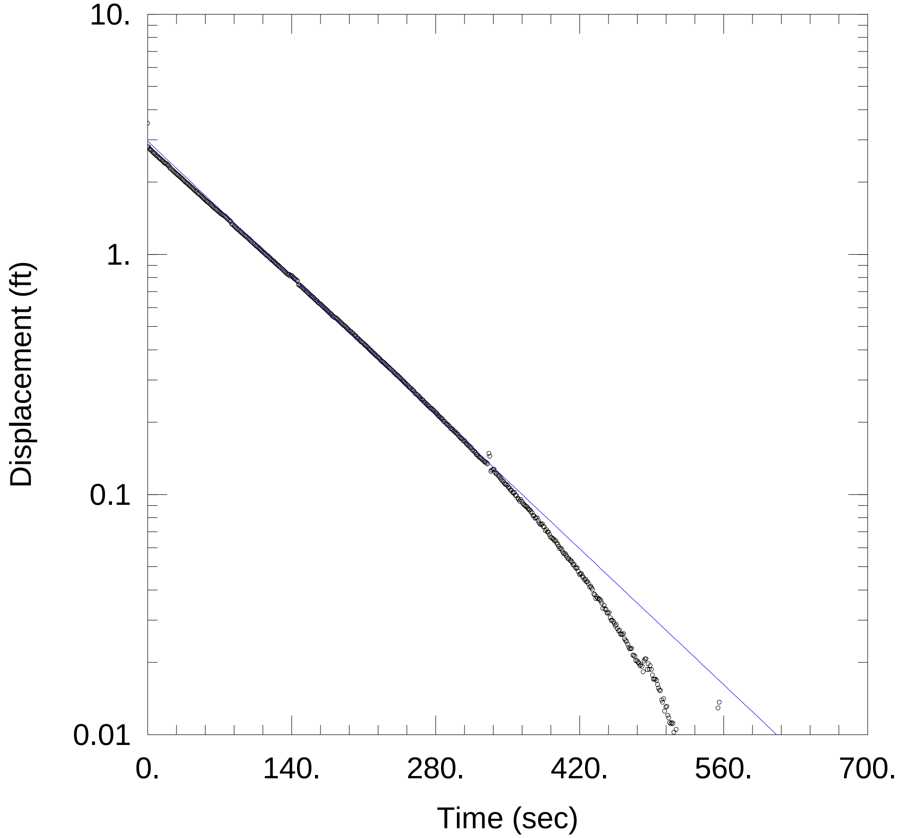
K = 2.734 ft/day
y0 = 3.105 ft

AQUIFER DATA

Saturated Thickness: 11. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-06I)

Initial Displacement: 3.1 ft
Total Well Penetration Depth: 13. ft
Casing Radius: 0.083 ft
Static Water Column Height: 16.58 ft
Screen Length: 10. ft
Well Radius: 0.33 ft



UFIW-07D SLUG IN 1

Data Set: T:\...\UFIW-07D_slugin_1.aqt
Date: 05/04/17 Time: 09:58:35

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-07D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

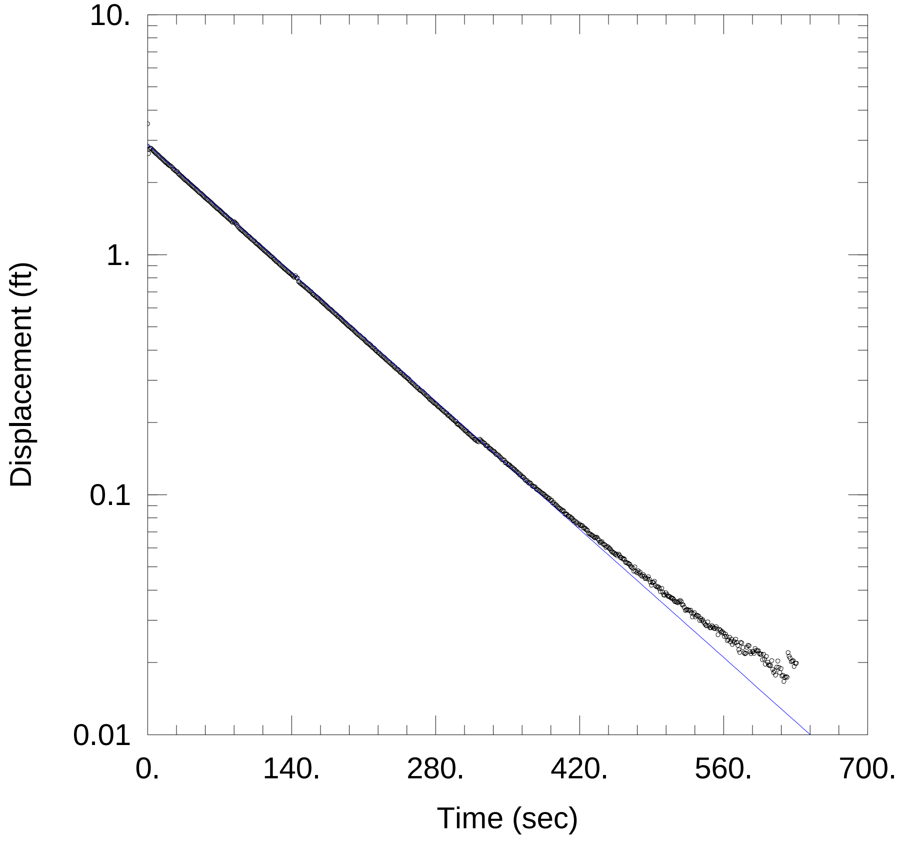
K = 2.107 ft/day
y0 = 2.959 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-07D)

Initial Displacement: 3.5 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.82 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-07D SLUG IN 2

Data Set: T:\...\UFIW-07D_slugin_2.aqt
Date: 05/04/17 Time: 09:58:45

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-07D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

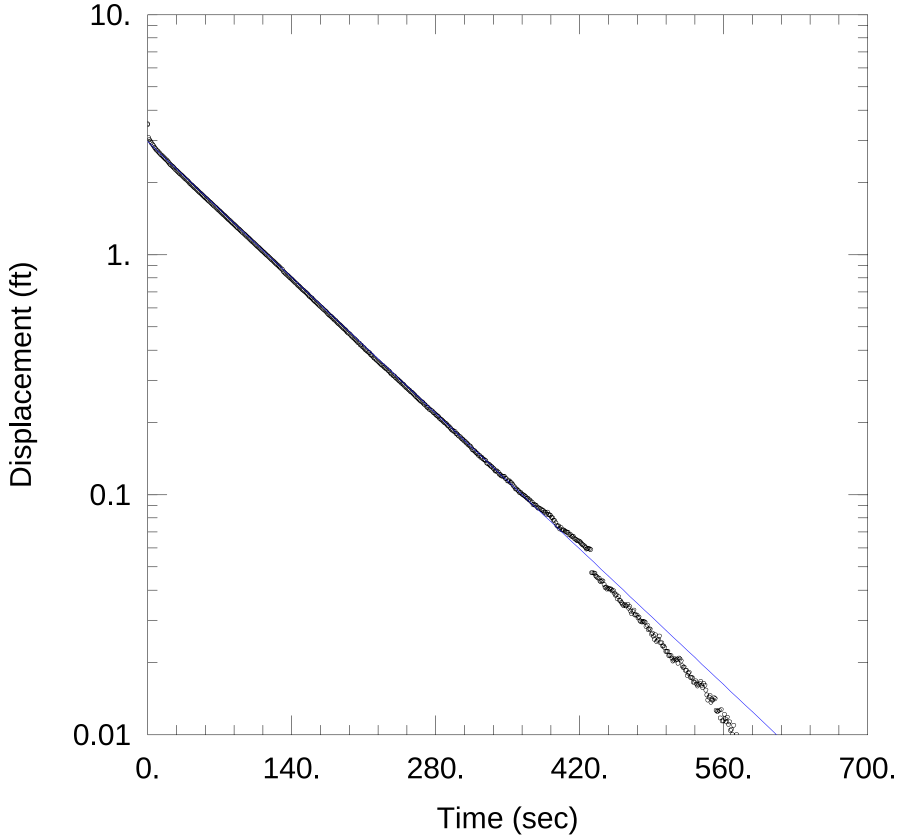
K = 1.989 ft/day
y0 = 2.873 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-07D)

Initial Displacement: 3.5 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.82 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-07D SLUG OUT 1

Data Set: T:\...\UFIW-07D_slugout_1.aqt
Date: 05/04/17 Time: 09:58:54

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-07D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

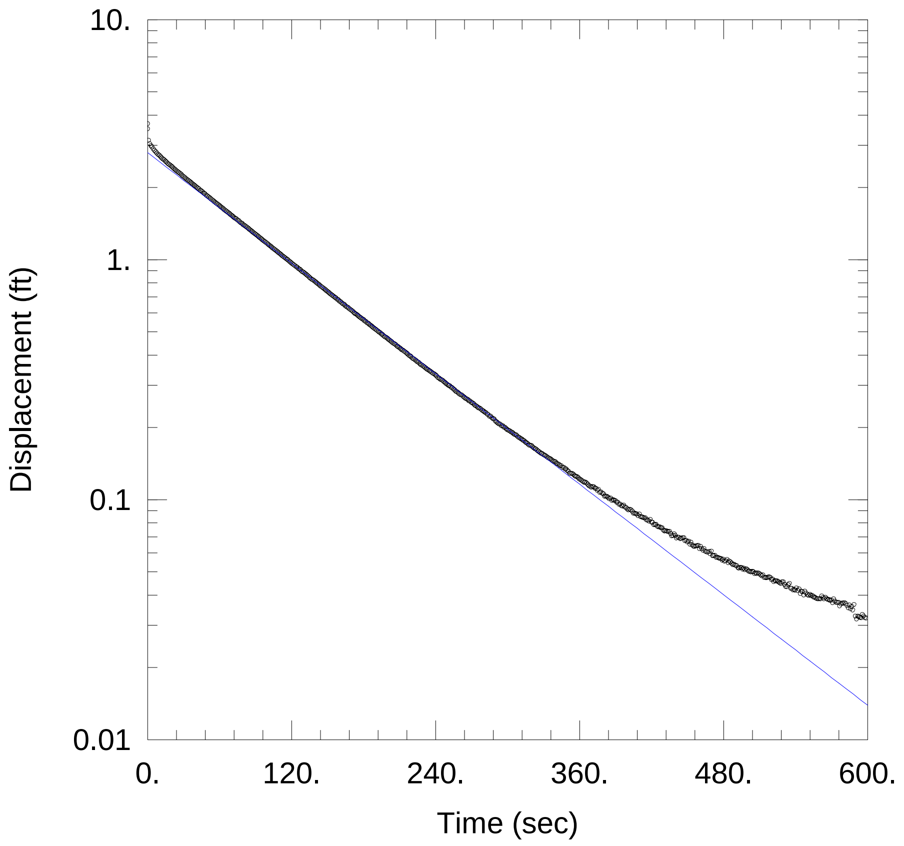
K = 2.107 ft/day
y0 = 2.959 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-07D)

Initial Displacement: 3.5 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.82 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-07D SLUG OUT 2

Data Set: T:\...\UFIW-07D_slugout_2.aqt
Date: 05/04/17 Time: 09:59:02

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-07D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

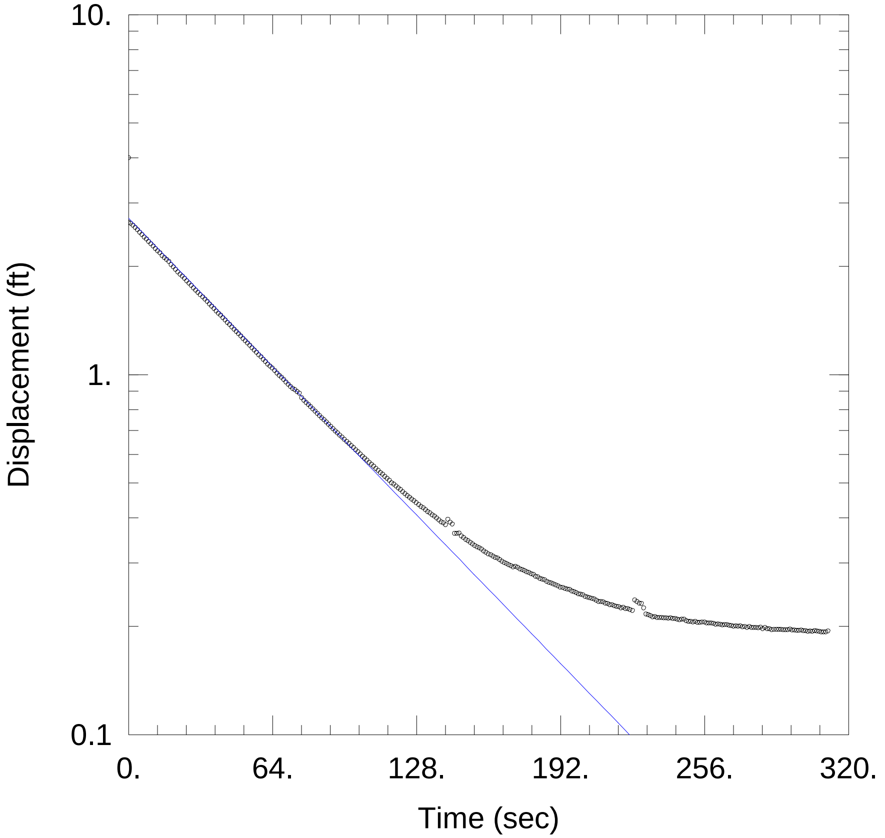
K = 2.001 ft/day
y0 = 2.791 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-07D)

Initial Displacement: 3.5 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.82 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-07I SLUG IN 1

Data Set: T:\...\UFIW-07I_slugin_1.aqt
Date: 05/04/17 Time: 09:59:10

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-07I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

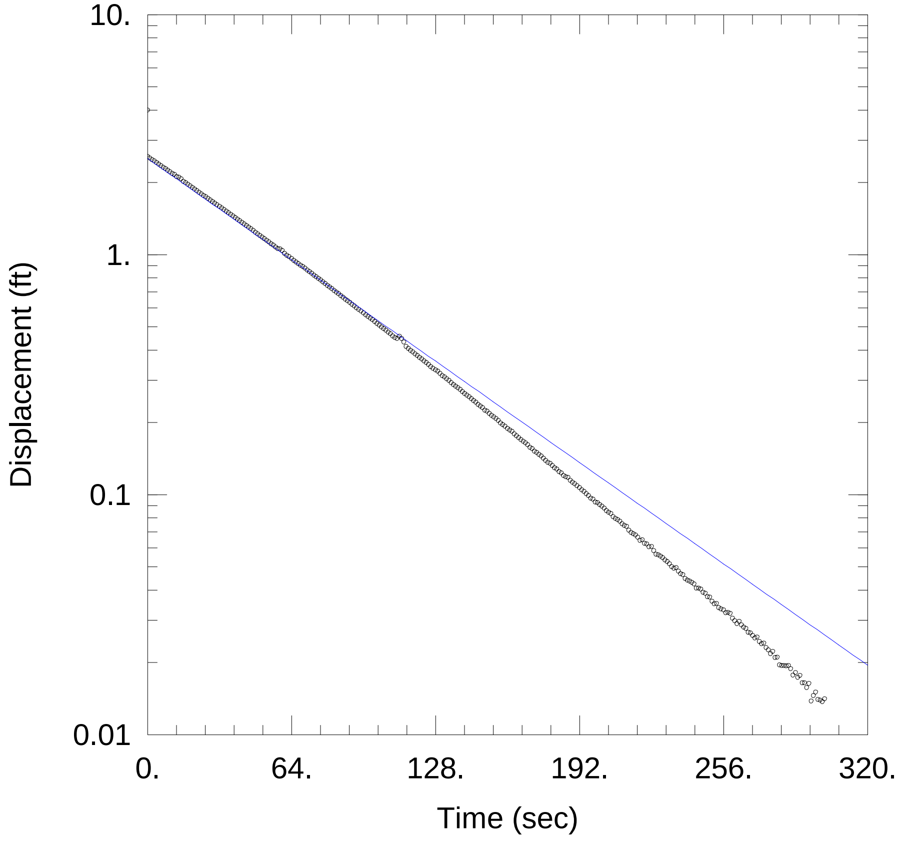
K = 2.995 ft/day
y0 = 2.719 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-07I)

Initial Displacement: 4. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.09 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-07I SLUG IN 2

Data Set: T:\...\UFIW-07I_slugin_2.aqt
Date: 05/04/17 Time: 09:59:18

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-07I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

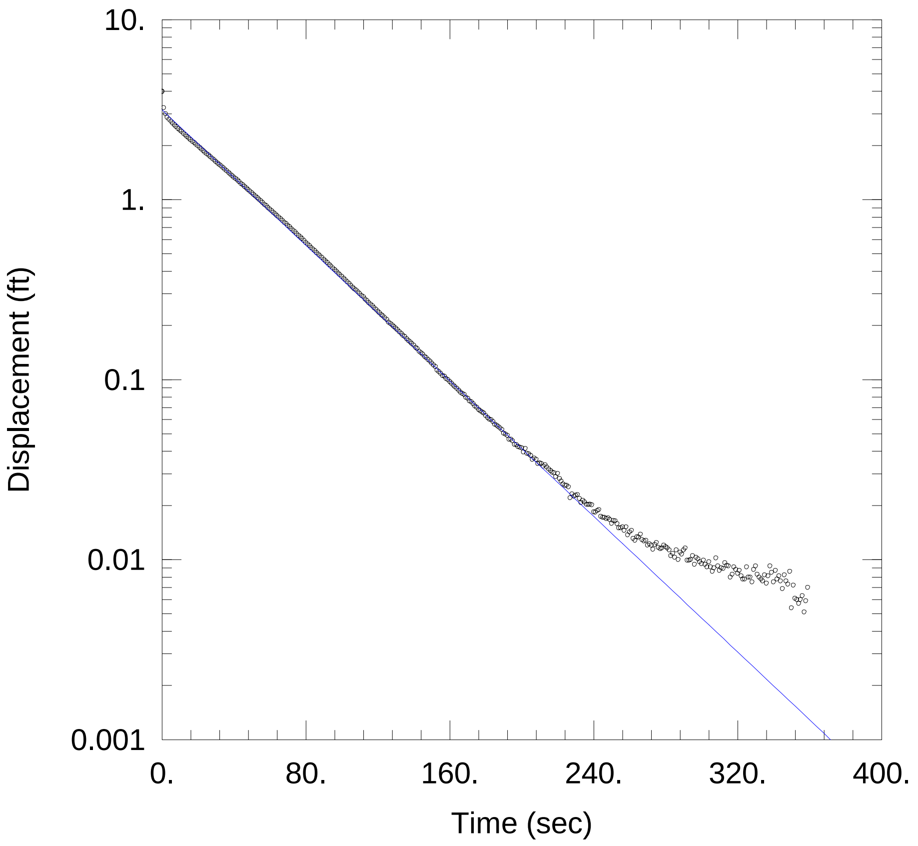
K = 3.068 ft/day
y0 = 2.515 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-07I)

Initial Displacement: 4. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.09 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-07I SLUG OUT 1

Data Set: T:\...\UFIW-07I_slugout_1.aqt
Date: 05/04/17 Time: 09:59:27

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-07I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

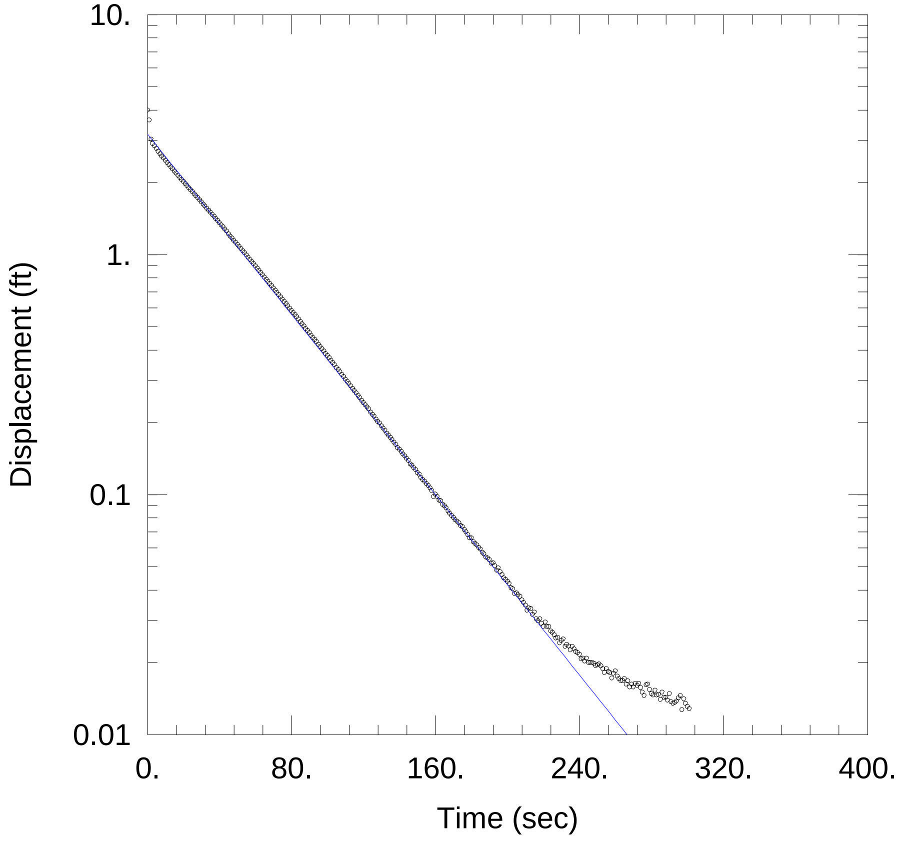
K = 4.378 ft/day
y0 = 3.154 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-07I)

Initial Displacement: 4. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.09 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-07I SLUG OUT 2

Data Set: T:\...\UFIW-07I_slugout_2.aqt
Date: 05/04/17 Time: 09:59:35

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-07I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

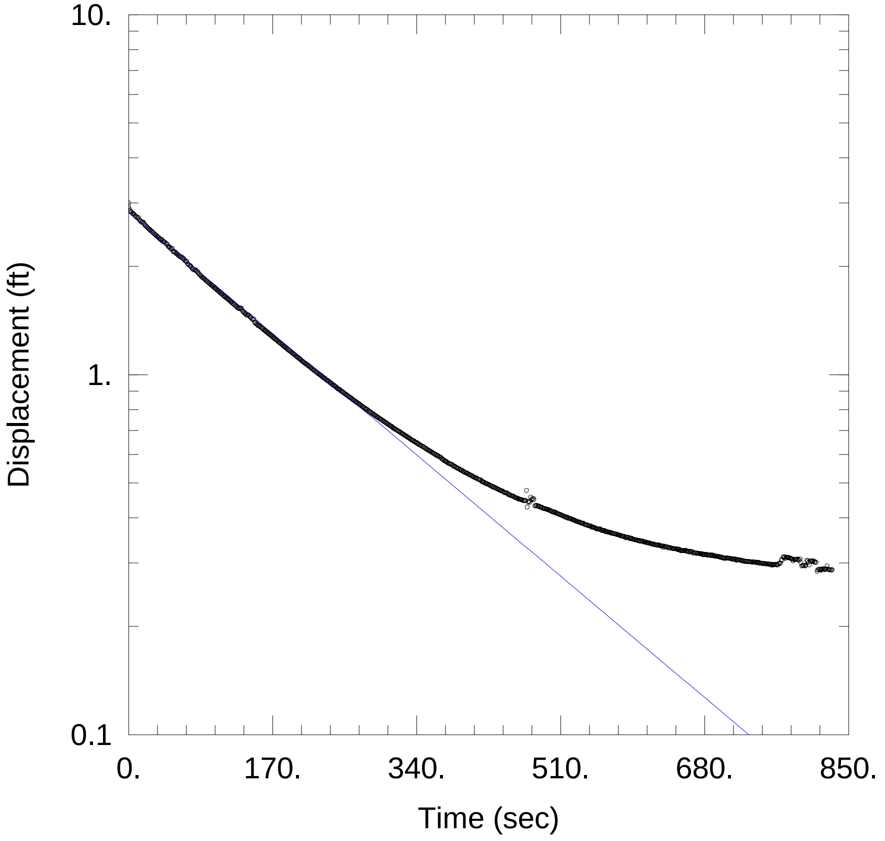
K = 4.368 ft/day
y0 = 3.175 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-07I)

Initial Displacement: 4. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.09 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-08D SLUG IN 1

Data Set: T:\...\UFIW-08D_slugin_1.aqt
Date: 05/04/17 Time: 09:59:45

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-08D
Test Date: 8/29/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

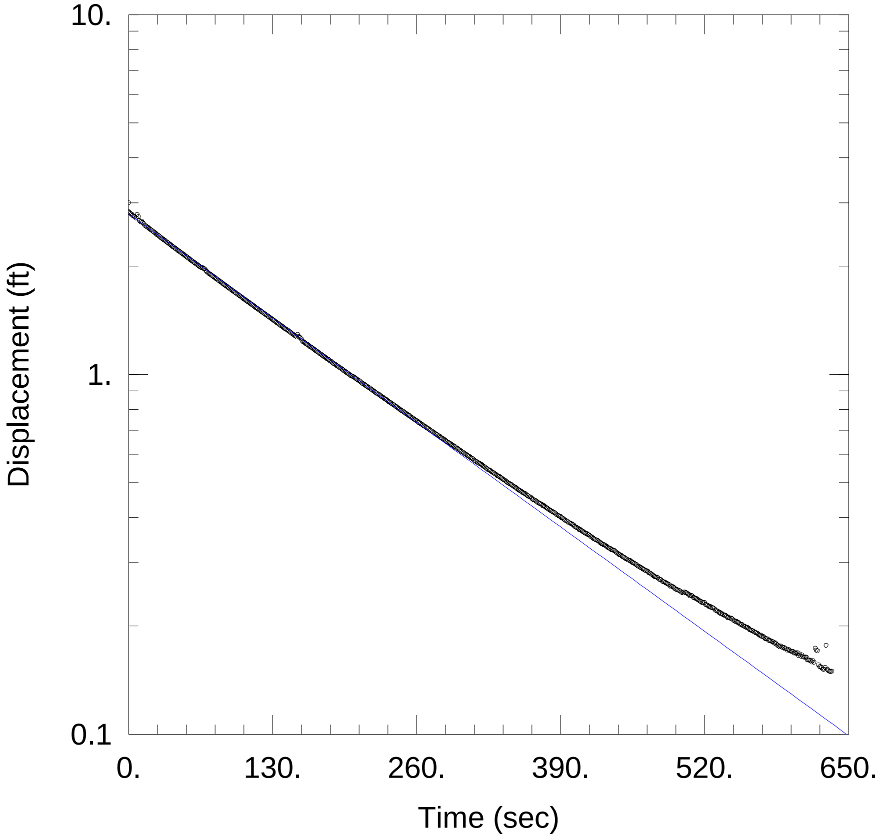
K = 1.033 ft/day
y0 = 2.826 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-08D)

Initial Displacement: 3. ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 21.73 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-08D SLUG IN 2

Data Set: T:\...\UFIW-08D_slugin_2.aqt
Date: 05/04/17 Time: 09:59:54

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-08D
Test Date: 8/29/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

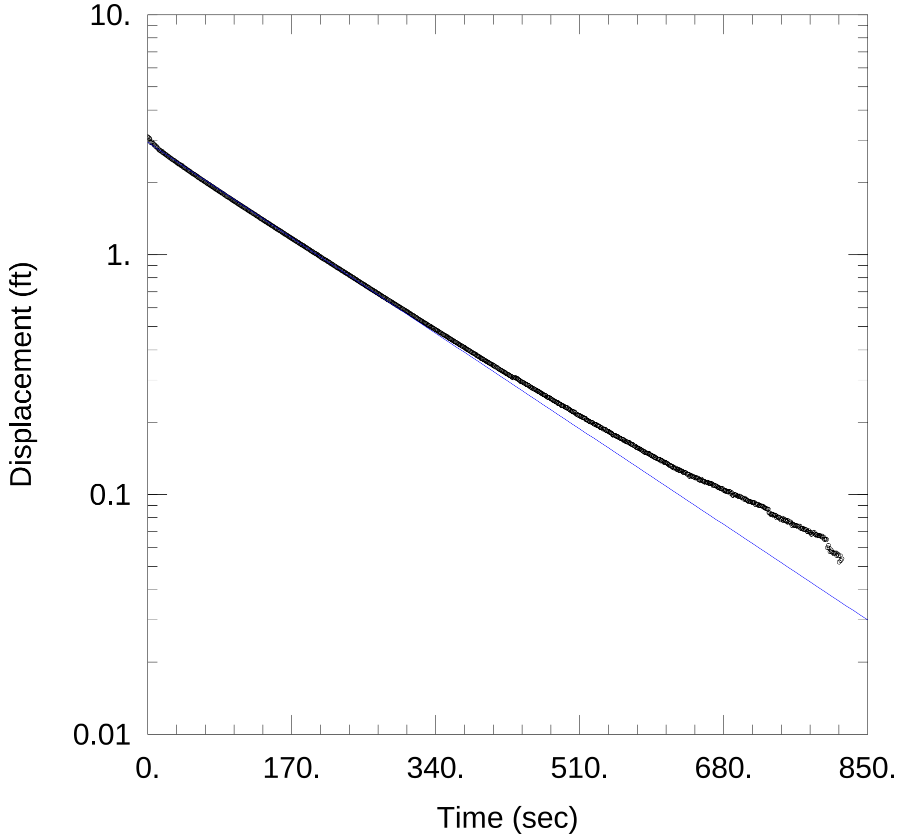
K = 1.163 ft/day
y0 = 2.795 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-08D)

Initial Displacement: 3. ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 21.73 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-08D SLUG OUT 1

Data Set: T:\...\UFIW-08D_slugout_1.aqt
Date: 05/04/17 Time: 10:00:01

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-08D
Test Date: 8/29/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

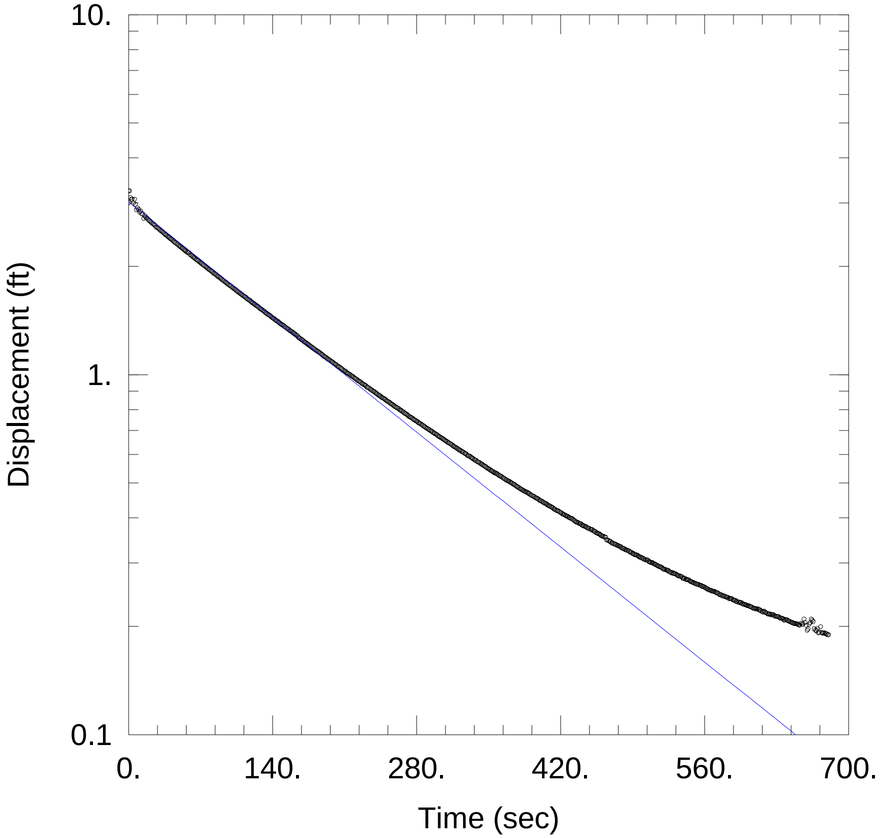
K = 1.222 ft/day
y0 = 2.943 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-08D)

Initial Displacement: 3. ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 21.73 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-08D SLUG OUT 2

Data Set: T:\...\UFIW-08D_slugout_2.aqt
Date: 05/04/17 Time: 10:00:12

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-08D
Test Date: 8/29/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

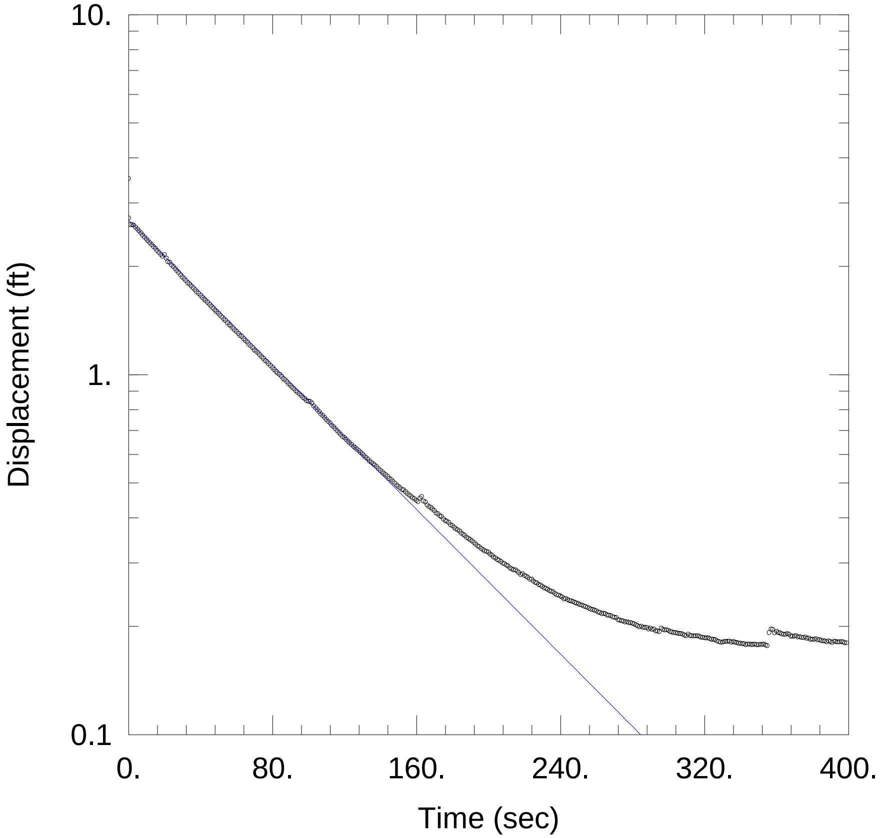
K = 1.19 ft/day
y0 = 3.016 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-08D)

Initial Displacement: 3. ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 21.73 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-08I SLUG IN 1

Data Set: T:\...\UFIW-08I_slugin_1.aqt
Date: 05/04/17 Time: 10:00:19

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-08I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

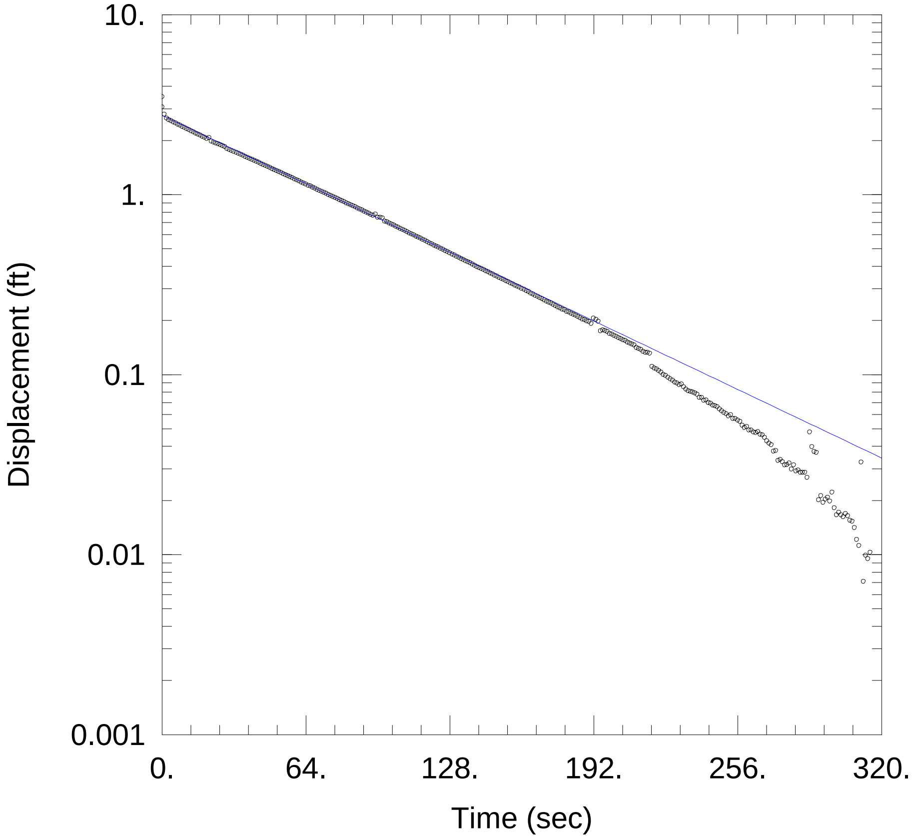
K = 2.337 ft/day
y0 = 2.686 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-08I)

Initial Displacement: 3.5 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.7 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-08I SLUG IN 2

Data Set: T:\...\UFIW-08I_slugin_2.aqt
Date: 05/04/17 Time: 10:00:28

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-08I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

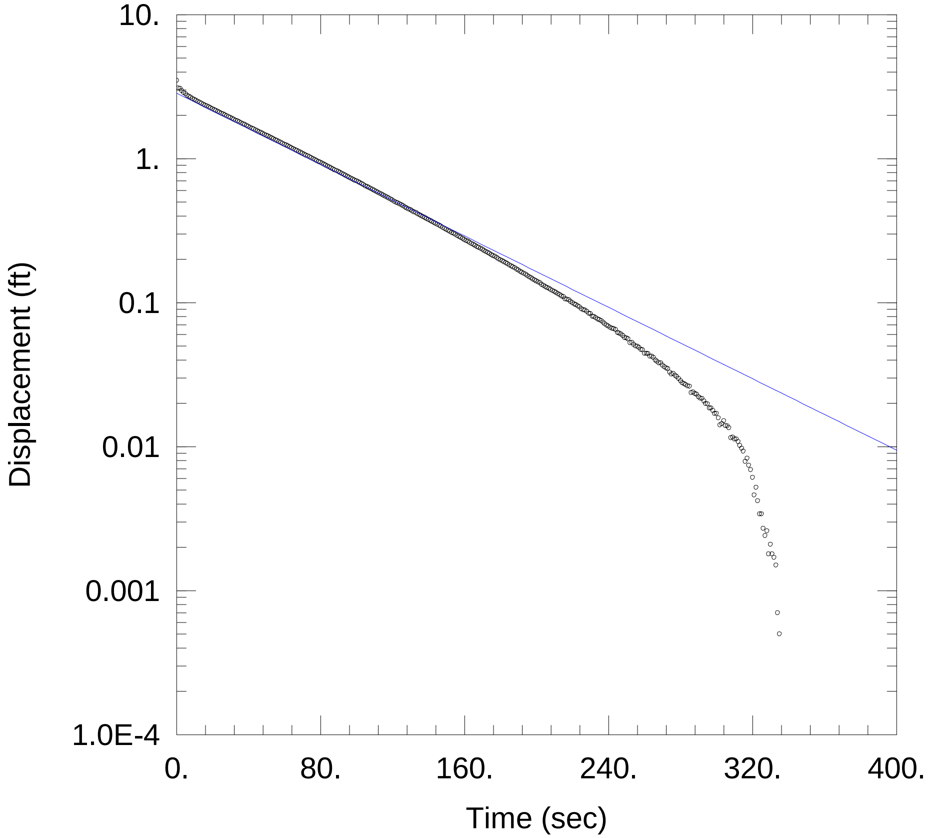
K = 2.765 ft/day
y0 = 2.756 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-08I)

Initial Displacement: 3.5 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.7 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-08I SLUG OUT 1

Data Set: T:\...\UFIW-08I_slugout_1.aqt
Date: 05/04/17 Time: 10:00:38

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-08I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

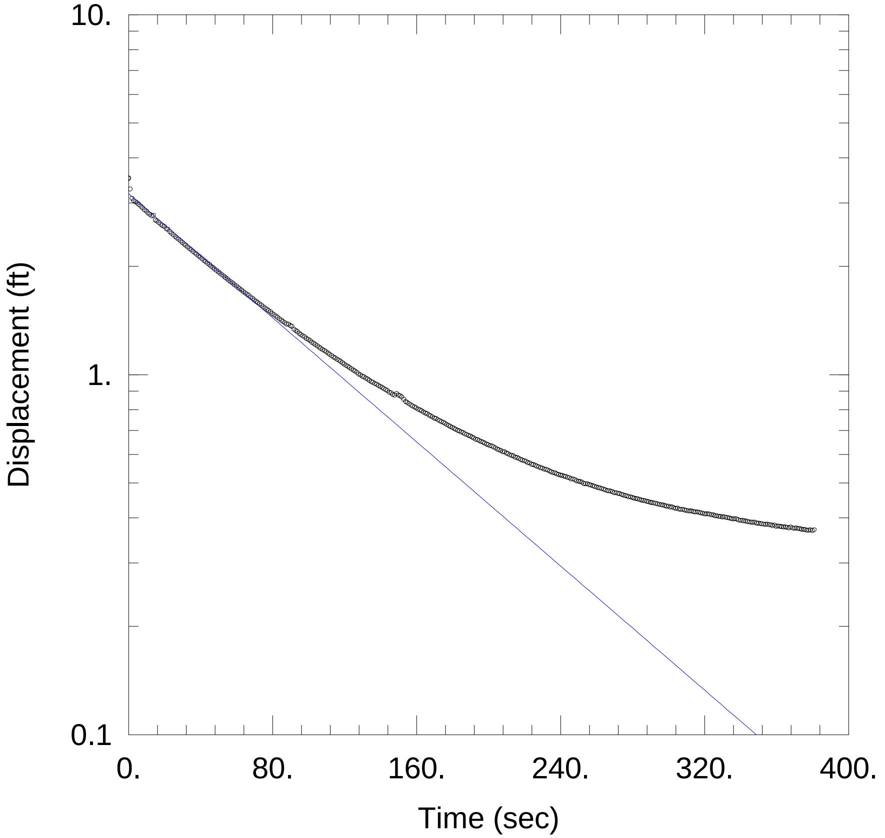
K = 2.883 ft/day
y0 = 2.849 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-08I)

Initial Displacement: 3.5 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.7 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFMW-01D SLUG IN 1

Data Set: T:\...\UFMW-01D_slugin_1.aqt
Date: 05/04/17 Time: 10:00:46

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-01D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

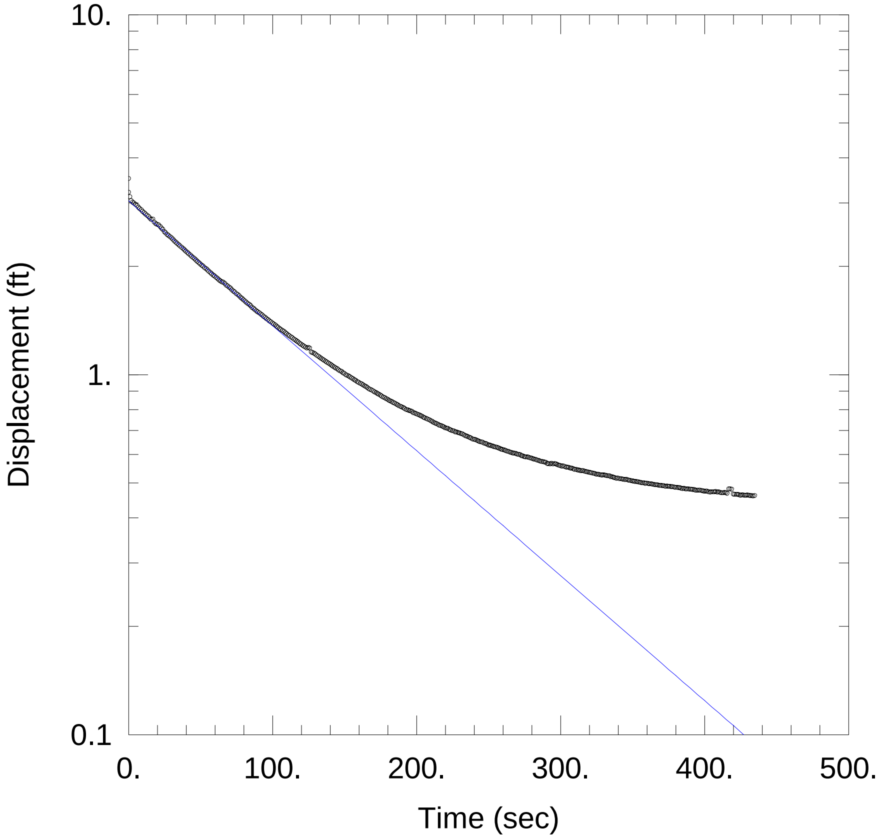
K = 2.028 ft/day
y0 = 3.182 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-01D)

Initial Displacement: 3.5 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20.92 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-01D SLUG IN 2

Data Set: T:\...\UFMW-01D_slugin_2.aqt
Date: 05/04/17 Time: 10:00:55

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-01D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

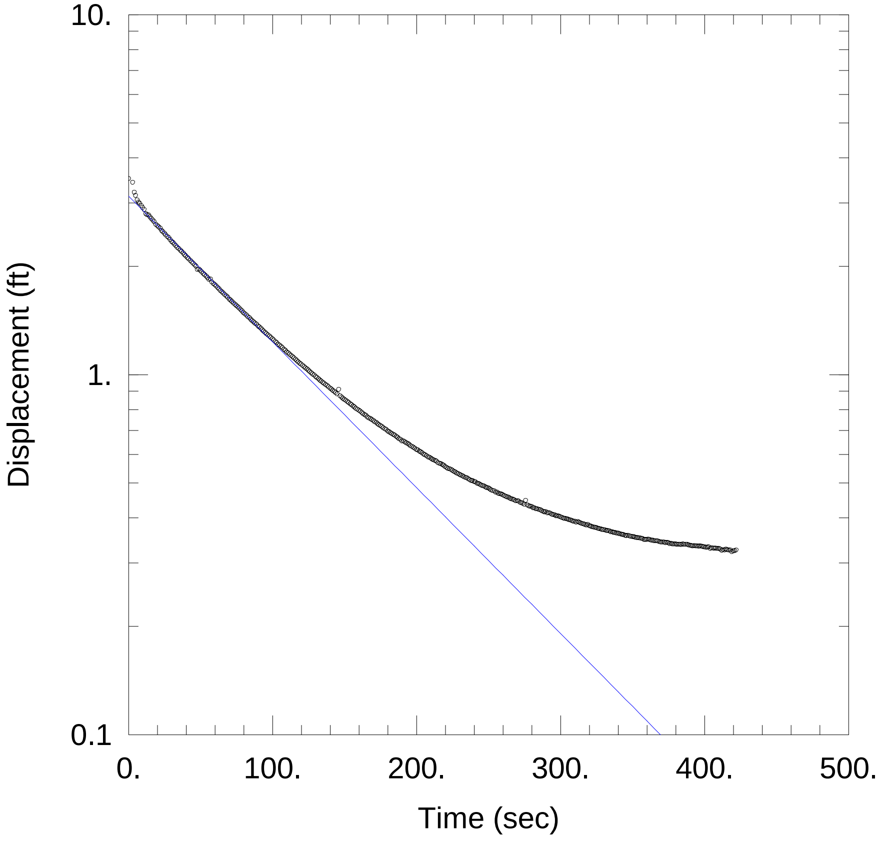
K = 1.634 ft/day
y0 = 3.041 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-01D)

Initial Displacement: 3.5 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20.92 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-01D SLUG OUT 1

Data Set: T:\...\UFMW-01D_slugout_1.aqt
Date: 05/04/17 Time: 10:01:04

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-01D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

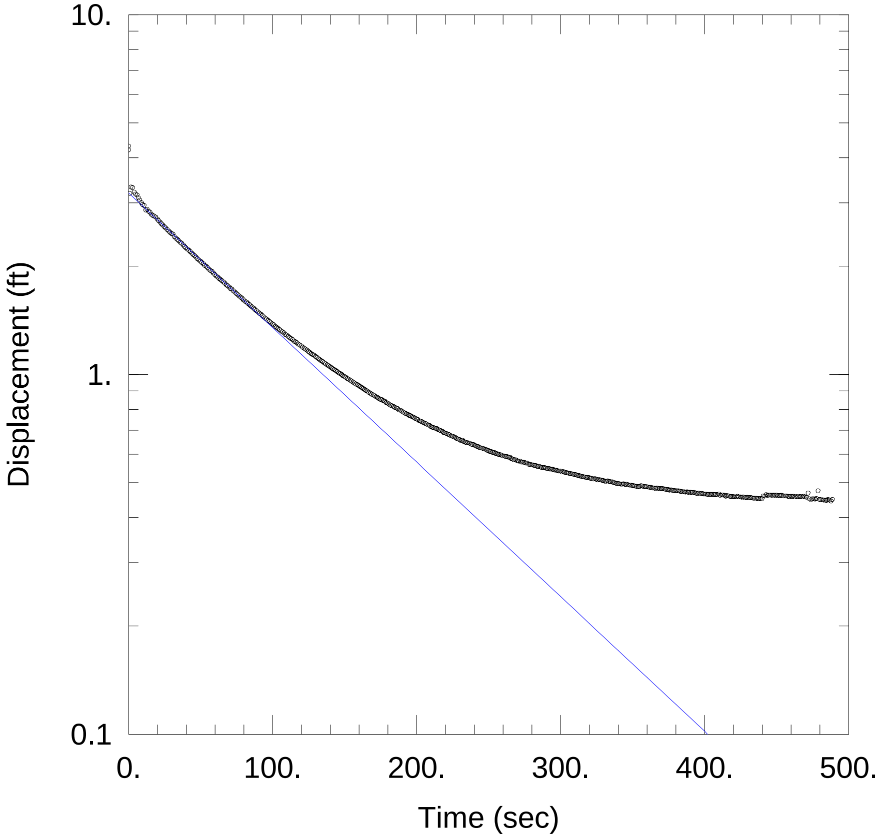
K = 1.906 ft/day
y0 = 3.132 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-01D)

Initial Displacement: 3.5 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20.92 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-01D SLUG OUT 2

Data Set: T:\...\UFMW-01D_slugout_2.aqt
Date: 05/04/17 Time: 10:01:13

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-01D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

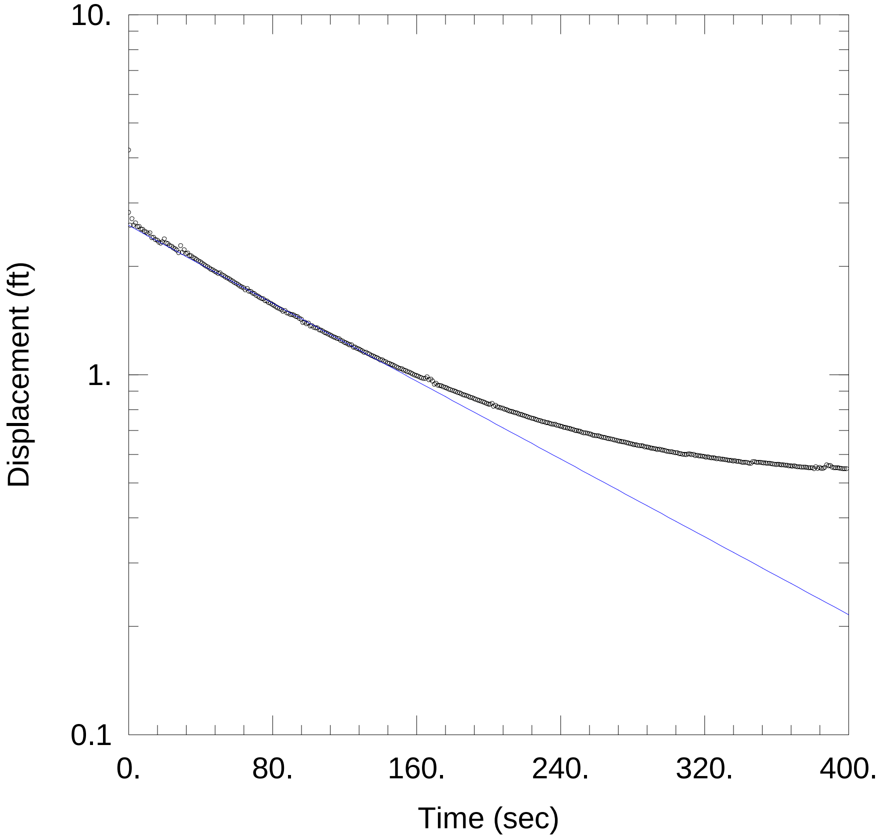
K = 1.761 ft/day
y0 = 3.196 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-01D)

Initial Displacement: 4.2 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20.92 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-01I SLUG IN 1

Data Set: T:\...\UFMW-01I_slugin_1.aqt
Date: 05/04/17 Time: 10:01:21

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-01I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

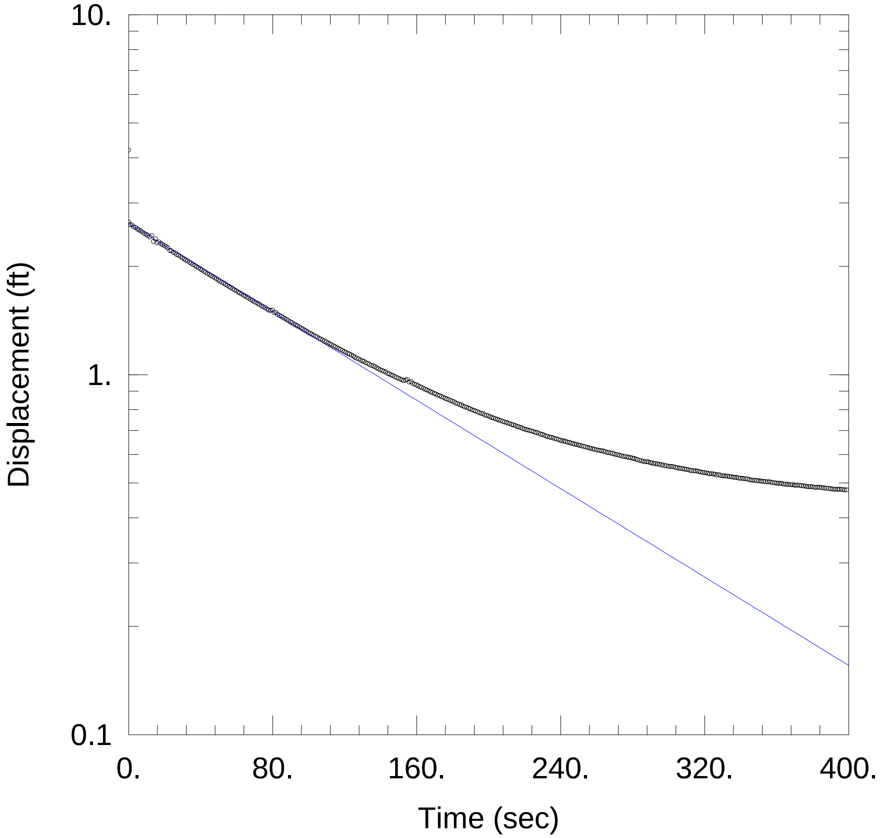
K = 1.126 ft/day
y0 = 2.597 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-01I)

Initial Displacement: 4.2 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.43 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-01I SLUG IN 2

Data Set: T:\...\UFMW-01I_slugin_2.aqt
Date: 05/04/17 Time: 10:01:29

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-01I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

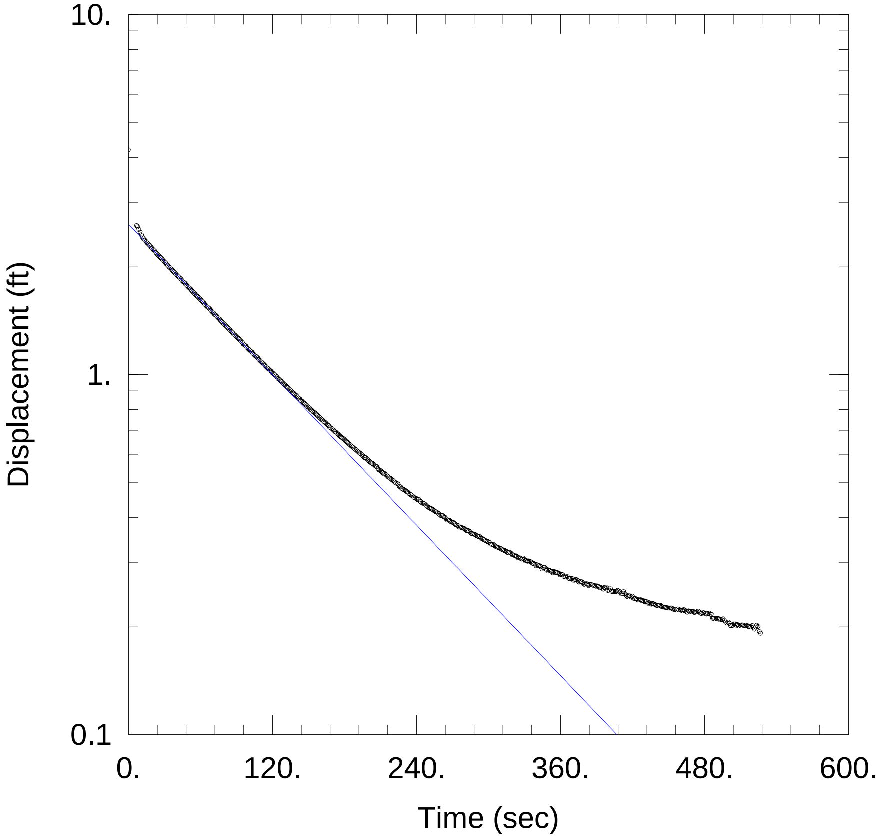
K = 1.278 ft/day
y0 = 2.632 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-01I)

Initial Displacement: 4.2 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.43 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-01I SLUG OUT 1

Data Set: T:\...\UFMW-01I_slugout_1.aqt
Date: 05/04/17 Time: 10:01:38

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-01I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

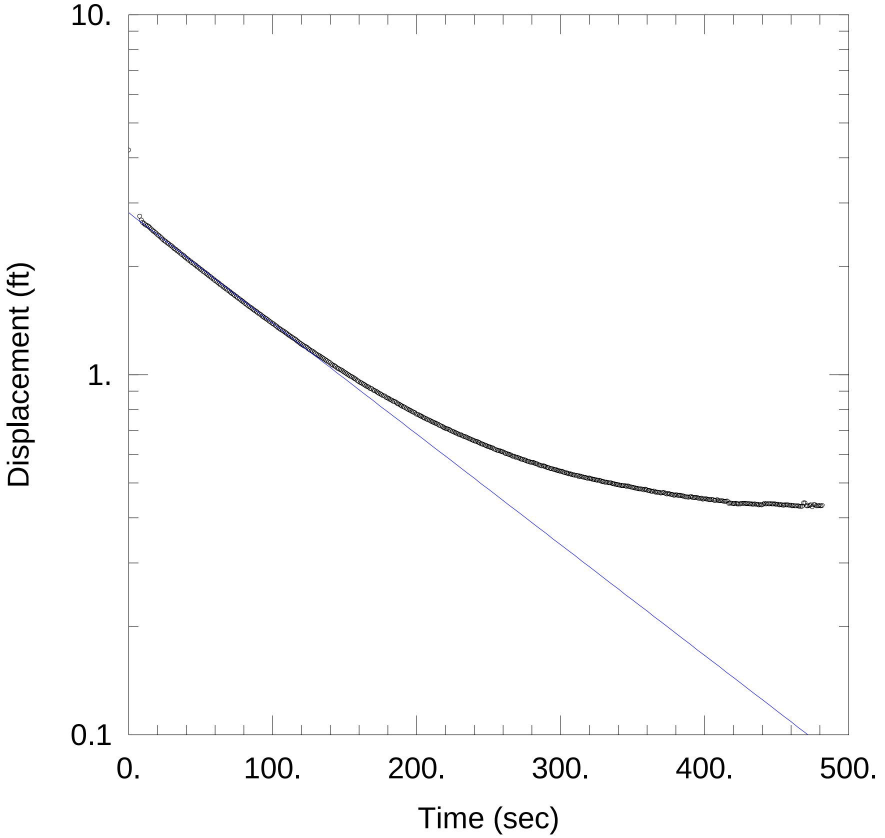
K = 1.451 ft/day
y0 = 2.617 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-01I)

Initial Displacement: 4.2 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.43 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-01I SLUG OUT 2

Data Set: T:\...\UFMW-01I_slugout_2.aqt
Date: 05/04/17 Time: 10:01:46

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-01I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

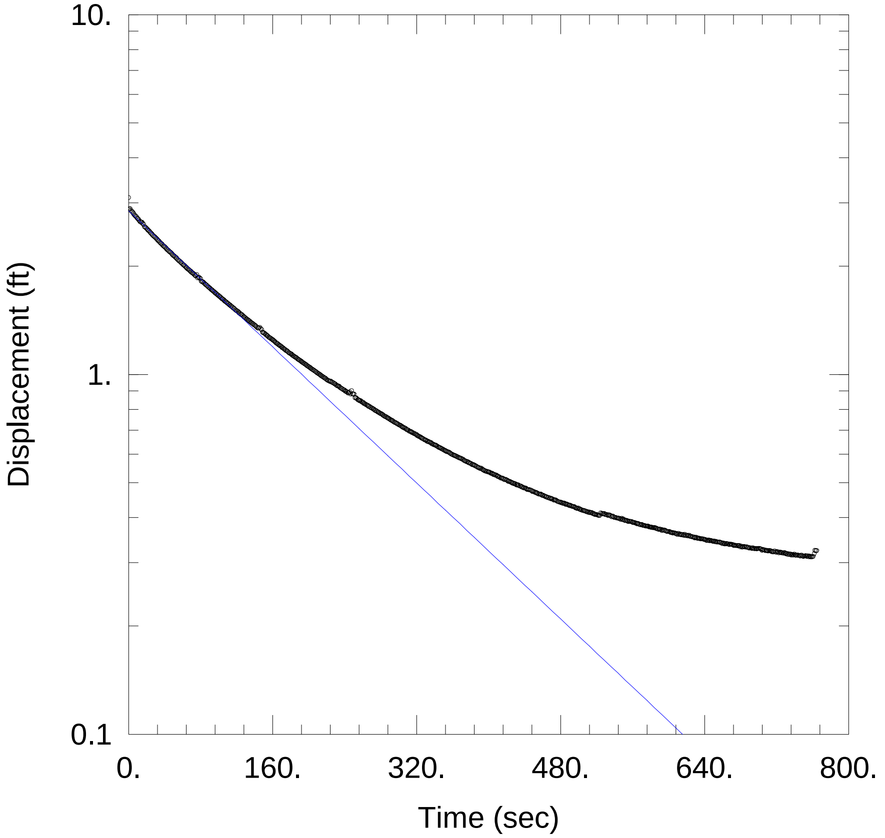
K = 1.28 ft/day
y0 = 2.819 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-01I)

Initial Displacement: 4.2 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.43 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-02D SLUG IN 1

Data Set: T:\...\UFMW-02D_slugin_1.aqt
Date: 05/04/17 Time: 10:01:54

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-02D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

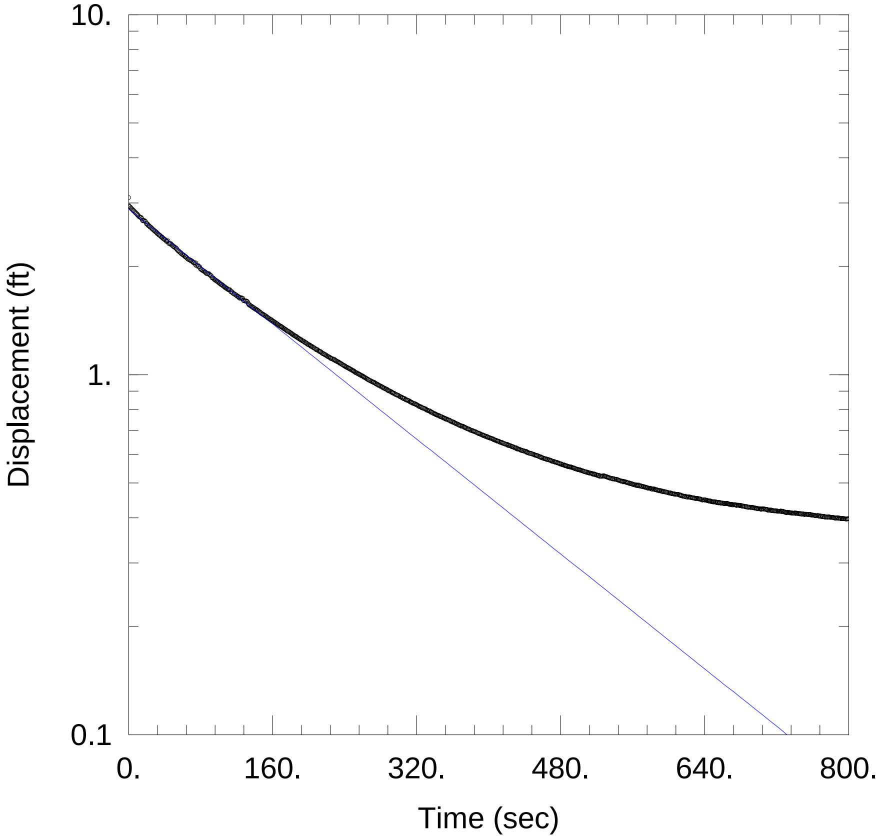
K = 1.112 ft/day
y0 = 2.849 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-02D)

Initial Displacement: 3.1 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20.98 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-02D SLUG IN 2

Data Set: T:\...\UFMW-02D_slugin_2.aqt
Date: 05/04/17 Time: 10:02:03

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-02D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.9389 ft/day
y0 = 2.881 ft

AQUIFER DATA

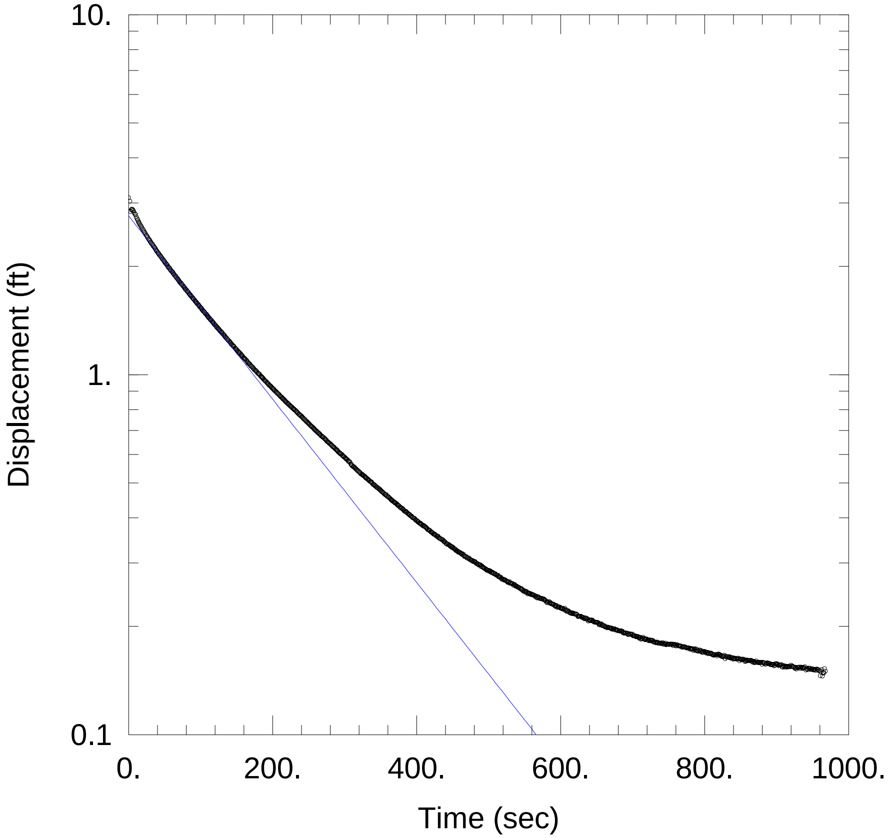
Saturated Thickness: 6. ft

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-02D)

Initial Displacement: 3.1 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft

Static Water Column Height: 20.98 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-02D SLUG OUT 1

Data Set: T:\...\UFMW-02D_slugout_1.aqt
Date: 05/04/17 Time: 10:02:10

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-02D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

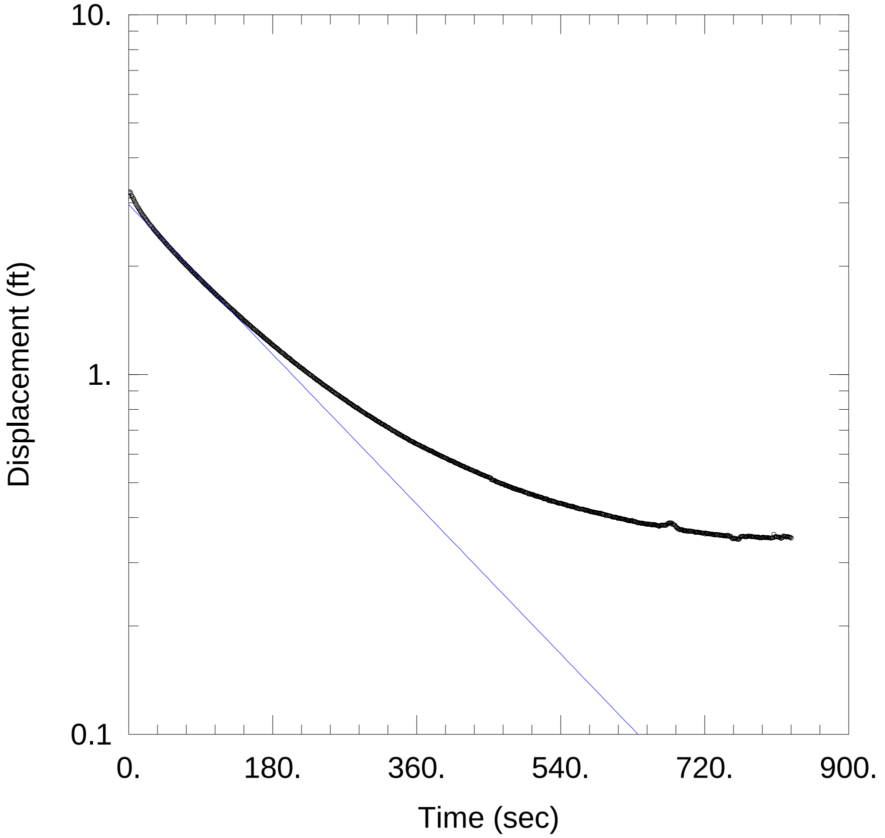
K = 1.198 ft/day
y0 = 2.762 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-02D)

Initial Displacement: 3.1 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20.98 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-02D SLUG OUT 2

Data Set: T:\...\UFMW-02D_slugout_2.aqt
Date: 05/04/17 Time: 10:02:18

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-02D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

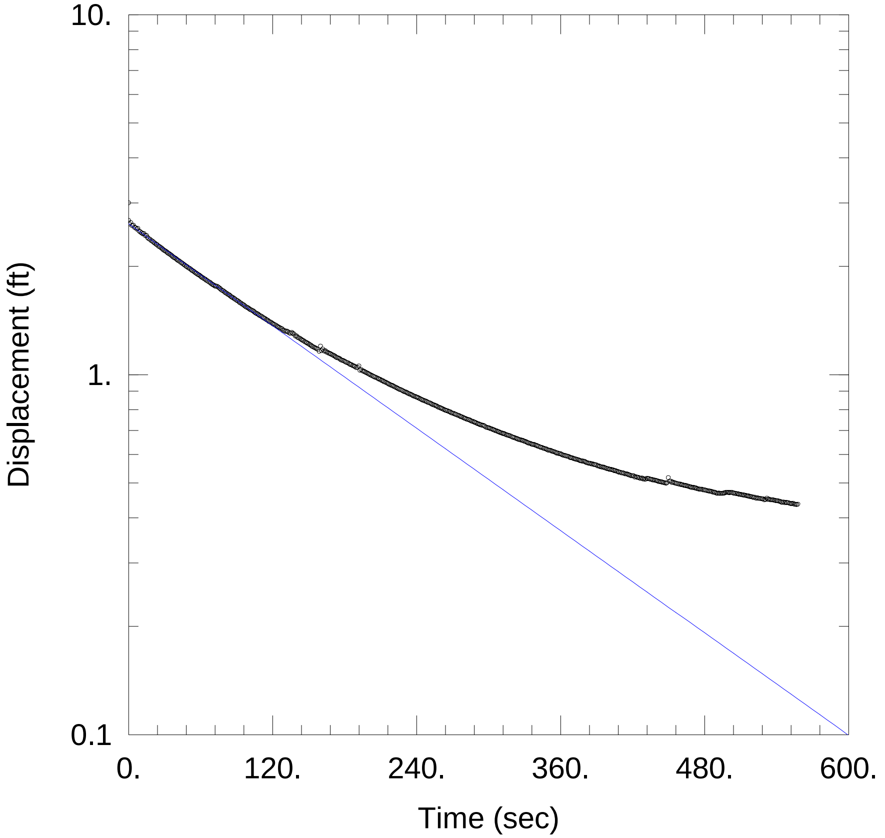
K = 1.089 ft/day
y0 = 2.966 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-02D)

Initial Displacement: 3.2 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20.98 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-02I SLUG IN 1

Data Set: T:\...\UFMW-02I_slugin_1.aqt
Date: 05/04/17 Time: 10:02:33

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-02I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

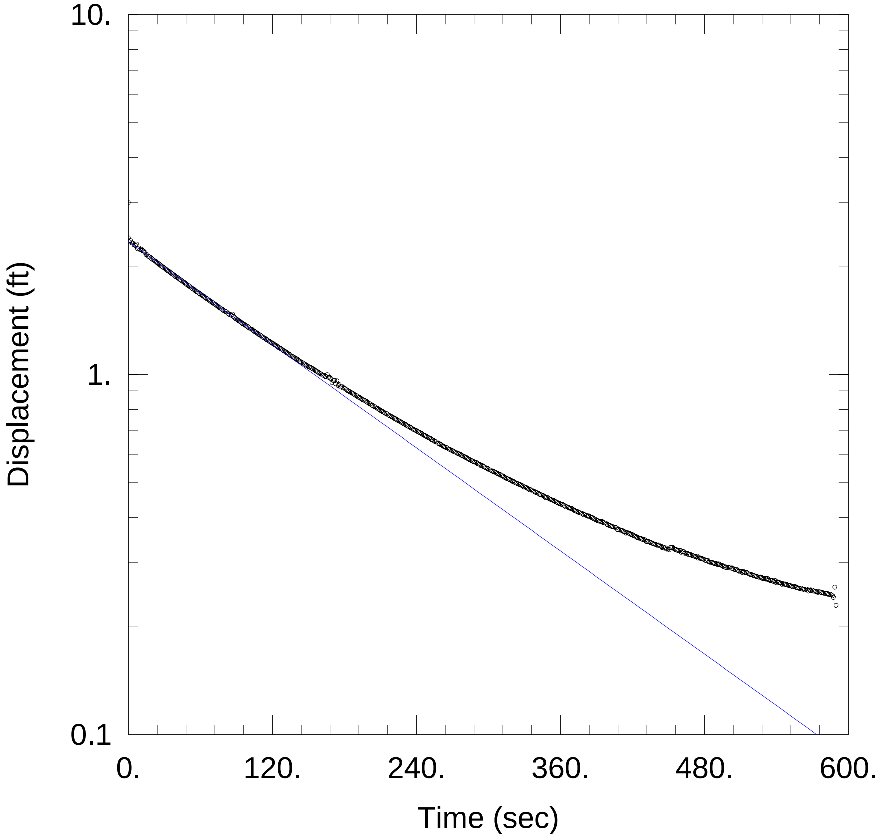
K = 0.986 ft/day
y0 = 2.626 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-02I)

Initial Displacement: 3. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.24 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-02I SLUG IN 2

Data Set: T:\...\UFMW-02I_slugin_2.aqt
Date: 05/04/17 Time: 10:02:42

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-02I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

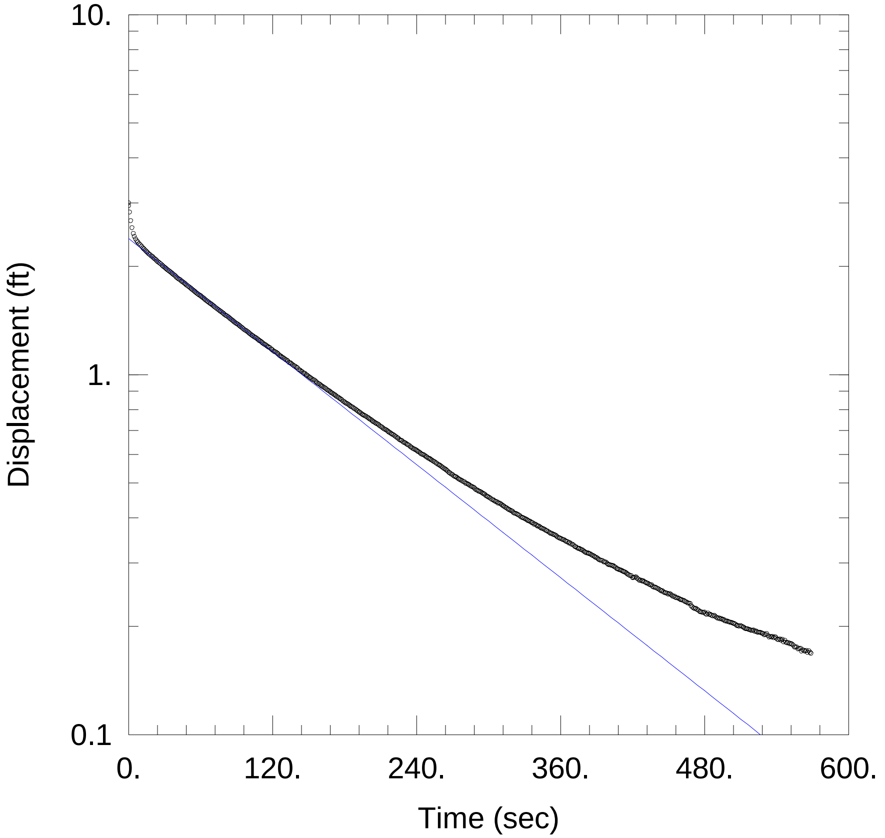
K = 0.994 ft/day
y0 = 2.34 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-02I)

Initial Displacement: 3. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.24 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-02I SLUG OUT 1

Data Set: T:\...\UFMW-02I_slugout_1.aqt
Date: 05/04/17 Time: 10:02:50

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-02I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

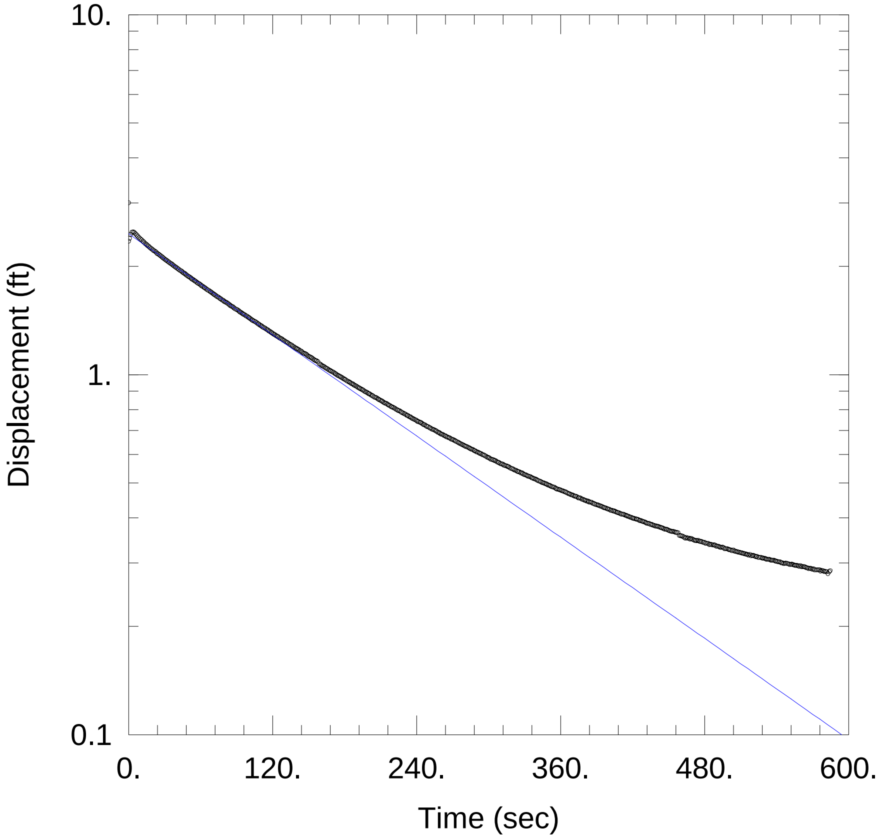
K = 1.09 ft/day
y0 = 2.389 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-02I)

Initial Displacement: 3. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.24 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-02I SLUG OUT 2

Data Set: T:\...\UFMW-02I_slugout_2.aqt
Date: 05/04/17 Time: 10:02:58

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-02I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

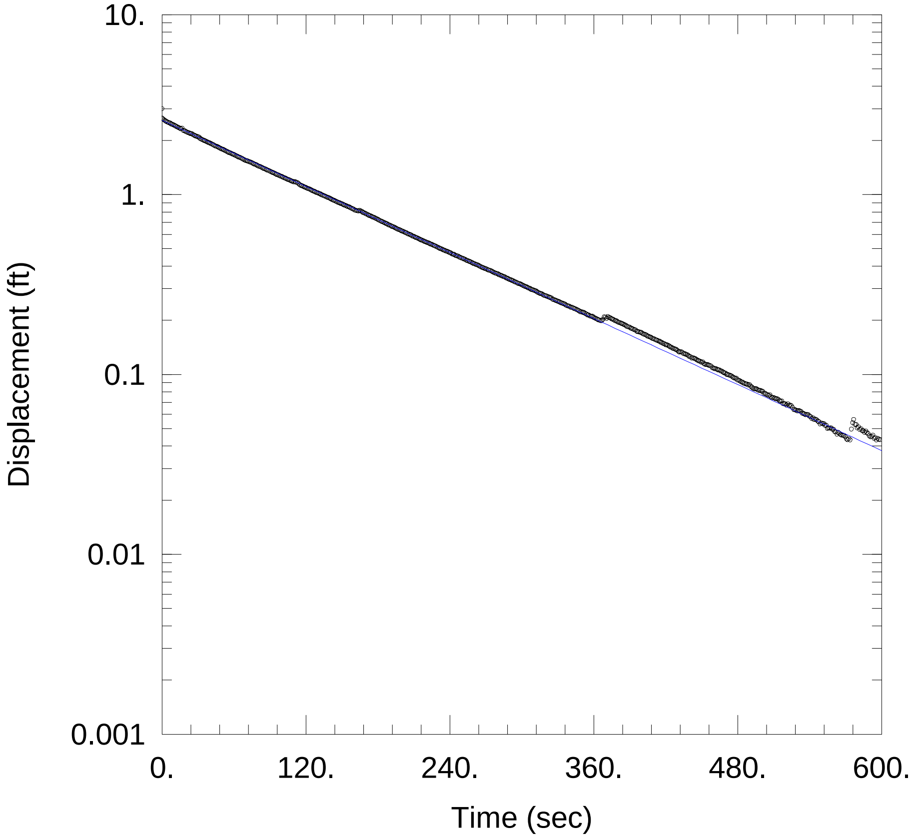
K = 0.975 ft/day
y0 = 2.464 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-02I)

Initial Displacement: 3. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.24 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-03D SLUG IN 1

Data Set: T:\...\UFMW-03D_slugin_1.aqt
Date: 05/04/17 Time: 10:03:06

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-03D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

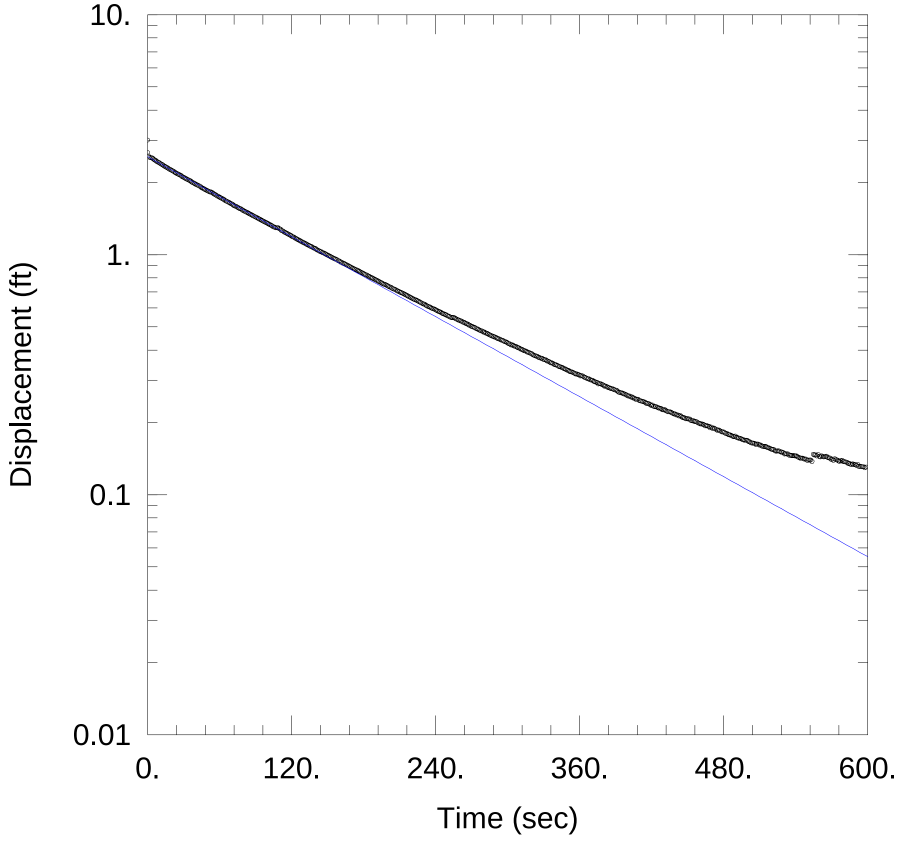
K = 1.482 ft/day
y0 = 2.584 ft

AQUIFER DATA

Saturated Thickness: 5.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-03D)

Initial Displacement: 3. ft
Total Well Penetration Depth: 24. ft
Casing Radius: 0.083 ft
Static Water Column Height: 23.04 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-03D SLUG IN 2

Data Set: T:\...\UFMW-03D_slugin_2.aqt
Date: 05/04/17 Time: 10:03:15

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-03D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

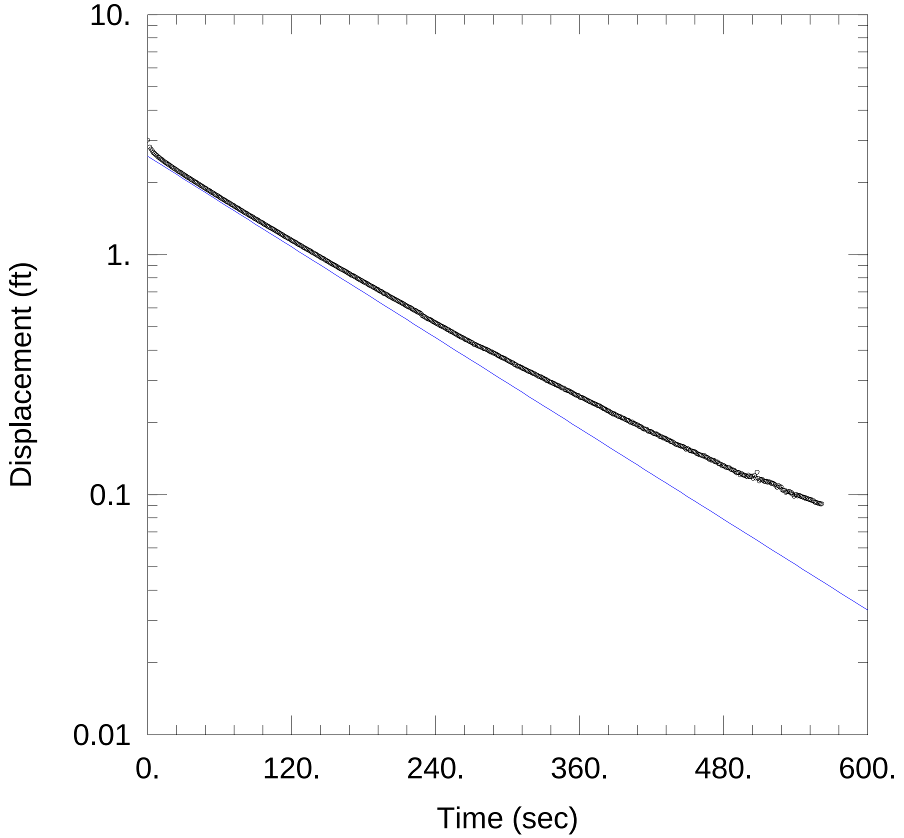
K = 1.346 ft/day
y0 = 2.561 ft

AQUIFER DATA

Saturated Thickness: 5.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-03D)

Initial Displacement: 3. ft
Total Well Penetration Depth: 24. ft
Casing Radius: 0.083 ft
Static Water Column Height: 23.04 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-03D SLUG OUT 1

Data Set: T:\...\UFMW-03D_slugout_1.aqt
Date: 05/04/17 Time: 10:03:23

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-03D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

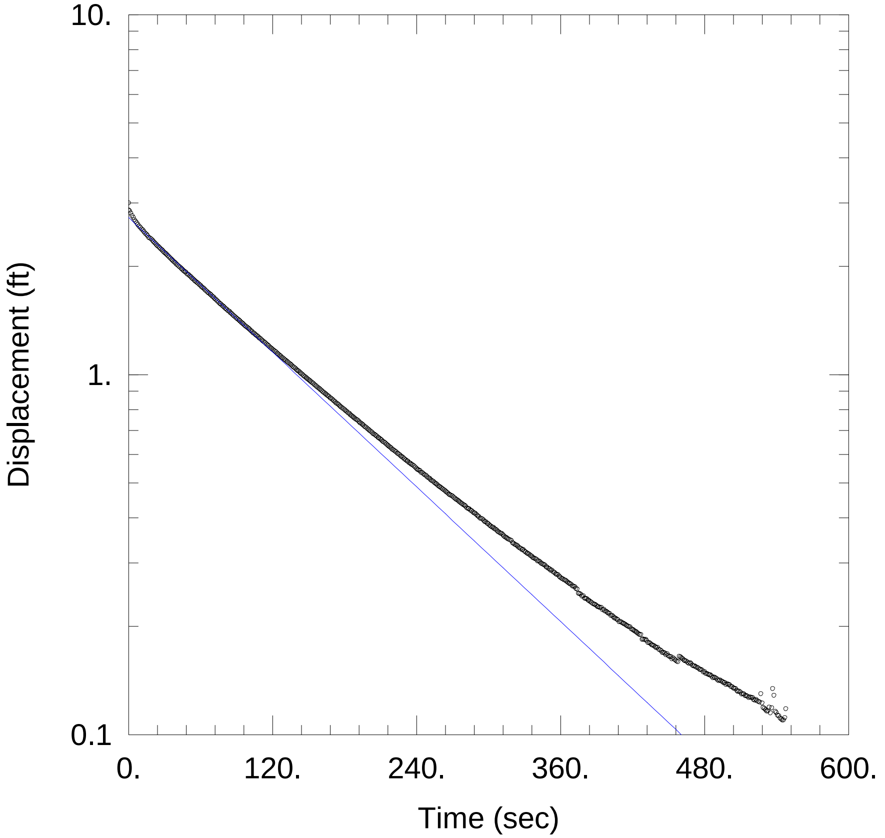
K = 1.527 ft/day
y0 = 2.572 ft

AQUIFER DATA

Saturated Thickness: 5.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-03D)

Initial Displacement: 3. ft
Total Well Penetration Depth: 24. ft
Casing Radius: 0.083 ft
Static Water Column Height: 23.04 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-03D SLUG OUT 2

Data Set: T:\...\UFMW-03D_slugout_2.aqt
Date: 05/04/17 Time: 10:04:51

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-03D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 1.51 ft/day
y0 = 2.732 ft

AQUIFER DATA

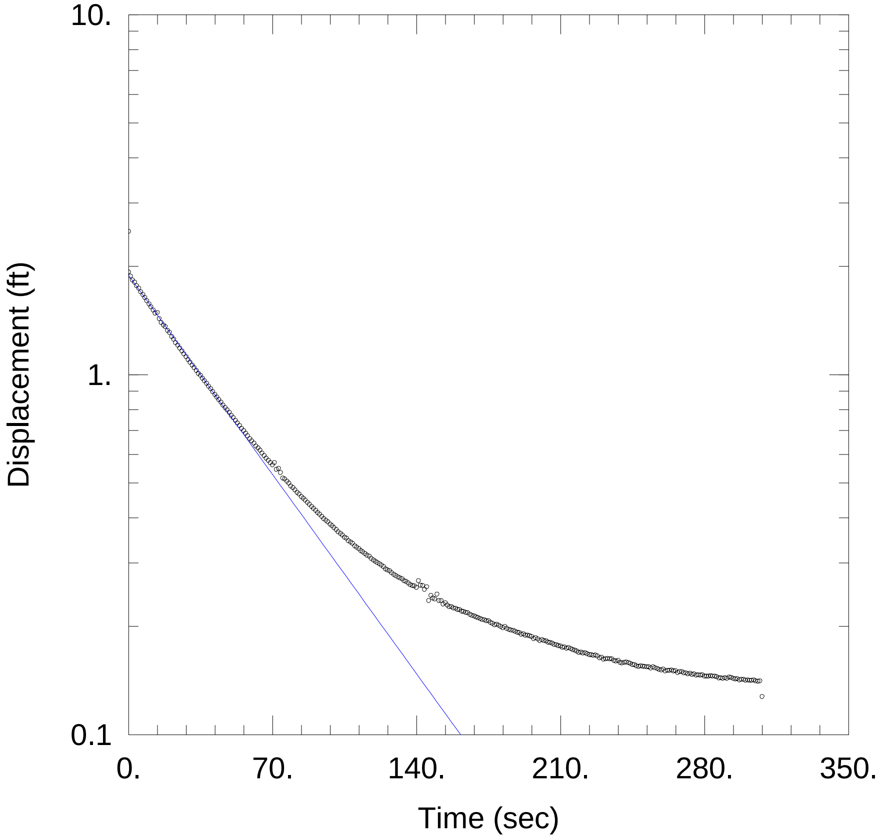
Saturated Thickness: 5.5 ft

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-03D)

Initial Displacement: 3. ft
Total Well Penetration Depth: 24. ft
Casing Radius: 0.083 ft

Static Water Column Height: 23.04 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-03I SLUG IN 1

Data Set: T:\...\UFMW-03I_slugin_1.aqt
Date: 05/04/17 Time: 10:04:59

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-03I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

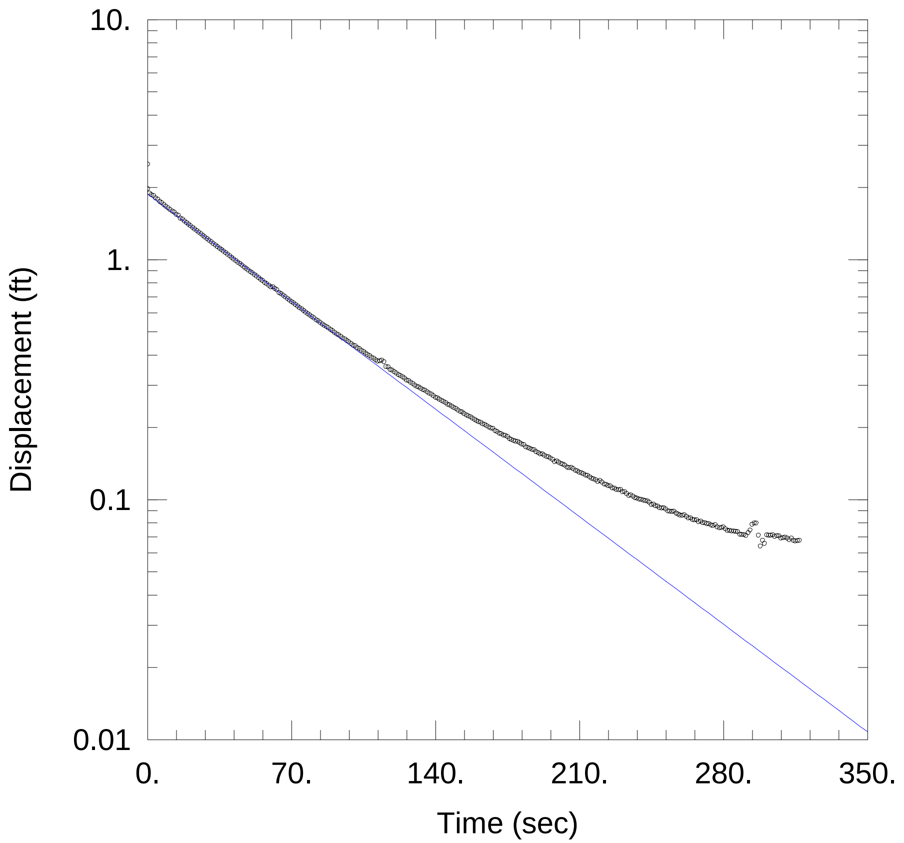
K = 1.841 ft/day
y0 = 1.888 ft

AQUIFER DATA

Saturated Thickness: 10.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-03I)

Initial Displacement: 2.5 ft
Total Well Penetration Depth: 14. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.22 ft
Screen Length: 10. ft
Well Radius: 0.5 ft



UFMW-03I SLUG IN 2

Data Set: T:\...\UFMW-03I_slugin_2.aqt
Date: 05/04/17 Time: 10:05:07

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-03I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

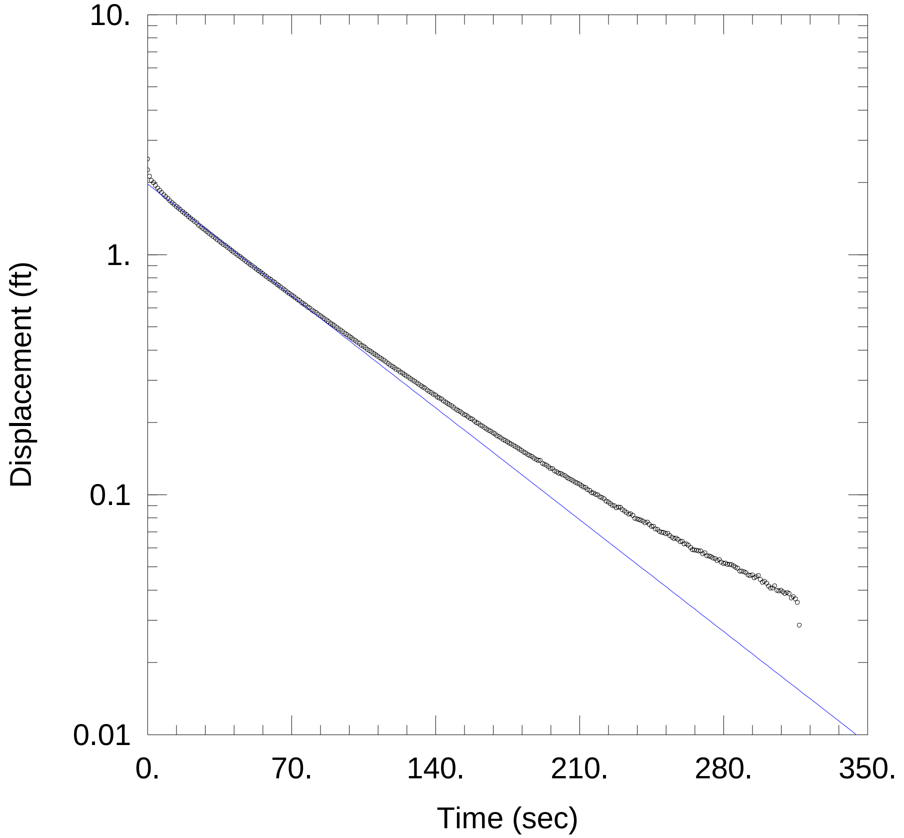
K = 1.491 ft/day
y0 = 1.878 ft

AQUIFER DATA

Saturated Thickness: 10.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-03I)

Initial Displacement: 2.5 ft
Total Well Penetration Depth: 14. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.22 ft
Screen Length: 10. ft
Well Radius: 0.5 ft



UFMW-03I SLUG OUT 1

Data Set: T:\...\UFMW-03I_slugout_1.aqt
Date: 05/04/17 Time: 10:05:14

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-03I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

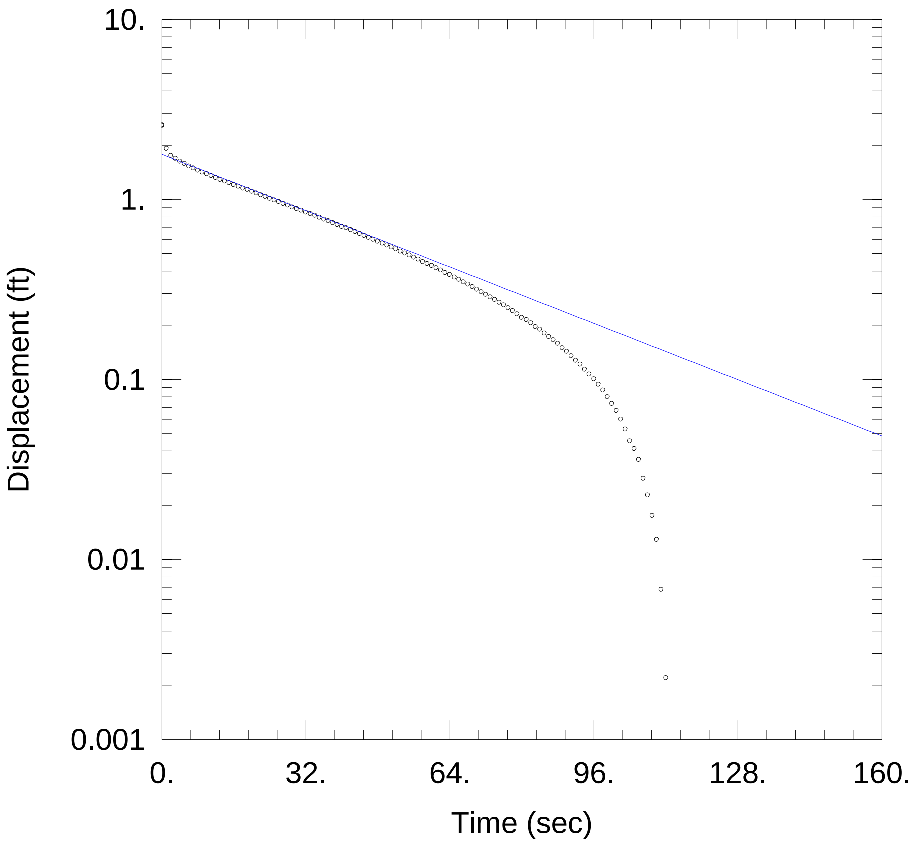
K = 1.55 ft/day
y0 = 1.968 ft

AQUIFER DATA

Saturated Thickness: 10.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-03I)

Initial Displacement: 2.5 ft
Total Well Penetration Depth: 14. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.22 ft
Screen Length: 10. ft
Well Radius: 0.5 ft



UFMW-03I SLUG OUT 2

Data Set: T:\...\UFMW-03I_slugout_2.aqt
Date: 05/04/17 Time: 10:05:22

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-03I
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

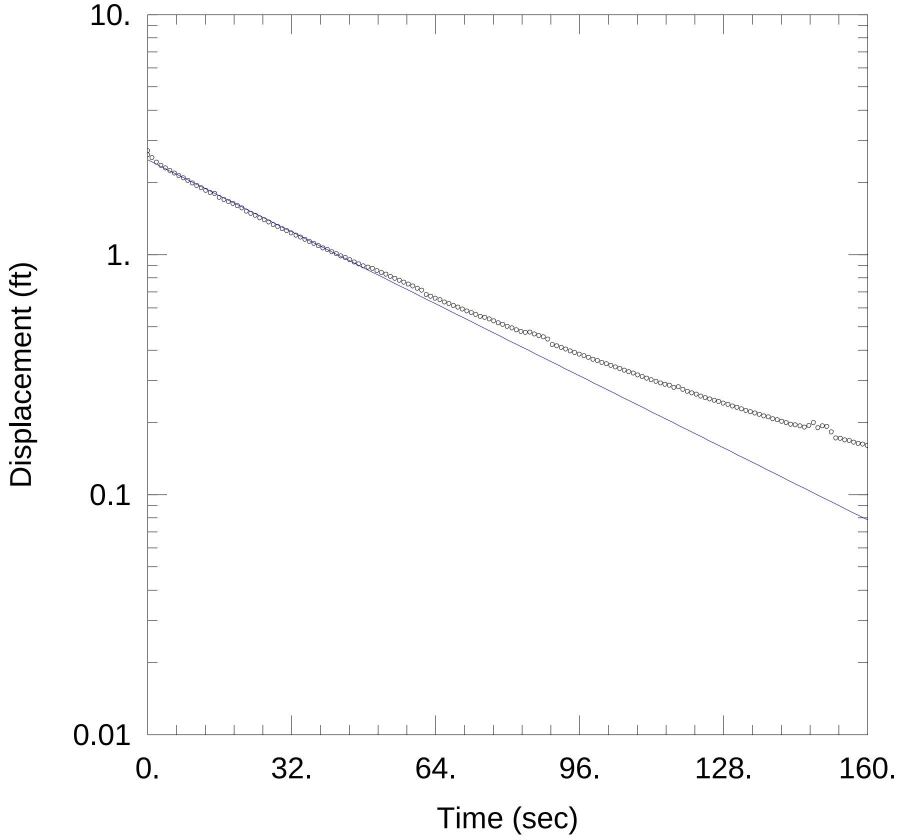
K = 2.275 ft/day
y0 = 1.778 ft

AQUIFER DATA

Saturated Thickness: 10.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-03I)

Initial Displacement: 2.6 ft
Total Well Penetration Depth: 14. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.22 ft
Screen Length: 10. ft
Well Radius: 0.5 ft



UFMW-04D SLUG IN 1

Data Set: T:\...\UFMW-04D_slugin_1.aqt
Date: 05/04/17 Time: 10:05:30

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-04D
Test Date: 8/17/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

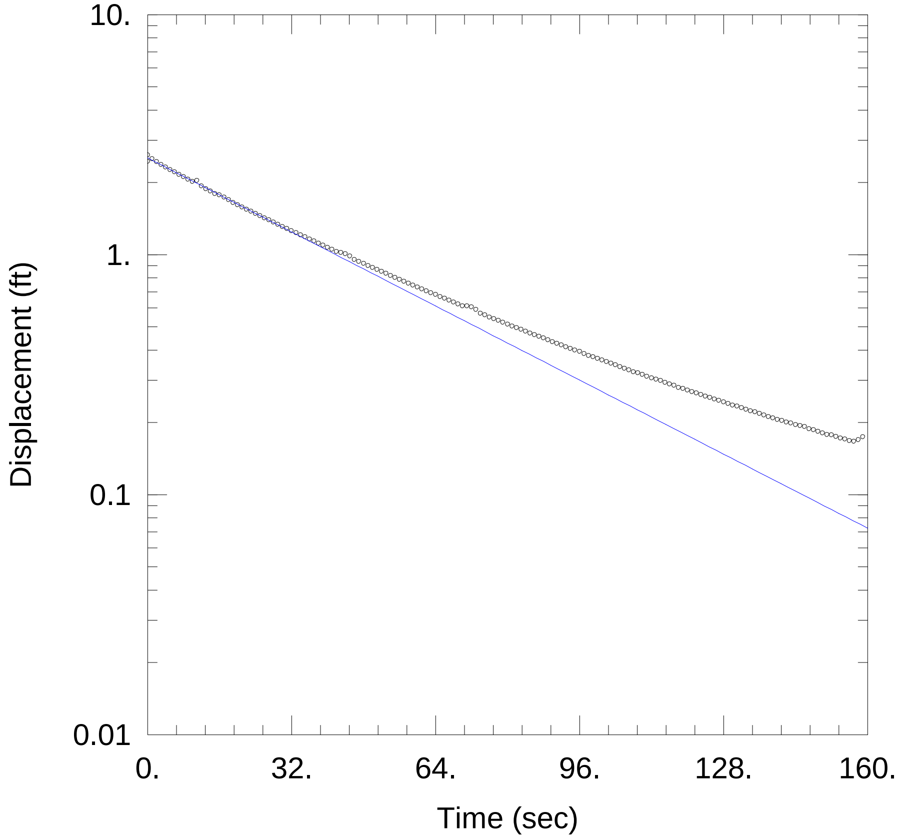
K = 4.414 ft/day
y0 = 2.484 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-04D)

Initial Displacement: 2.6 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 21.8 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-04D SLUG IN 2

Data Set: T:\...\UFMW-04D_slugin_2.aqt
Date: 05/04/17 Time: 10:05:55

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-04D
Test Date: 8/17/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

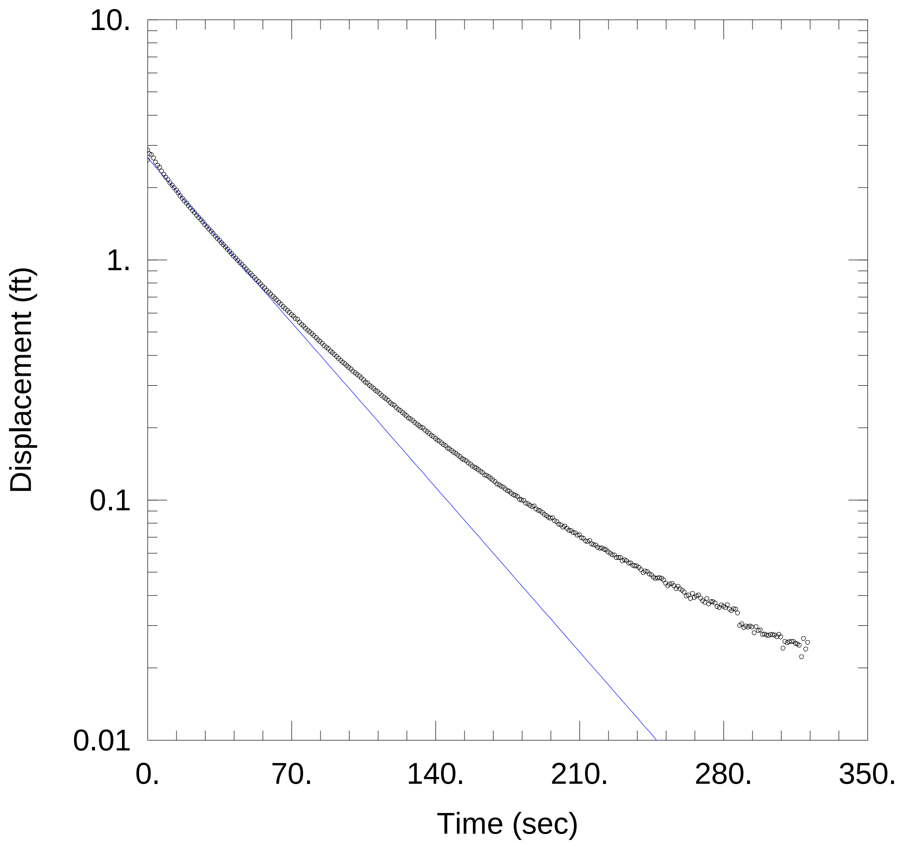
K = 4.537 ft/day
y0 = 2.529 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-04D)

Initial Displacement: 2.6 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 21.8 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-04D SLUG OUT 1

Data Set: T:\...\UFMW-04D_slugout_1.aqt
Date: 05/04/17 Time: 10:06:02

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-04D
Test Date: 8/17/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

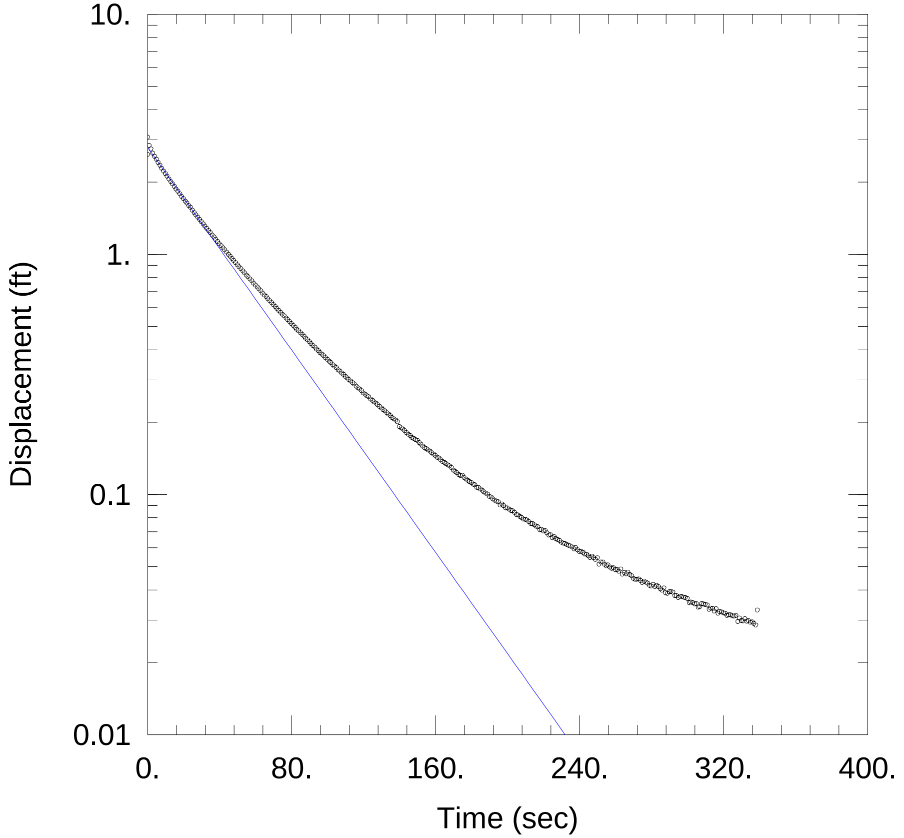
K = 4.612 ft/day
y0 = 2.658 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-04D)

Initial Displacement: 2.6 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 21.8 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-04D SLUG OUT 2

Data Set: T:\...\UFMW-04D_slugout_2.aqt
Date: 05/04/17 Time: 10:06:11

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-04D
Test Date: 8/16/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

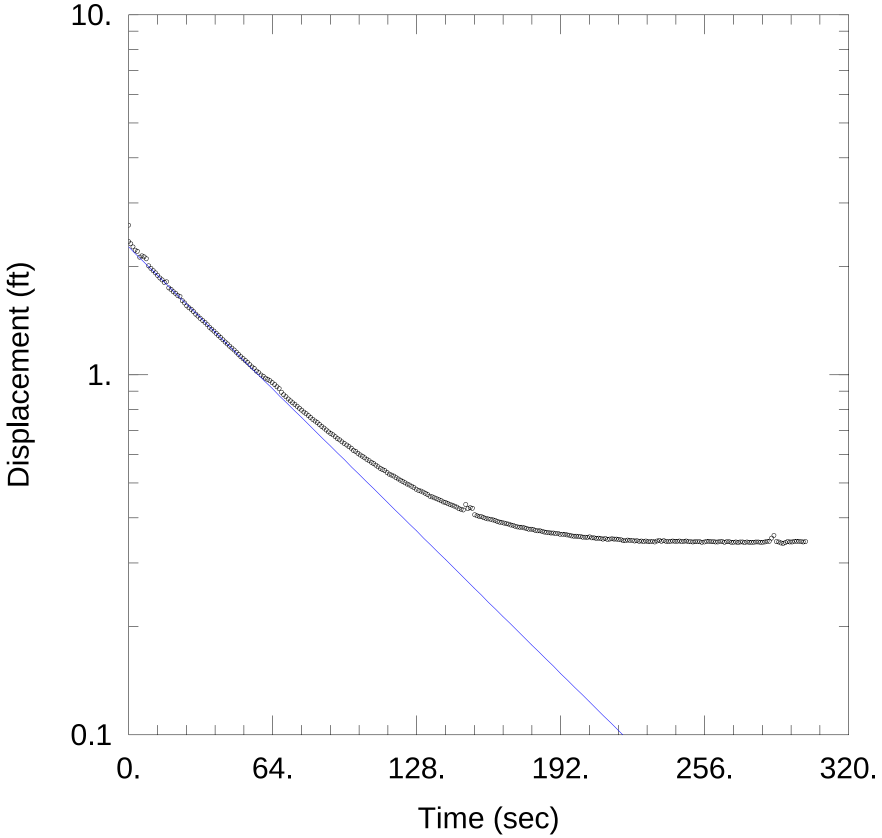
K = 4.962 ft/day
y0 = 2.786 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-04D)

Initial Displacement: 2.6 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 21.8 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-04I SLUG IN 1

Data Set: T:\...\UFMW-04I_slugin_1.aqt
Date: 05/04/17 Time: 10:06:18

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-04I
Test Date: 8/17/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

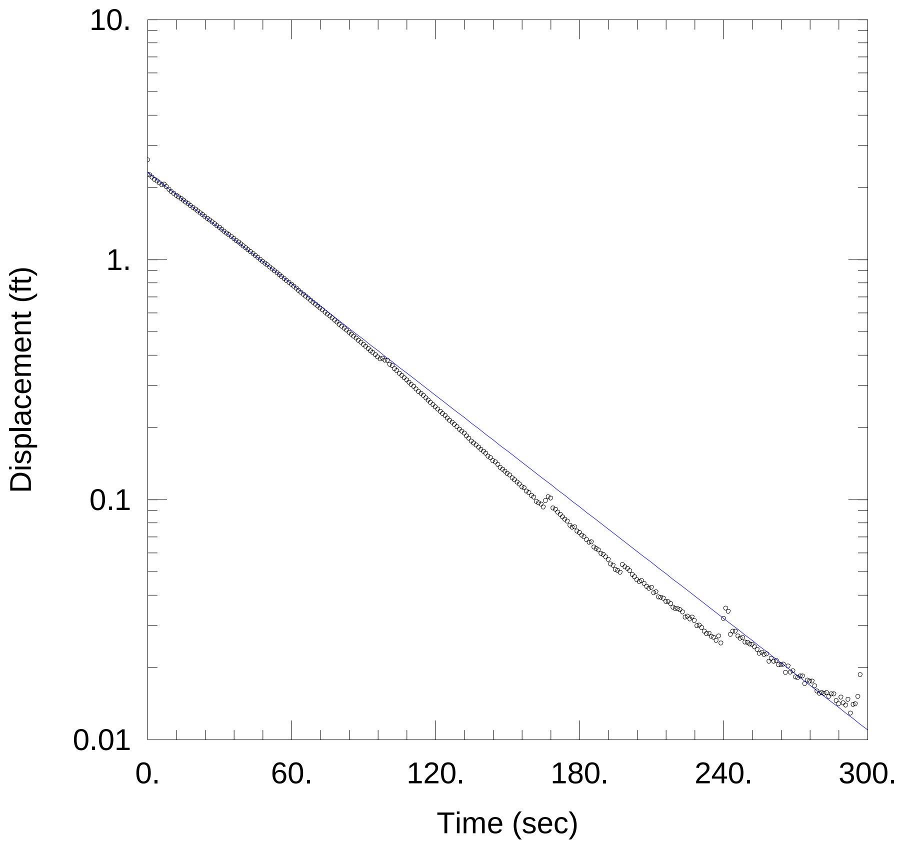
K = 2.568 ft/day
y0 = 2.264 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-04D)

Initial Displacement: 2.6 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.8 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-04I SLUG IN 2

Data Set: T:\...\UFMW-04I_slugin_2.aqt
Date: 05/04/17 Time: 10:06:26

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-04I
Test Date: 8/17/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

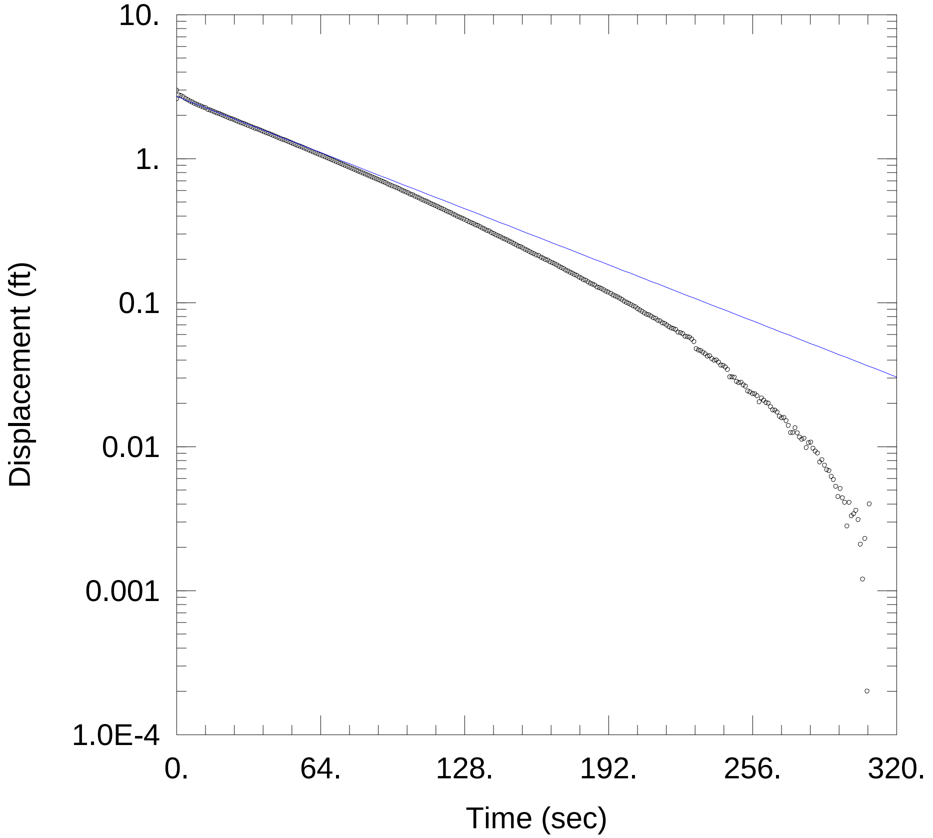
K = 3.224 ft/day
y0 = 2.31 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-04I)

Initial Displacement: 2.6 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.8 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-04I SLUG OUT 1

Data Set: T:\...\UFMW-04I_slugout_1.aqt
Date: 05/04/17 Time: 10:06:34

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-04I
Test Date: 8/17/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

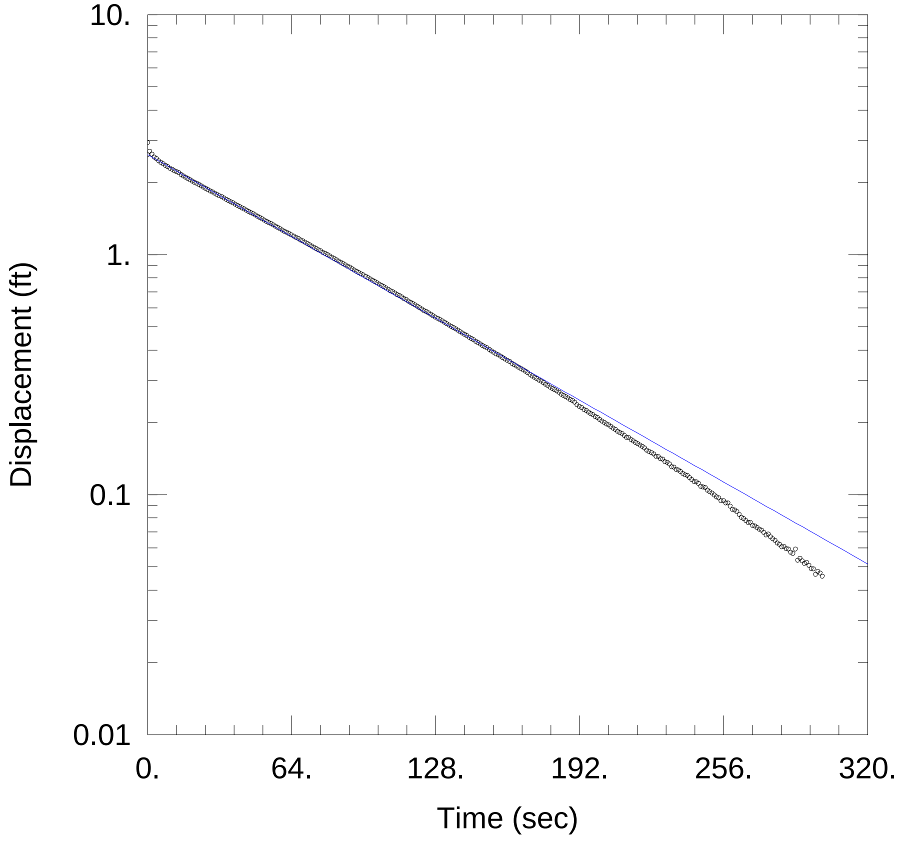
K = 2.535 ft/day
y0 = 2.705 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-04I)

Initial Displacement: 2.6 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.8 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-04I SLUG OUT 2

Data Set: T:\...\UFMW-04I_slugout_2.aqt
Date: 05/04/17 Time: 10:06:41

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-04I
Test Date: 8/17/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

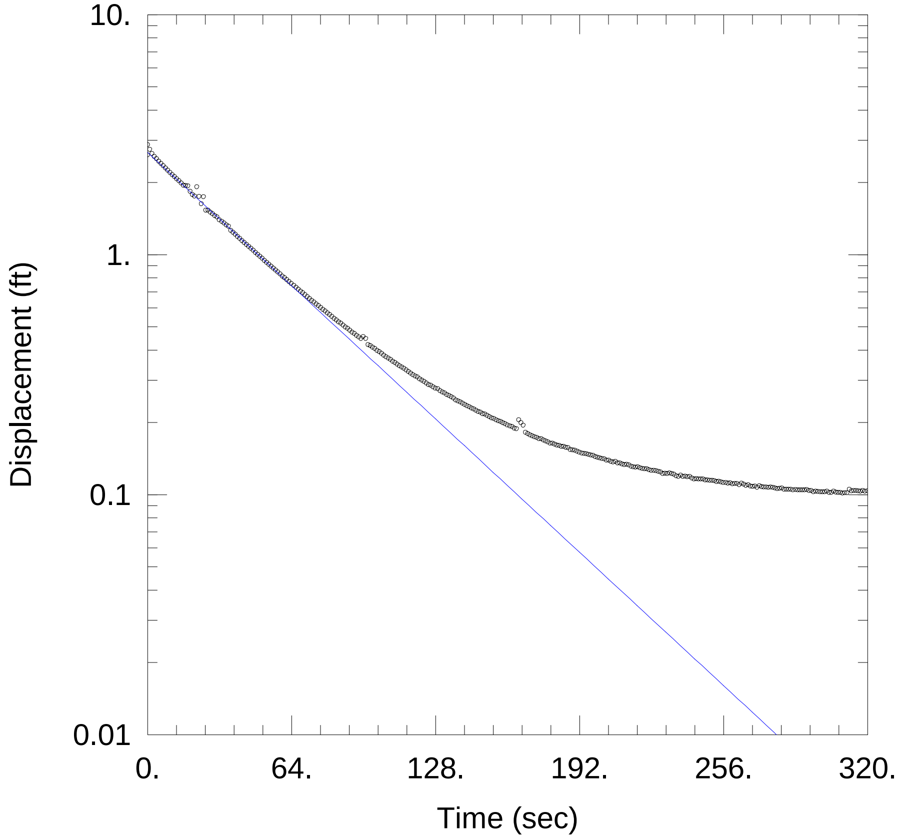
K = 2.218 ft/day
y0 = 2.611 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-04I)

Initial Displacement: 2.6 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.8 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-05D SLUG IN 1

Data Set: T:\...\UFMW-05D_slugin_1.aqt
Date: 05/04/17 Time: 10:06:49

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-05D
Test Date: 8/18/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

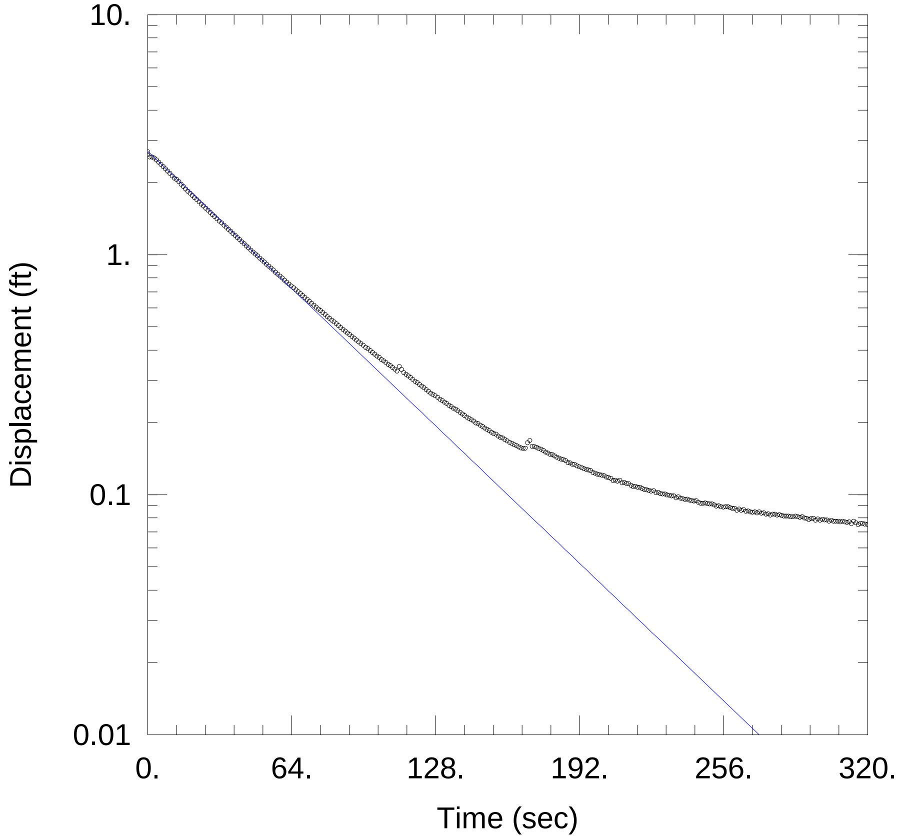
K = 4.084 ft/day
y0 = 2.665 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-05D)

Initial Displacement: 2.6 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 21.9 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-05D SLUG IN 2

Data Set: T:\...\UFMW-05D_slugin_2.aqt
Date: 05/04/17 Time: 10:06:58

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-05D
Test Date: 8/18/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 4.211 ft/day
y0 = 2.703 ft

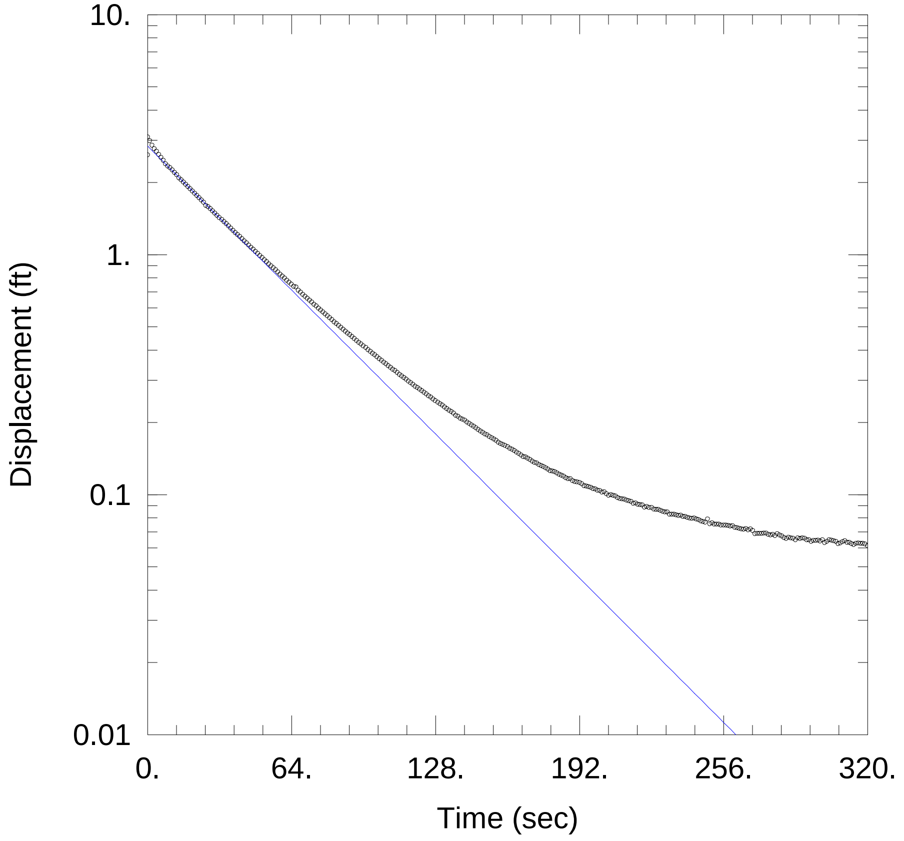
AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-05D)

Initial Displacement: 2.6 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft

Static Water Column Height: 21.9 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-05D SLUG OUT 1

Data Set: T:\...\UFMW-05D_slugout_1.aqt
Date: 05/04/17 Time: 10:07:05

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-05D
Test Date: 8/18/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 4.414 ft/day
y0 = 2.834 ft

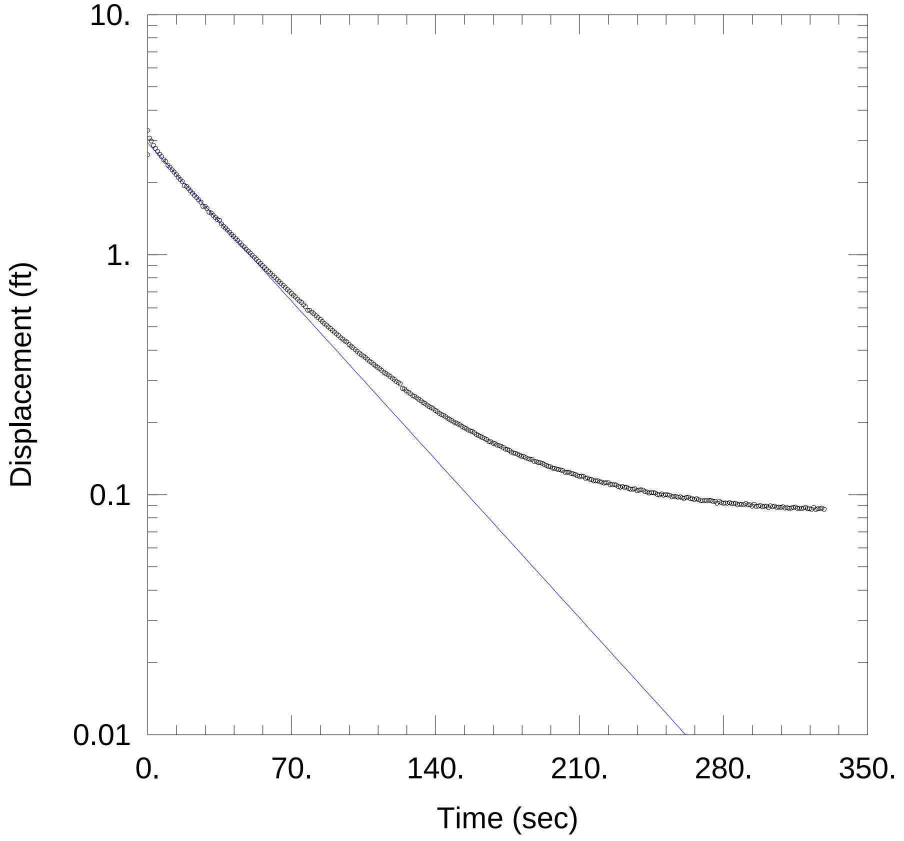
AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-05D)

Initial Displacement: 2.6 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft

Static Water Column Height: 21.9 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-05D SLUG OUT 2

Data Set: T:\...\UFMW-05D_slugout_2.aqt
Date: 05/04/17 Time: 10:07:15

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-05D
Test Date: 8/18/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

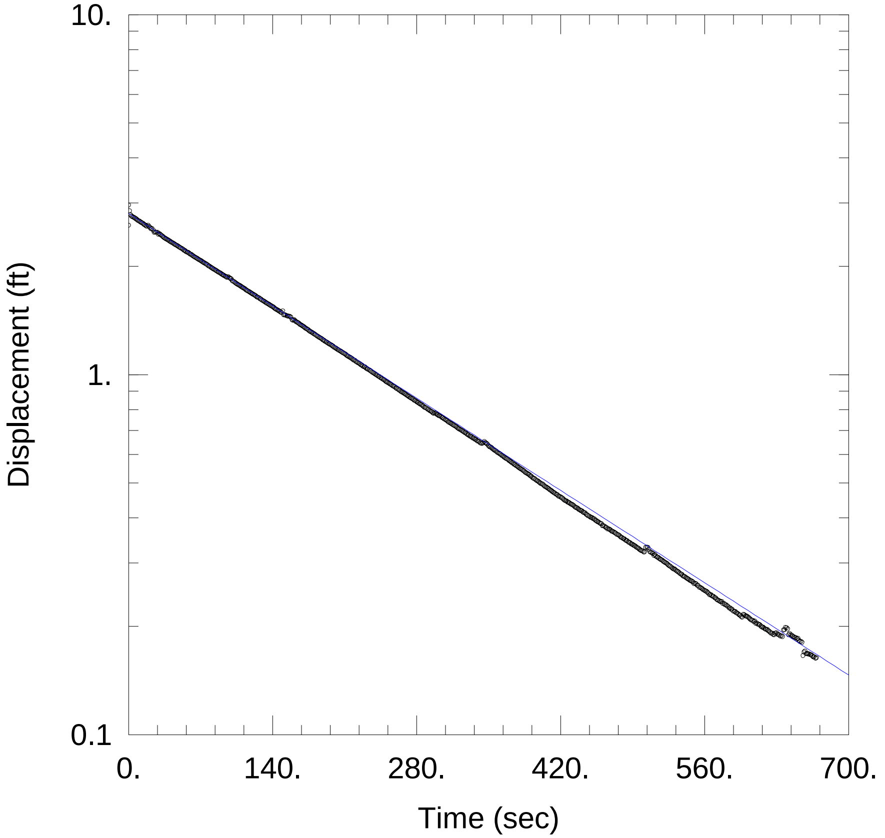
K = 4.439 ft/day
y0 = 2.925 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-05D)

Initial Displacement: 2.6 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 21.9 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-05I SLUG IN 1

Data Set: T:\...\UFMW-05I_slugin_1.aqt
Date: 05/04/17 Time: 10:07:24

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-05I
Test Date: 8/18/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

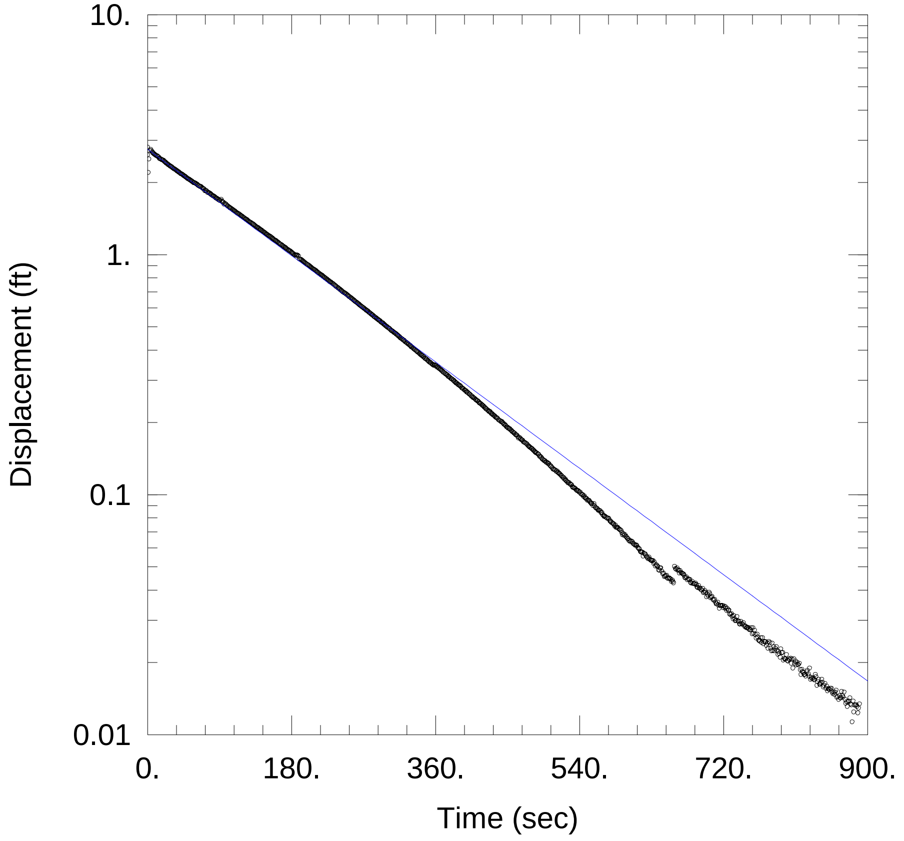
K = 0.7624 ft/day
y0 = 2.802 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-05I)

Initial Displacement: 2.6 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.8 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-05I SLUG IN 2

Data Set: T:\...\UFMW-05I_slugin_2.aqt
Date: 05/04/17 Time: 10:07:32

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-05I
Test Date: 8/18/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

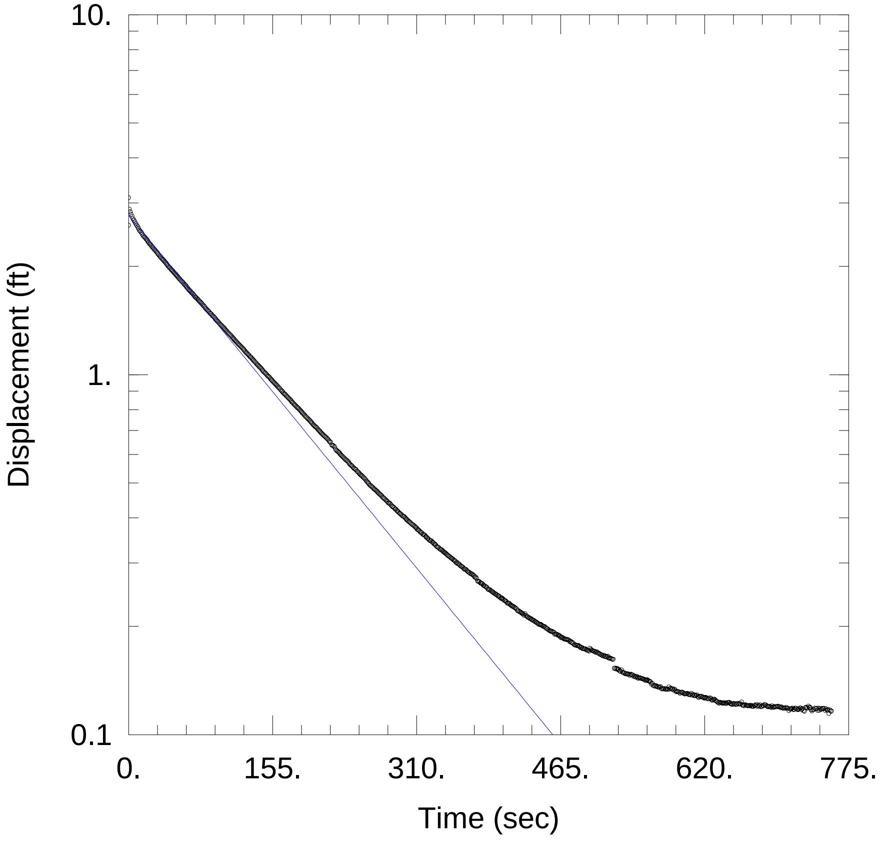
K = 1.025 ft/day
y0 = 2.747 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-05I)

Initial Displacement: 2.6 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.8 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-05I SLUG OUT 1

Data Set: T:\...\UFMW-05I_slugout_1.aqt
Date: 05/04/17 Time: 10:07:40

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-05I
Test Date: 8/18/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

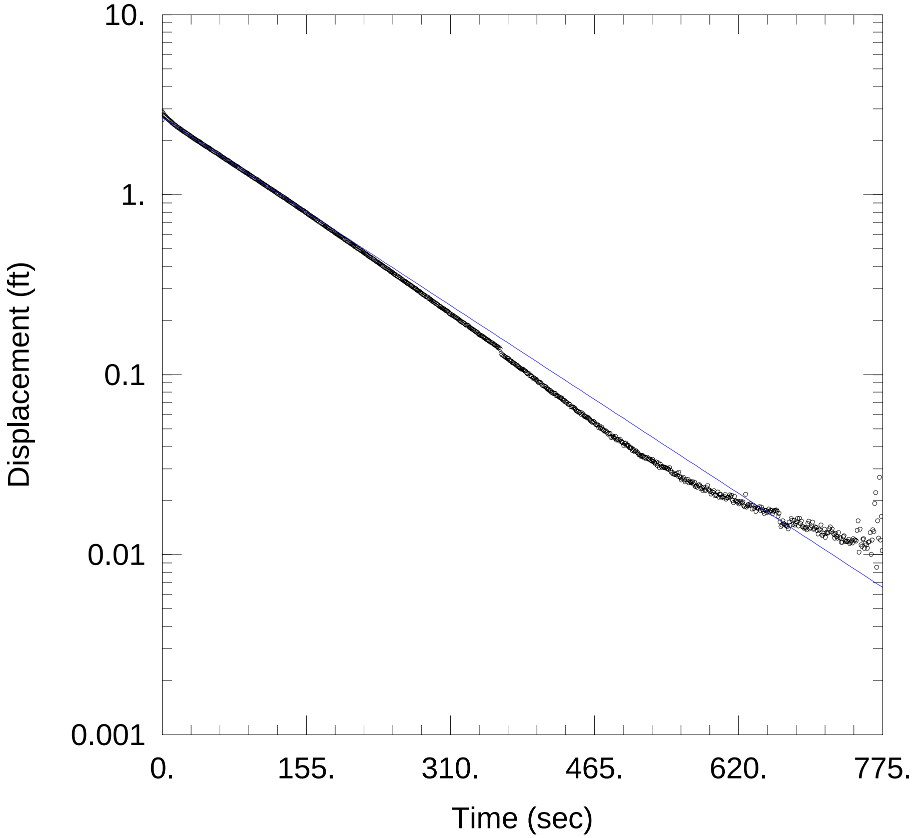
K = 1.316 ft/day
y0 = 2.769 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-05I)

Initial Displacement: 2.6 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.8 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-05I SLUG OUT 2

Data Set: T:\...\UFMW-05I_slugout_2.aqt
Date: 05/04/17 Time: 10:07:48

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-05I
Test Date: 8/18/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

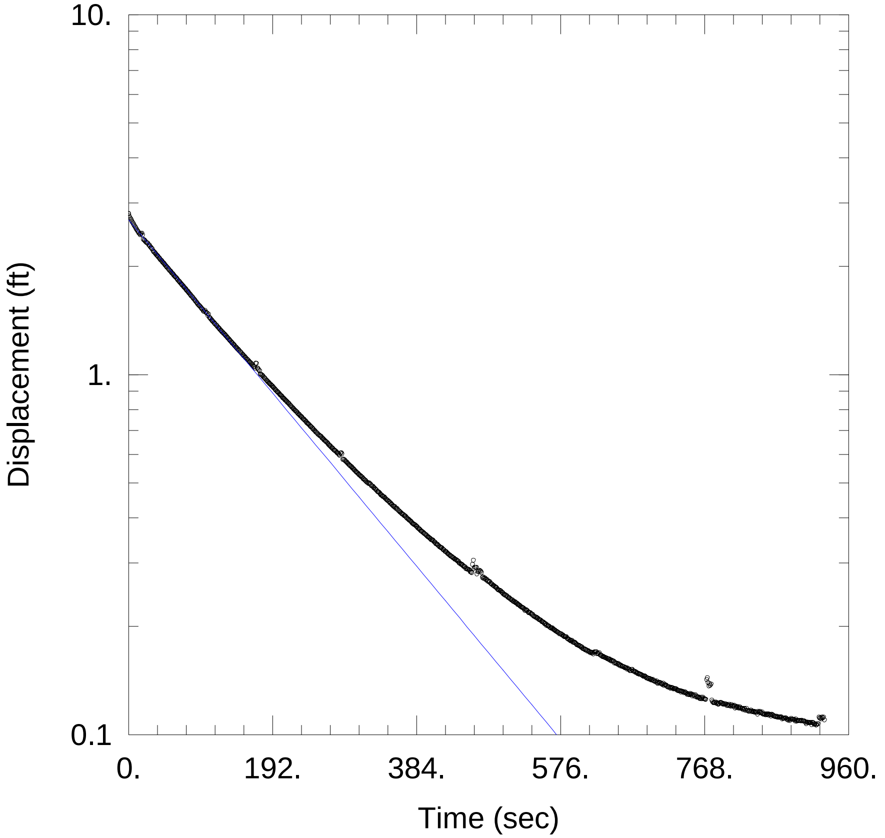
K = 1.403 ft/day
y0 = 2.69 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-05I)

Initial Displacement: 2.6 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.8 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-06D SLUG IN 1

Data Set: T:\...\UFMW-06D_slugin_1.aqt
Date: 05/04/17 Time: 10:07:56

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-06D
Test Date: 8/18/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

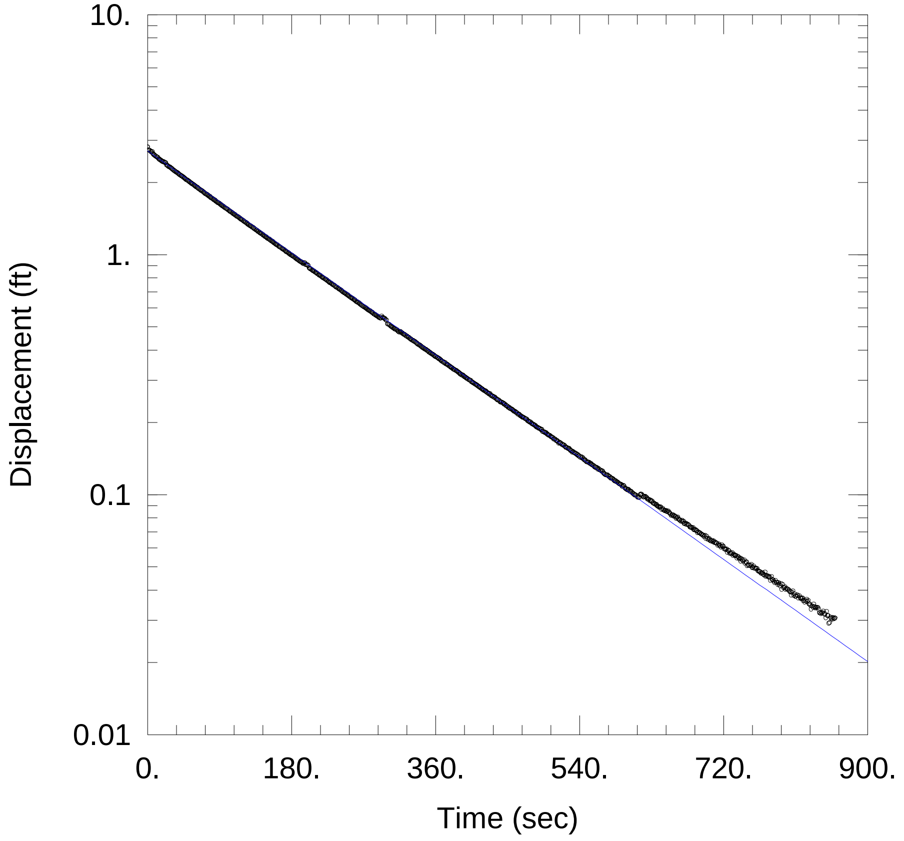
K = 1.179 ft/day
y0 = 2.691 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-06D)

Initial Displacement: 2.8 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.1 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-06D SLUG IN 2

Data Set: T:\...\UFMW-06D_slugin_2.aqt
Date: 05/04/17 Time: 10:08:05

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-06D
Test Date: 8/18/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

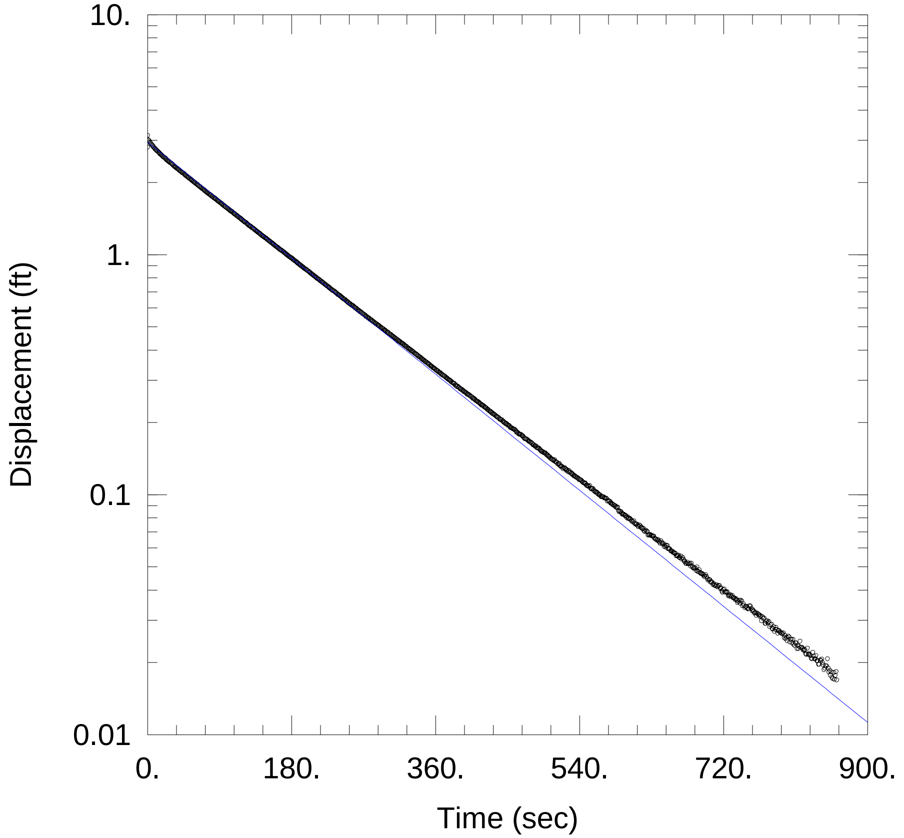
K = 1.113 ft/day
y0 = 2.71 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-06D)

Initial Displacement: 2.8 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.1 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-06D SLUG OUT 1

Data Set: T:\...\UFMW-06D_slugout_1.aqt
Date: 05/04/17 Time: 10:08:13

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-06D
Test Date: 8/18/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

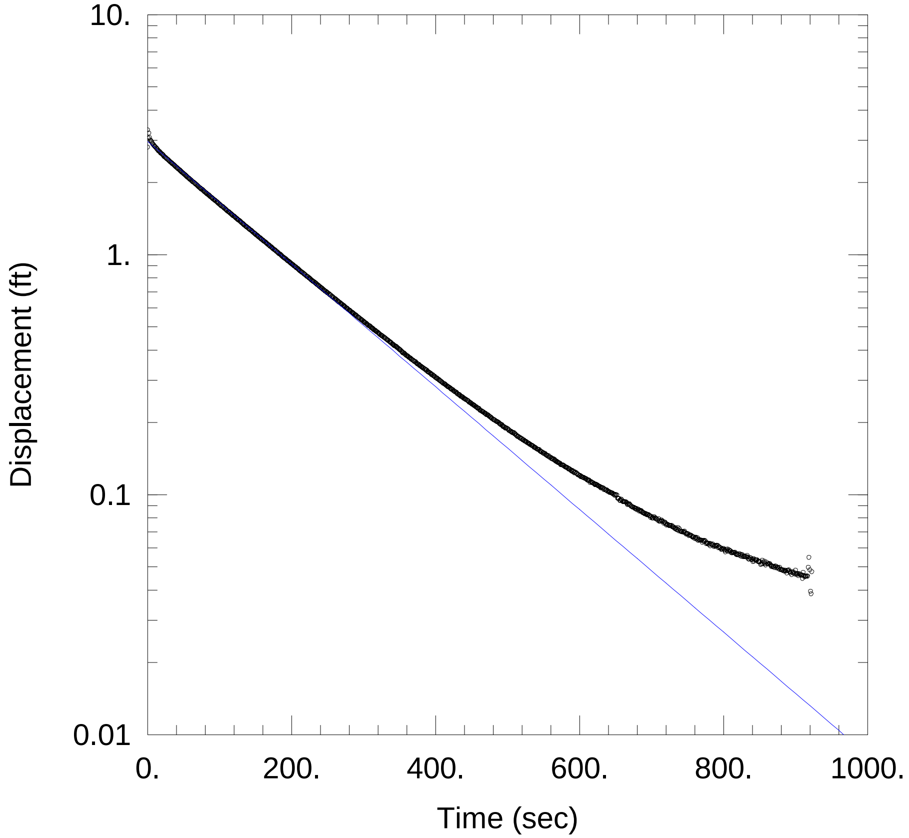
K = 1.265 ft/day
y0 = 2.944 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-06D)

Initial Displacement: 2.8 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.1 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-06D SLUG OUT 2

Data Set: T:\...\UFMW-06D_slugout_2.aqt
Date: 05/04/17 Time: 10:08:21

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-06D
Test Date: 8/18/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

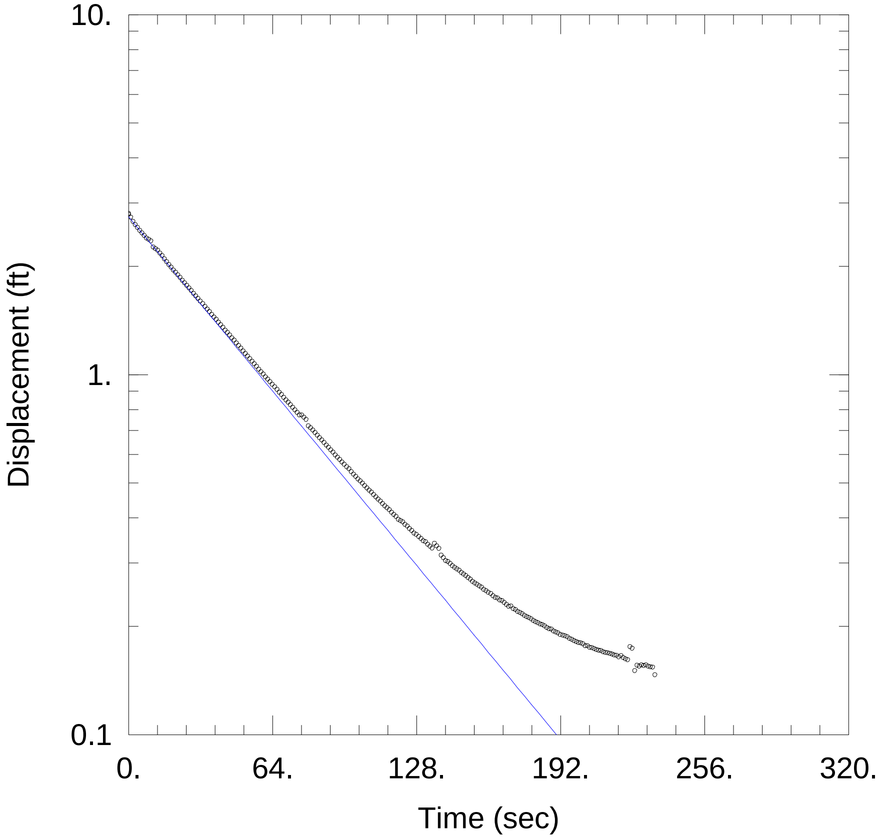
K = 1.203 ft/day
y0 = 2.963 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-06D)

Initial Displacement: 2.8 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 22.1 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-06I SLUG IN 1

Data Set: T:\...\UFMW-06I_slugin_1.aqt
Date: 05/04/17 Time: 10:08:59

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-06I
Test Date: 8/29/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

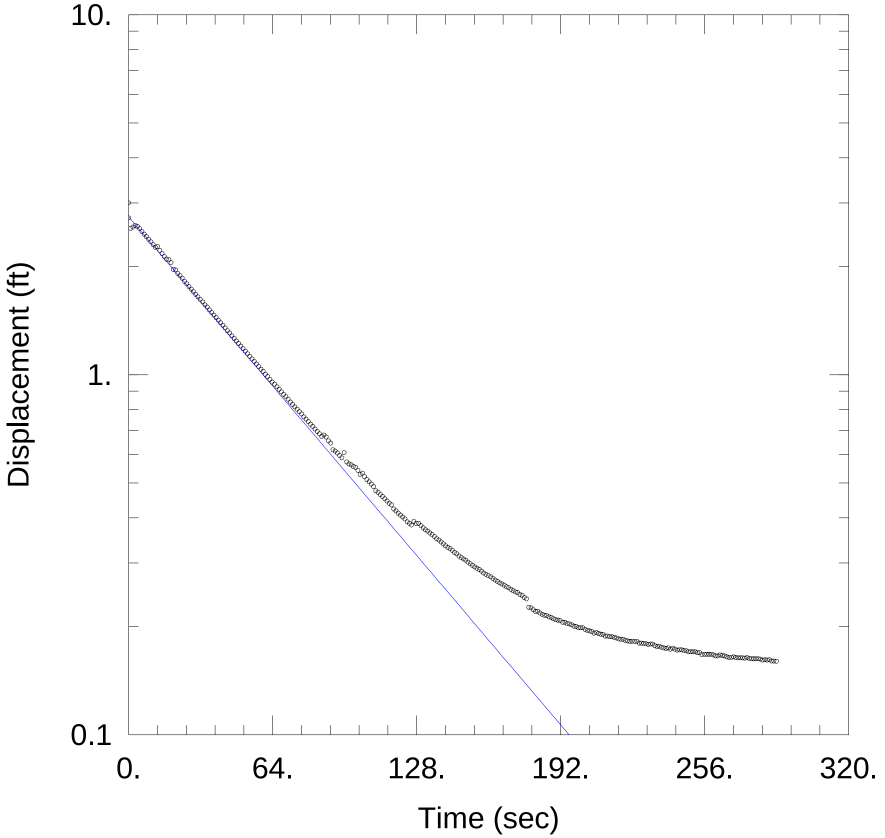
K = 3.149 ft/day
y0 = 2.744 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-06I)

Initial Displacement: 2.8 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.3 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-06I SLUG IN 2

Data Set: T:\...\UFMW-06I_slugin_2.aqt
Date: 05/04/17 Time: 10:09:08

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-06I
Test Date: 8/29/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

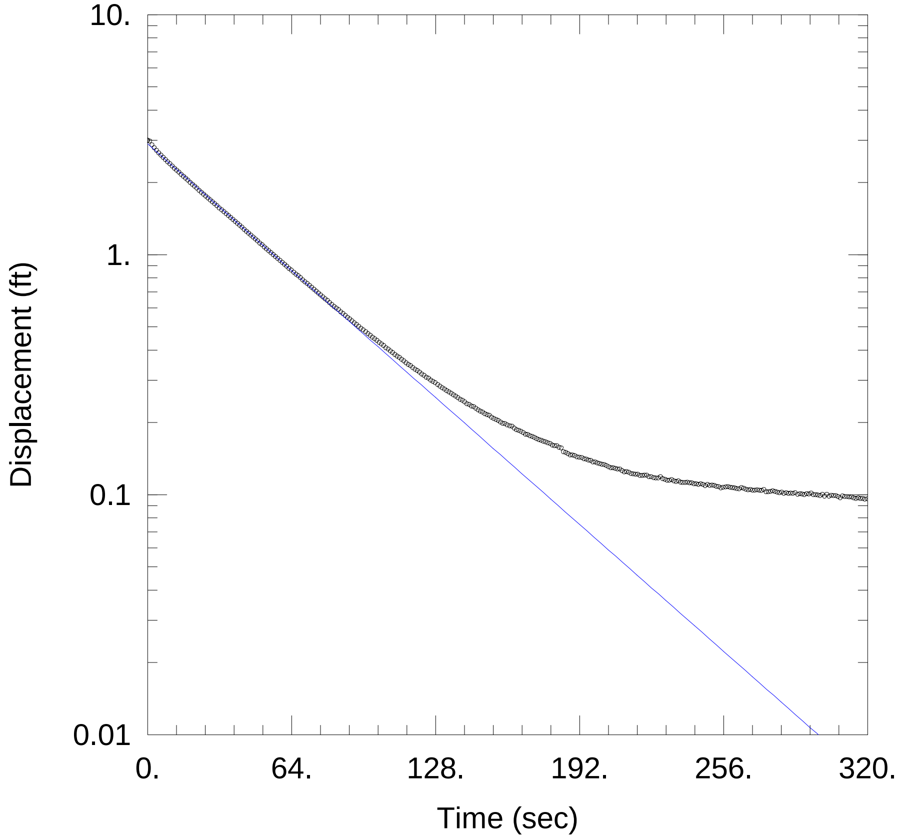
K = 3.059 ft/day
y0 = 2.744 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-06I)

Initial Displacement: 3. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.3 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-06I SLUG OUT 1

Data Set: T:\...\UFMW-06I_slugout_1.aqt
Date: 05/04/17 Time: 10:09:16

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-06I
Test Date: 8/29/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

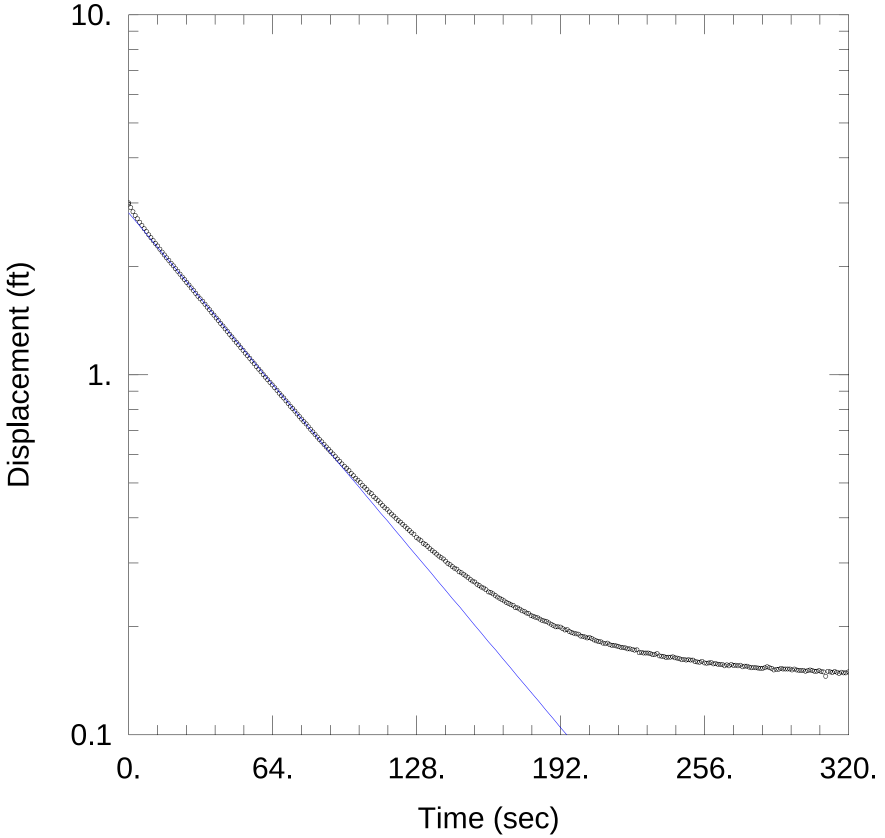
K = 3.438 ft/day
y0 = 2.894 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-06I)

Initial Displacement: 3. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.3 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-06I SLUG OUT 2

Data Set: T:\...\UFMW-06I_slugout_2.aqt
Date: 05/04/17 Time: 10:09:25

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-06I
Test Date: 8/29/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

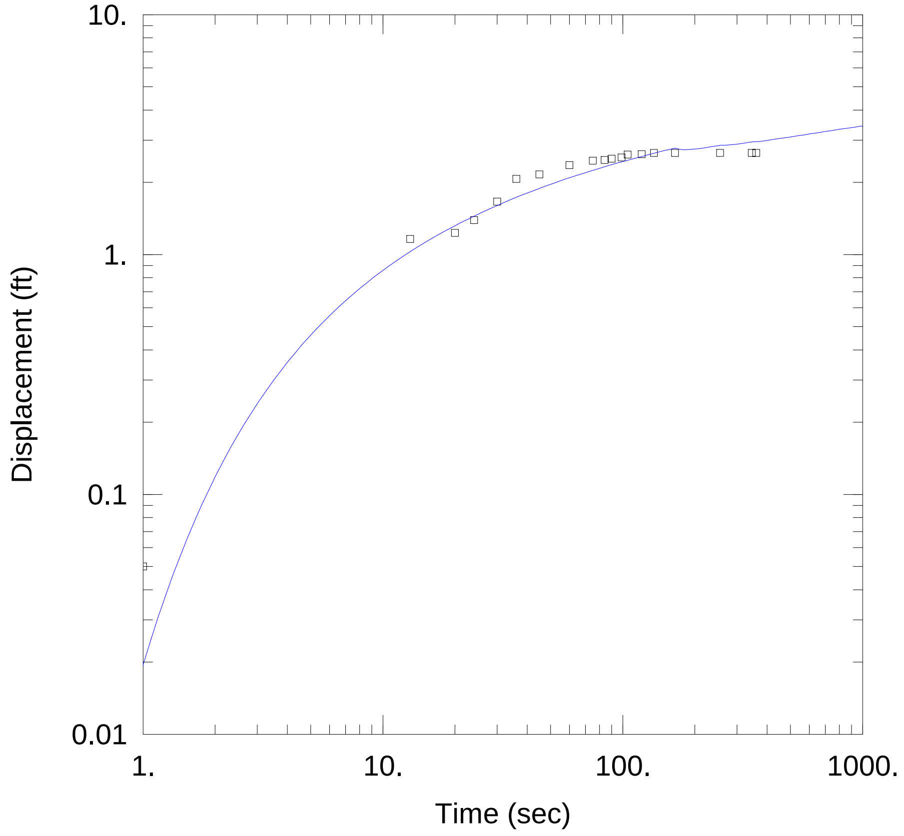
K = 3.1 ft/day
y0 = 2.817 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-06I)

Initial Displacement: 3. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.3 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFIW-06I SHORT-TERM PUMPING TEST

Data Set: T:\...\UFIW-06I_PTddn.aqt
Date: 05/10/17 Time: 15:49:33

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-06I
Test Date: 9/15/2016

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush

T = 11.35 ft^2/day
S = 0.01228
ß = 0.1
Kz/Kr = 0.1
b = 11. ft

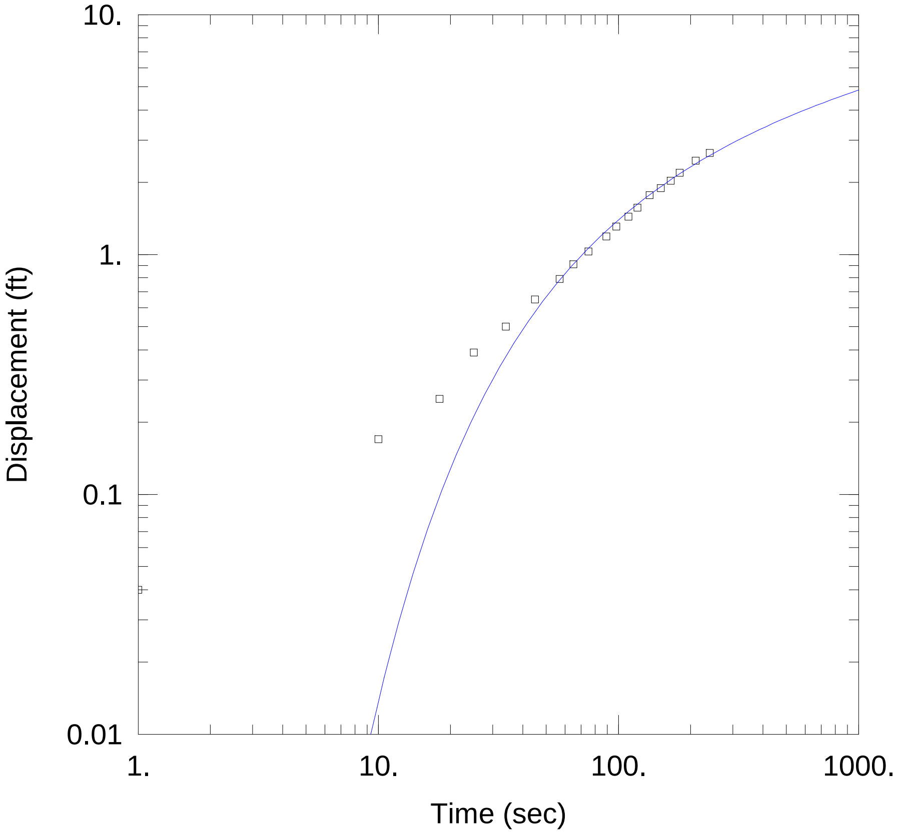
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
UFIW-06I	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ UFIW-06I	0	0



UFIW-06I SHORT-TERM PUMPING TEST - RECOVERY

Data Set: T:\...\UFIW-06I_PTrec.aqt
Date: 05/10/17 Time: 15:48:47

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-06I
Test Date: 9/15/2016

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 6.277 ft^2/day
S = 0.08885
Kz/Kr = 0.1
b = 11. ft

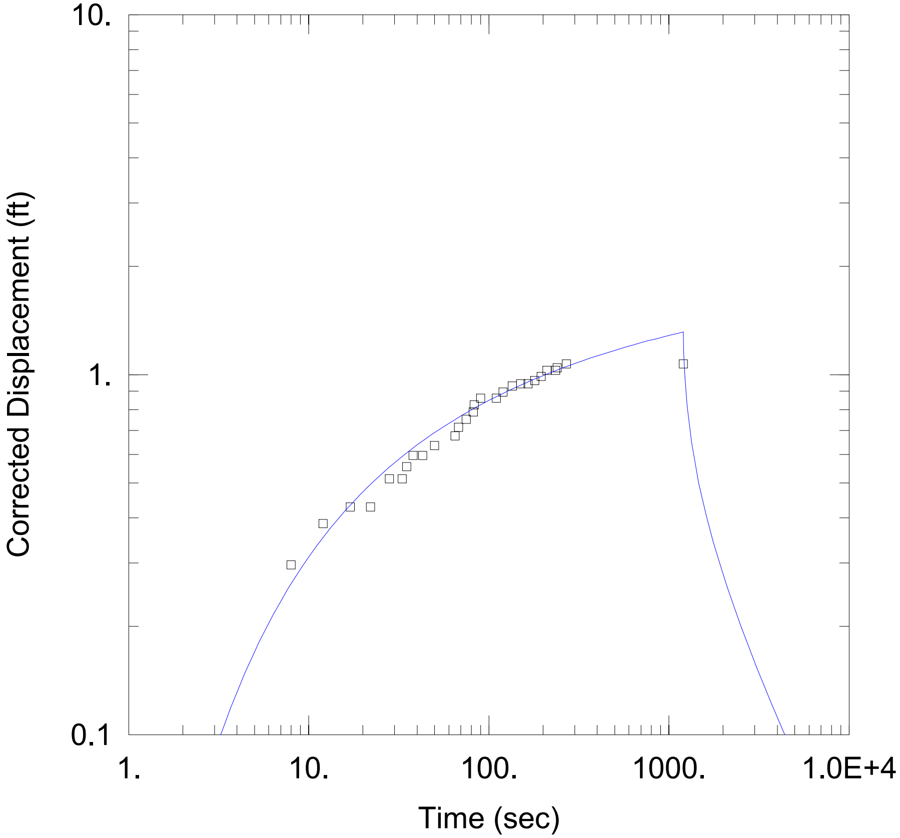
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
UFIW-06I	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ UFIW-06I	0	0



UFIW-06S SHORT-TERM PUMPING TEST

Data Set: C:\...\UFIW-06S_PTddn.aqt
Date: 11/18/16 Time: 13:57:30

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-06S
Test Date: 9/15/2016

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 39. ft^2/day
S = 0.0415
Kz/Kr = 0.1
b = 3.41 ft

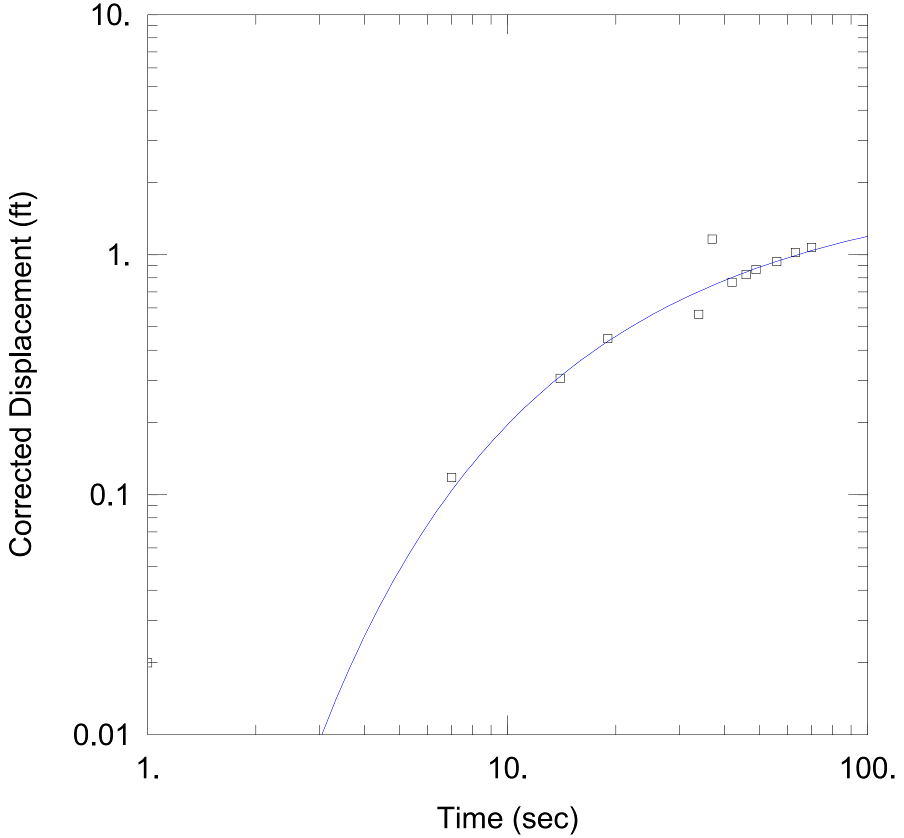
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
UFIW-06S	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ UFIW-06S	0	0



UFIW-06S SHORT-TERM PUMPING TEST - RECOVERY

Data Set: C:\...\UFIW-06S_PTrec.aqt
Date: 11/18/16 Time: 13:27:32

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-06S
Test Date: 9/15/2016

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 15.21 ft^2/day
S = 0.05898
Kz/Kr = 0.1
b = 3.41 ft

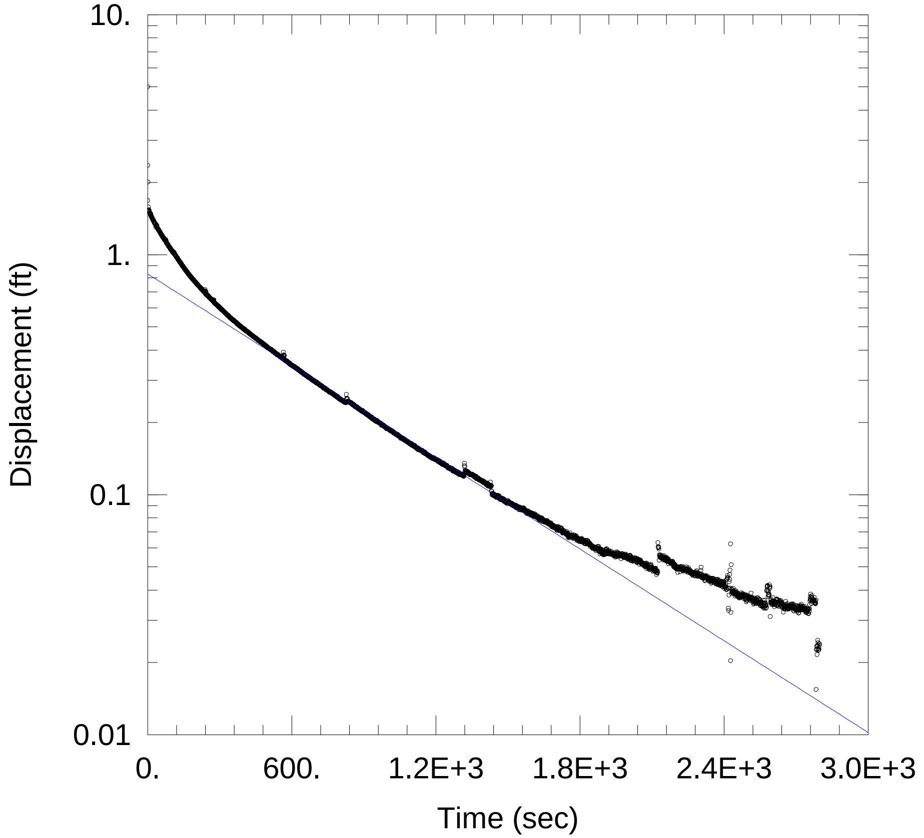
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
UFIW-06S	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ UFIW-06S	0	0



UFIW_01I_SLUGIN_1

Data Set: T:\...\UFIW_01I_slugin_1_MBQC.aqt
Date: 05/10/17 Time: 14:31:43

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW_01I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

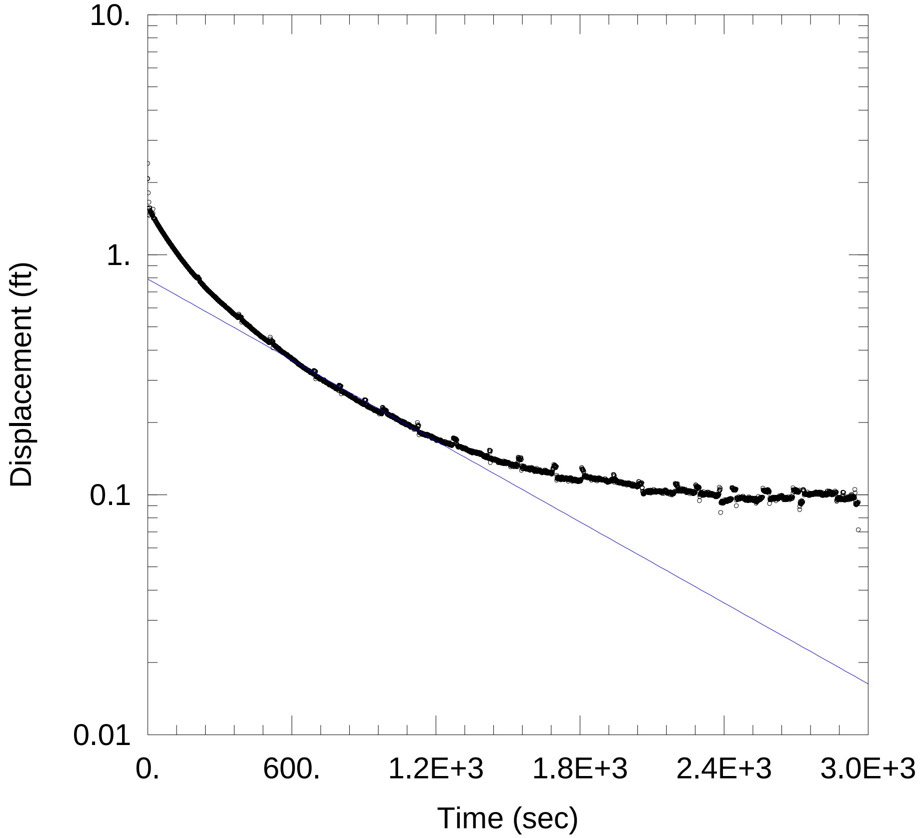
K = 0.2961 ft/day
y0 = 0.8309 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW_01I)

Initial Displacement: 5. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.95 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW_01I_SLUGIN_2

Data Set: T:\...\UFIW_01I_slugin_2_MBQC.aqt
Date: 05/10/17 Time: 14:32:07

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW_01I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

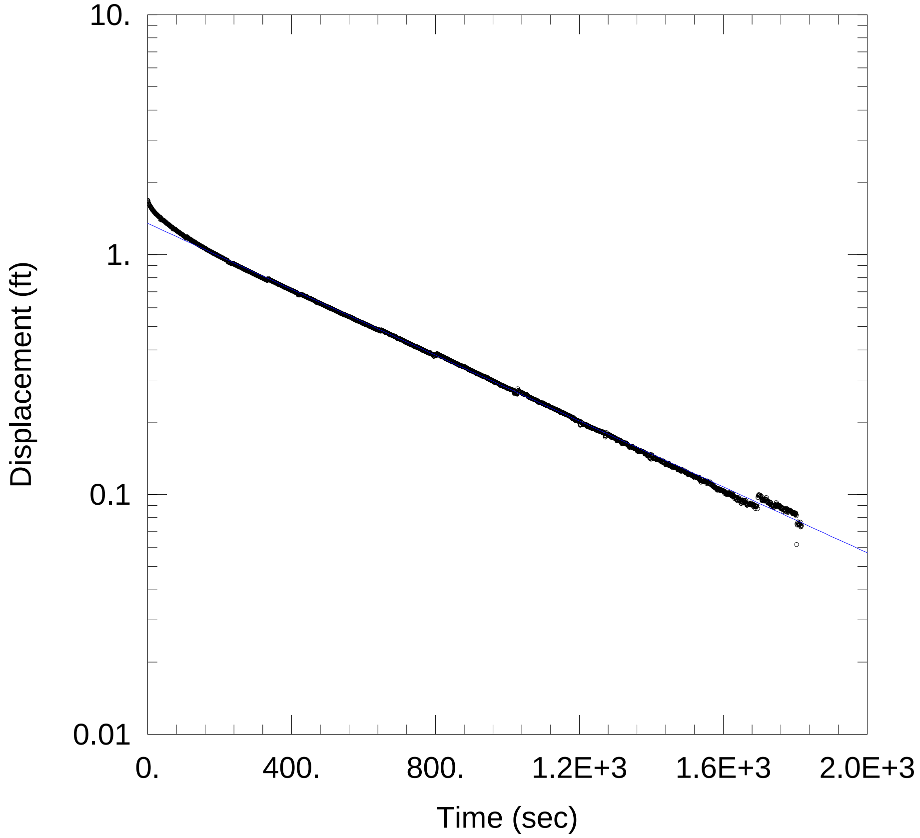
K = 0.2615 ft/day
y0 = 0.7919 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW_01I)

Initial Displacement: 2.07 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.95 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW_01I_SLUGOUT_1

Data Set: T:\...\UFIW_01I_slugout_1_MBQC.aqt
Date: 05/10/17 Time: 14:32:38

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW_01I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

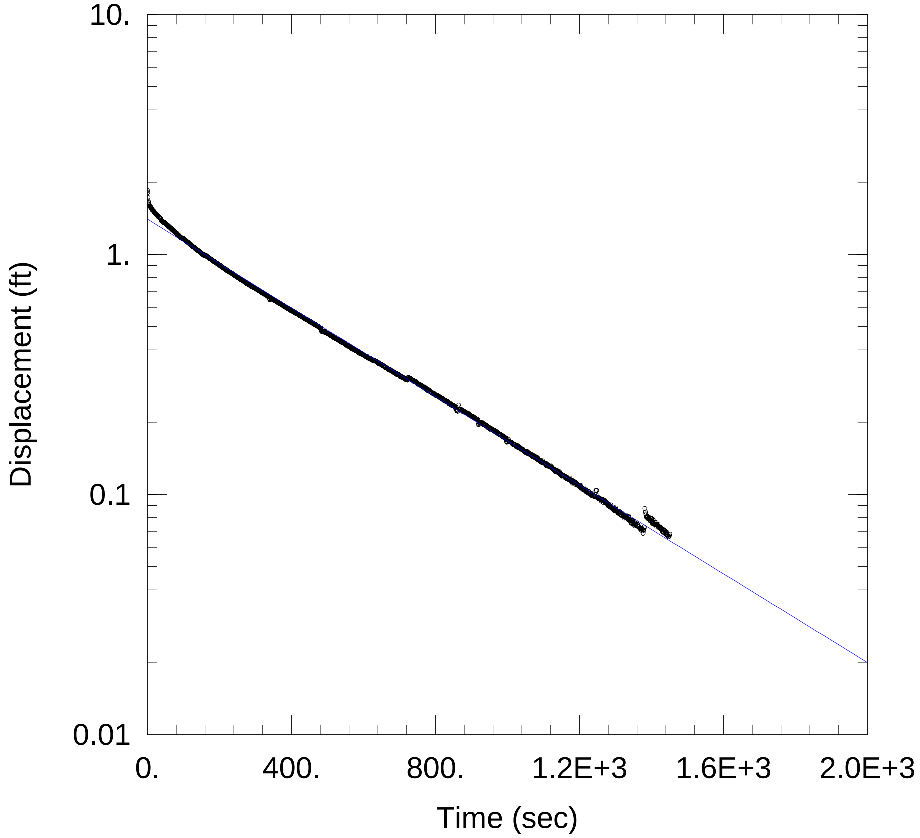
K = 0.3194 ft/day
y0 = 1.349 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW_01I)

Initial Displacement: 1.685 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.95 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW_01I_SLUGOUT_2

Data Set: T:\...\UFIW_01I_slugout_2_MBQC.aqt
Date: 05/10/17 Time: 14:33:02

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW_01I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

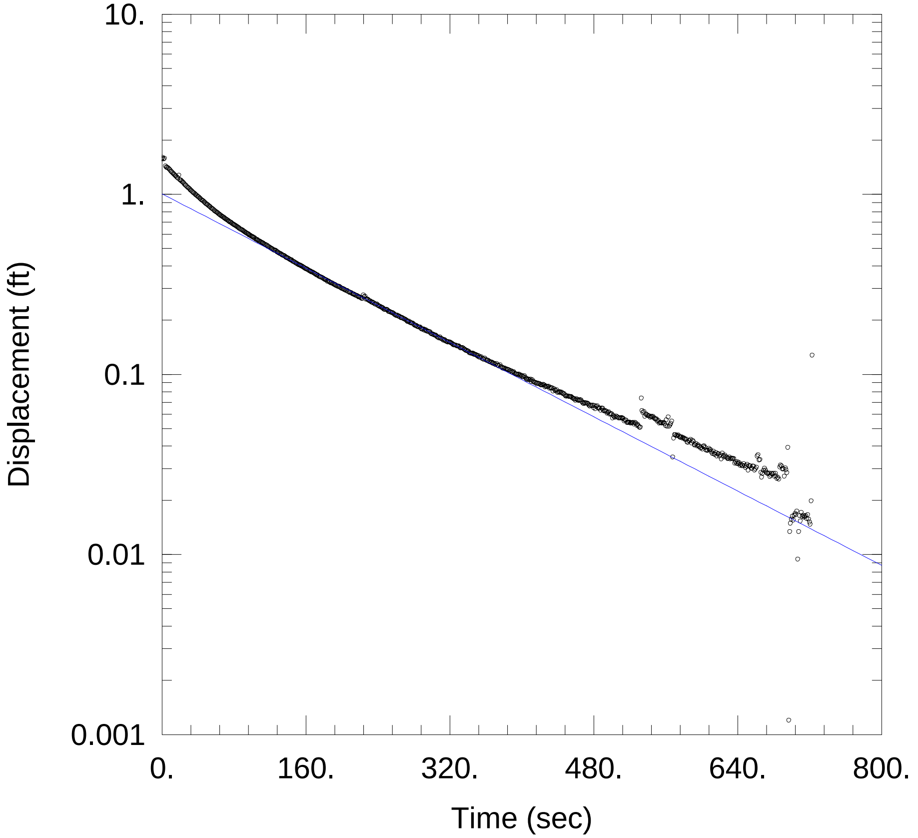
K = 0.4295 ft/day
y0 = 1.402 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW_01I)

Initial Displacement: 1.84 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.95 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW_04I_SLUGIN_1

Data Set: T:\...\UFIW_04I_slugin_1.aqt
Date: 05/10/17 Time: 14:37:43

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW_04I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

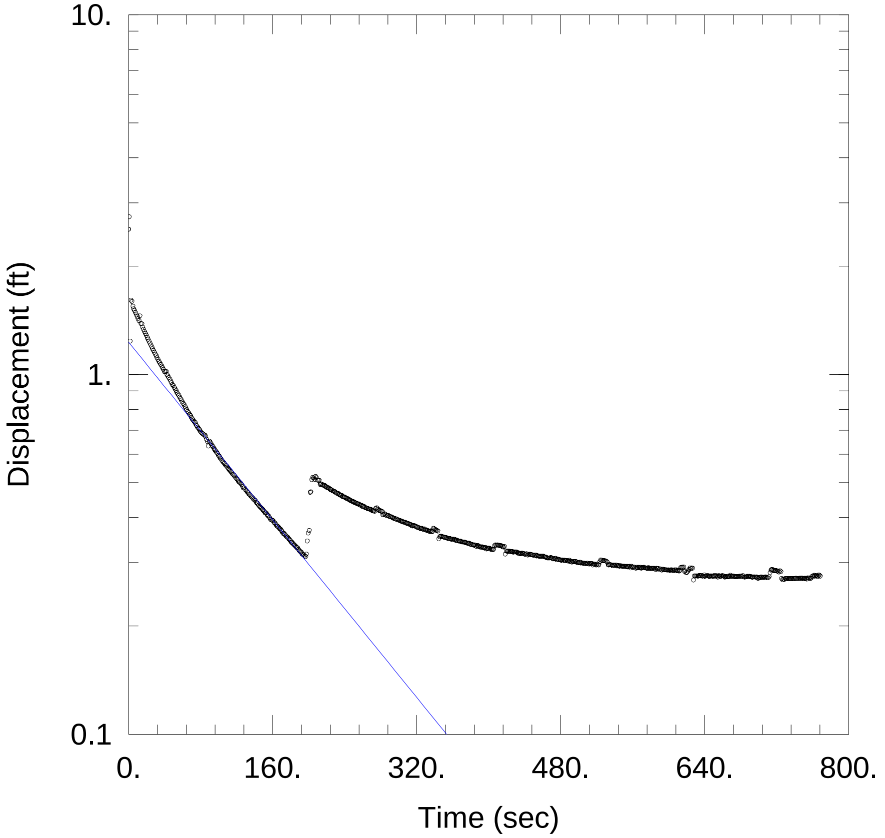
K = 1.199 ft/day
y0 = 1.005 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW_04I)

Initial Displacement: 1.57 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.91 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW_04I_SLUGIN_2

Data Set: T:\...\UFIW_04I_slugin_2.aqt
Date: 05/10/17 Time: 14:38:10

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW_04I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 1.431 ft/day
y0 = 1.229 ft

AQUIFER DATA

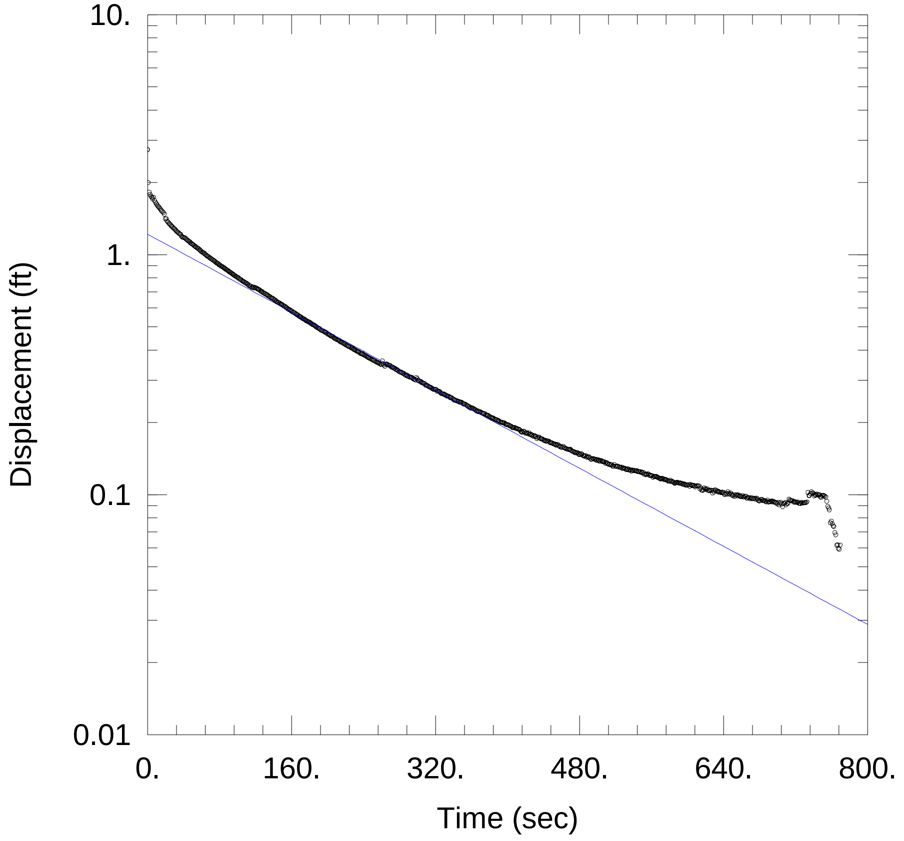
Saturated Thickness: 7. ft

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW_04I)

Initial Displacement: 2.53 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft

Static Water Column Height: 11.91 ft
Screen Length: 5. ft
Well Radius: 0.333 ft



UFIW_04I_SLUGOUT_1

Data Set: T:\...\UFIW_04I_slugout_1.aqt
Date: 05/10/17 Time: 14:38:36

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW_04I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.9451 ft/day
y0 = 1.217 ft

AQUIFER DATA

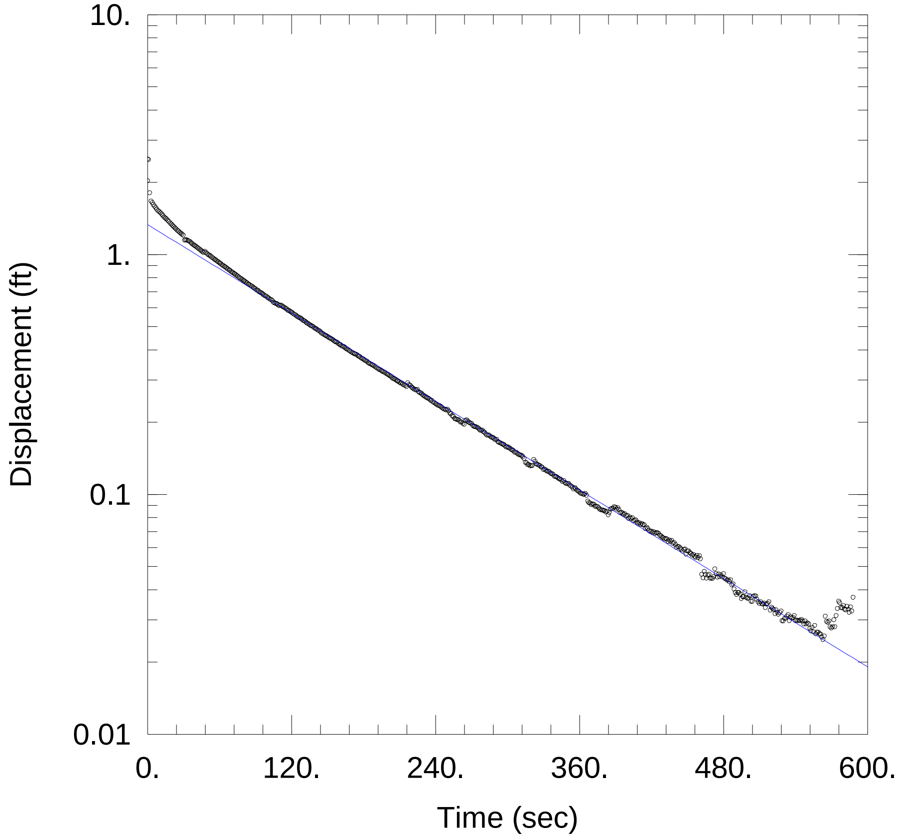
Saturated Thickness: 7. ft

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW_04I)

Initial Displacement: 2.73 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft

Static Water Column Height: 11.91 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW_04I_SLUGOUT_2

Data Set: T:\...\UFIW_04I_slugout_2.aqt
Date: 05/10/17 Time: 14:38:56

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW_04I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

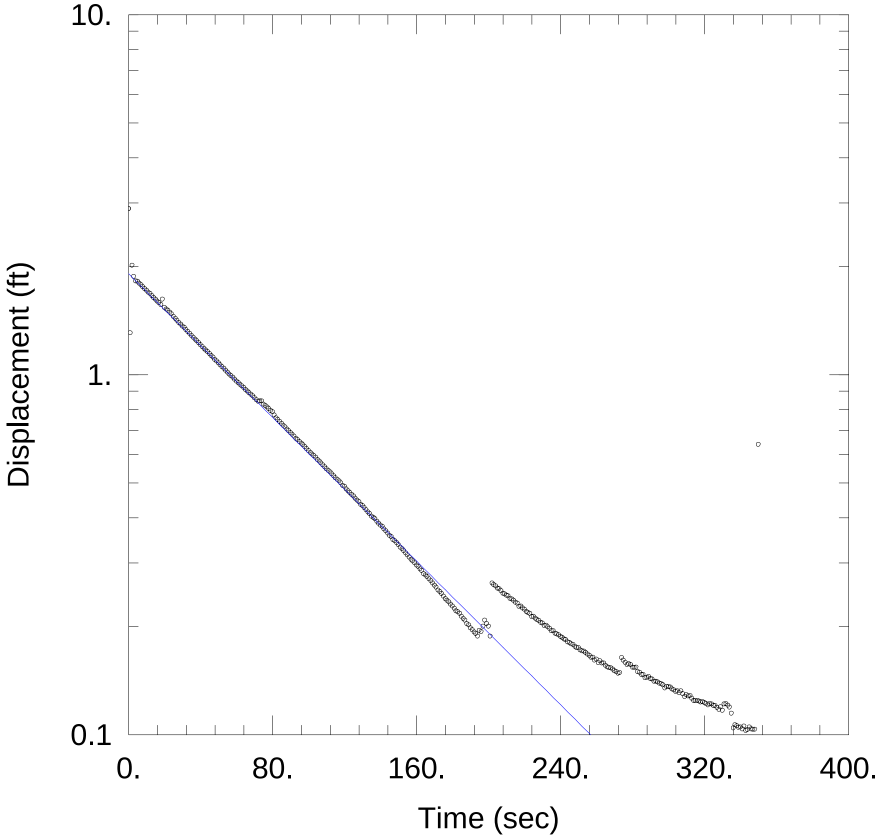
K = 1.429 ft/day
y0 = 1.332 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW_04I)

Initial Displacement: 2.5 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.91 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW_05I_SLUGIN_1

Data Set: T:\...\UFIW_05I_slugin_1.aqt
Date: 05/10/17 Time: 14:40:35

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW_05I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

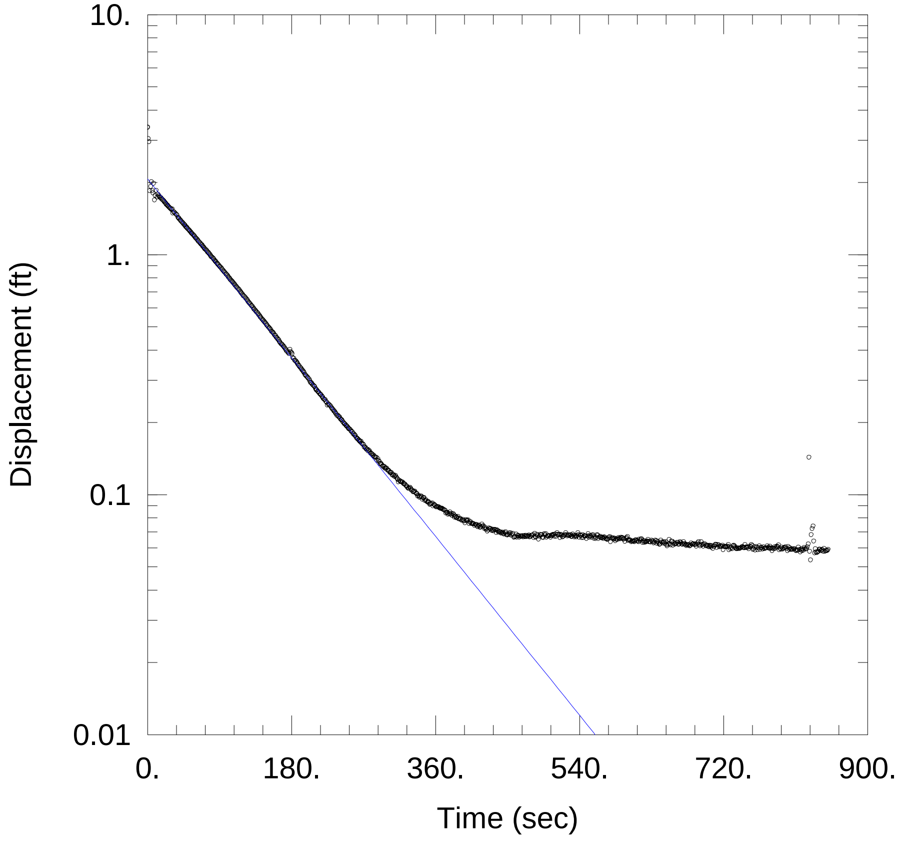
K = 2.32 ft/day
y0 = 1.906 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW_05I)

Initial Displacement: 2.89 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.2 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW_05I_SLUGIN_2

Data Set: T:\...\UFIW_05I_slugin_2.aqt
Date: 05/10/17 Time: 14:41:16

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW_05I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

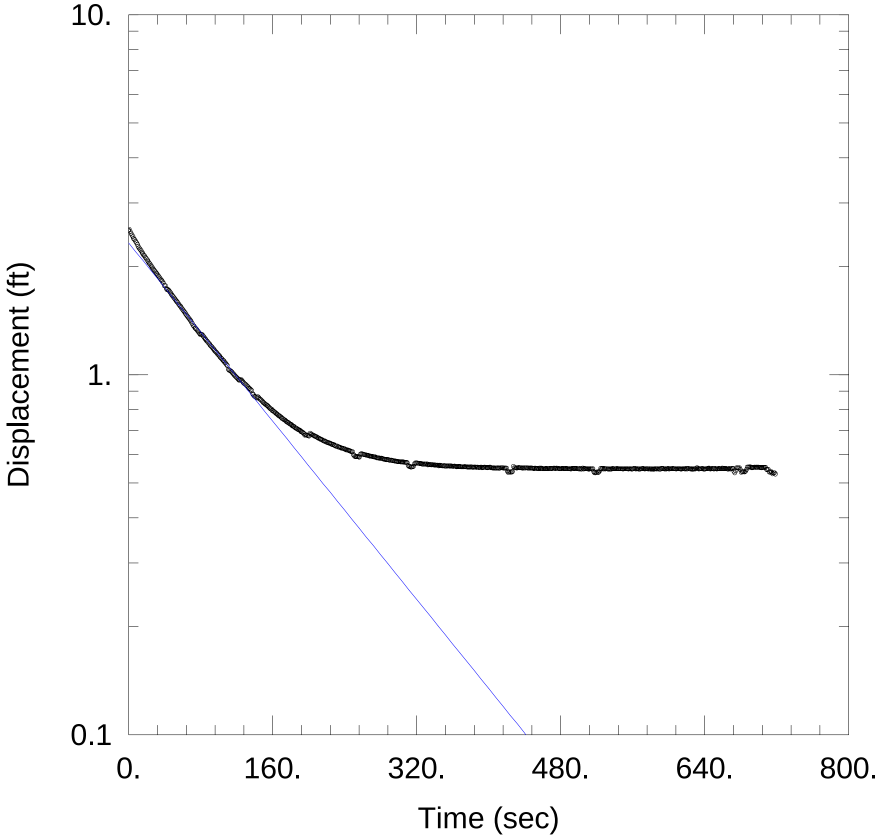
K = 1.925 ft/day
y0 = 2.068 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW_05I)

Initial Displacement: 3.39 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.2 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW_05I_SLUGOUT_1

Data Set: T:\...\UFIW_05I_slugout_1.aqt
Date: 05/10/17 Time: 14:42:10

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW_05I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

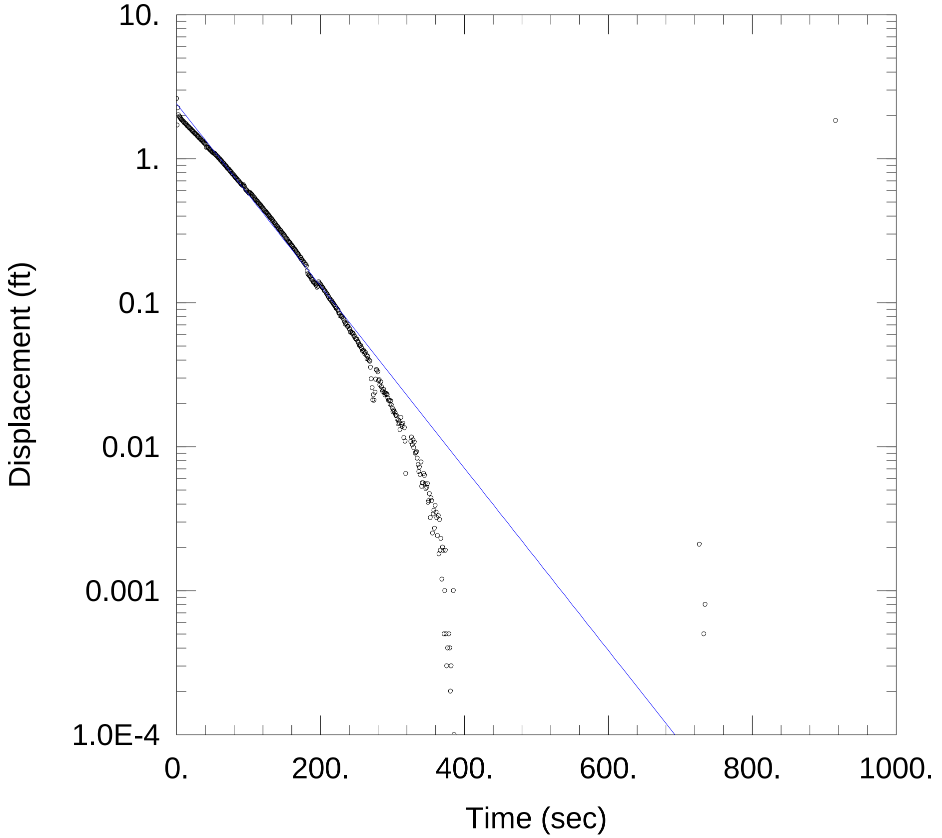
K = 1.439 ft/day
y0 = 2.323 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW_05I)

Initial Displacement: 2.51 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.2 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW_05I_SLUGOUT_2

Data Set: T:\...\UFIW_05I_slugout_2.aqt
Date: 05/10/17 Time: 14:43:12

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW_05I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 2.943 ft/day
y0 = 2.41 ft

AQUIFER DATA

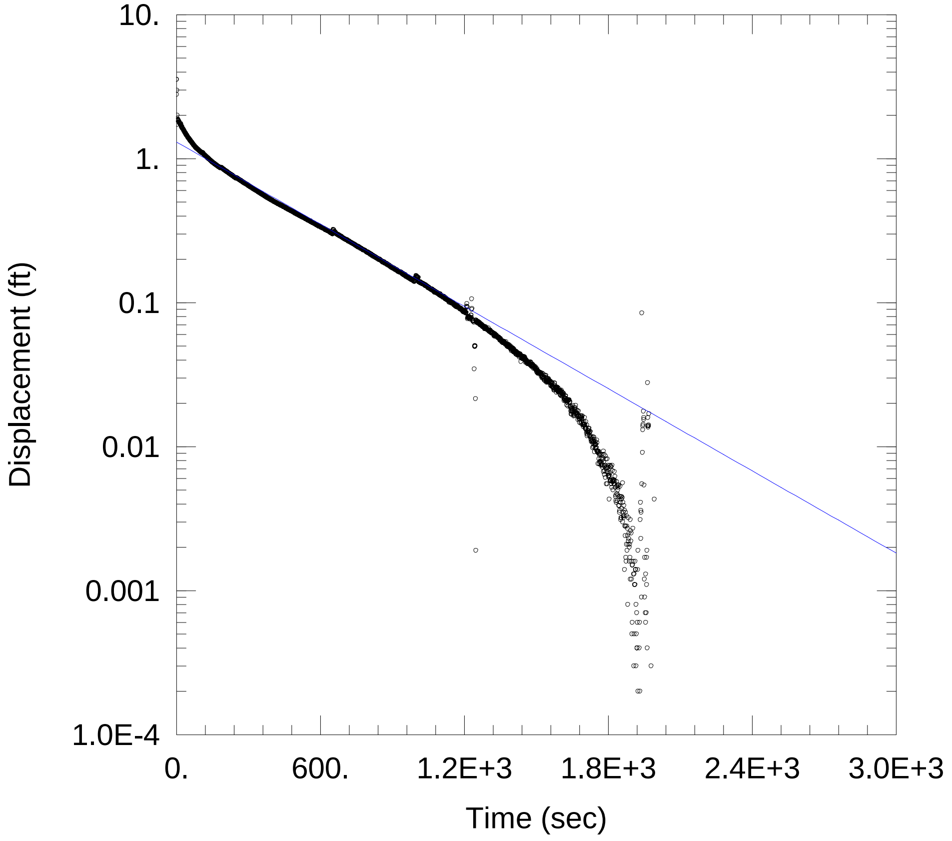
Saturated Thickness: 7. ft

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW_05I)

Initial Displacement: 2.61 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft

Static Water Column Height: 12.2 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW_08I_SLUGIN_1

Data Set: T:\...\UFIW_08I_slugin_1.aqt
Date: 05/10/17 Time: 14:48:28

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW_08I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

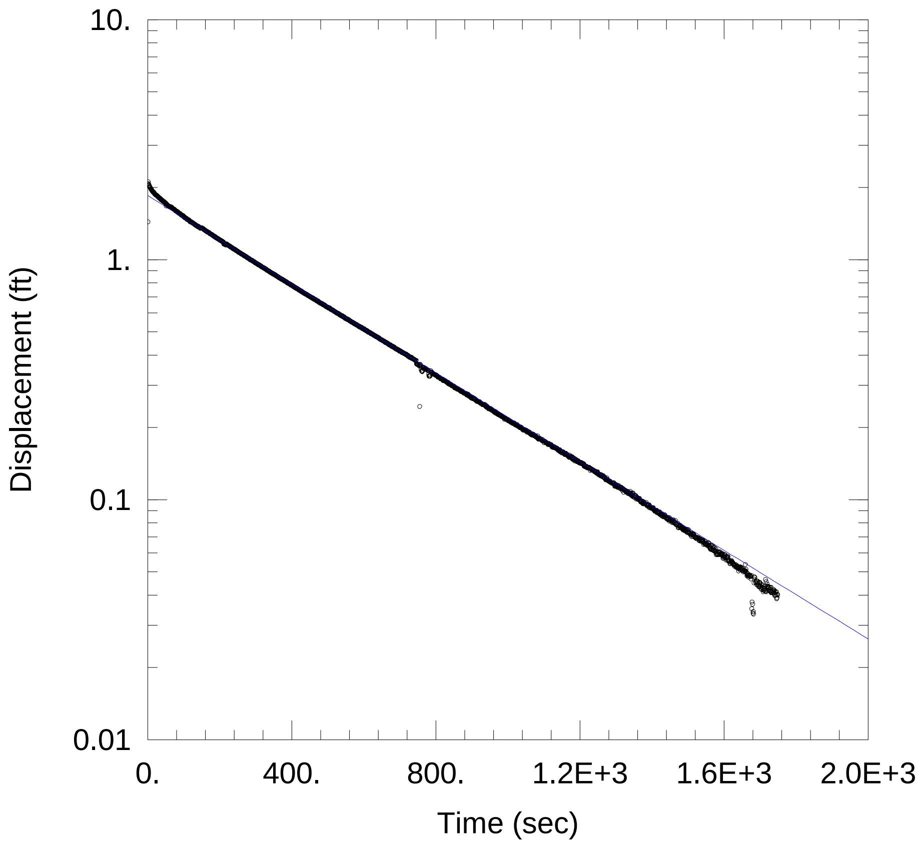
K = 0.4426 ft/day
y0 = 1.305 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW_08I)

Initial Displacement: 3.55 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.83 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW_08I_SLUGOUT_1

Data Set: T:\...\UFIW_08I_slugout_1.aqt
Date: 05/10/17 Time: 14:49:38

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW_08I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

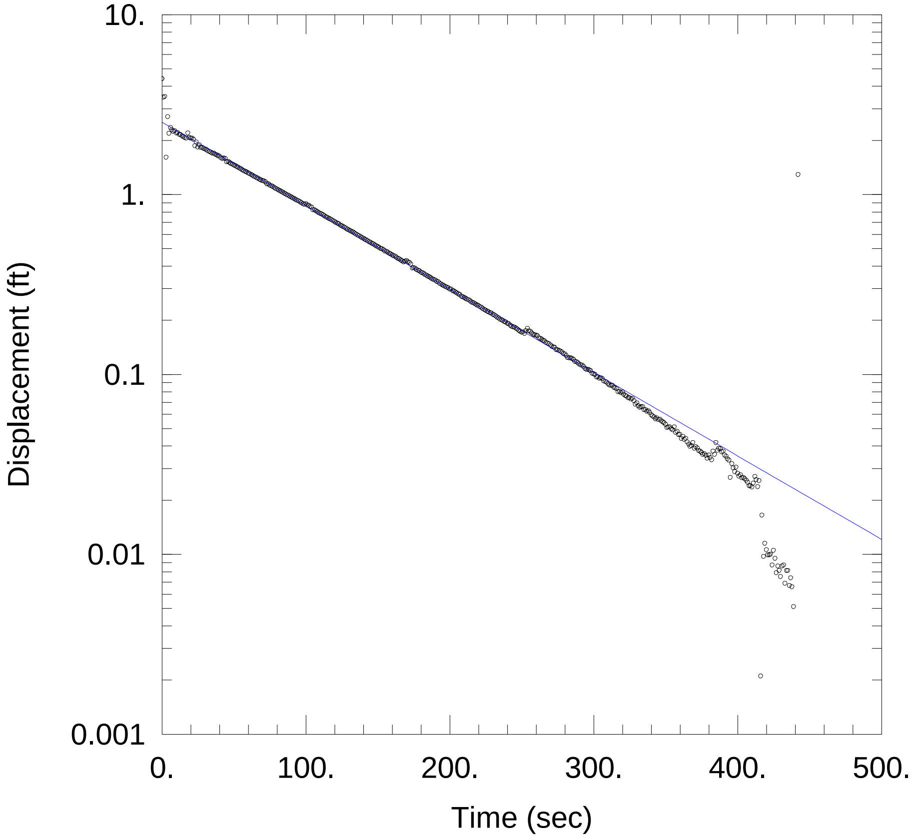
K = 0.4295 ft/day
y0 = 1.848 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW_08I)

Initial Displacement: 2.06 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.83 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFMW_01I_SLUGIN_1

Data Set: T:\...\UFMW_01I_slugin_1.aqt
Date: 04/27/17 Time: 10:27:22

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW_01I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

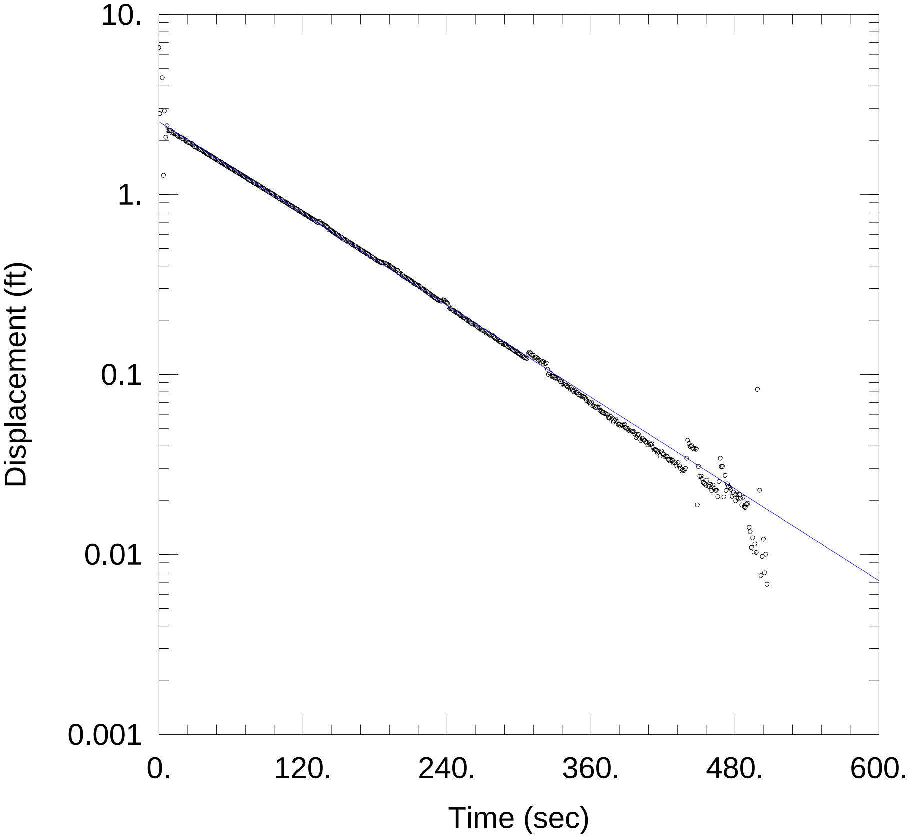
K = 2.301 ft/day
y0 = 2.527 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW_01I)

Initial Displacement: 4.4 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.87 ft
Screen Length: 5. ft
Well Radius: 0.25 ft



UFMW_01I_SLUGIN_2

Data Set: T:\...\UFMW_01I_slugin_2.aqt
Date: 05/10/17 Time: 14:52:38

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW_01I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

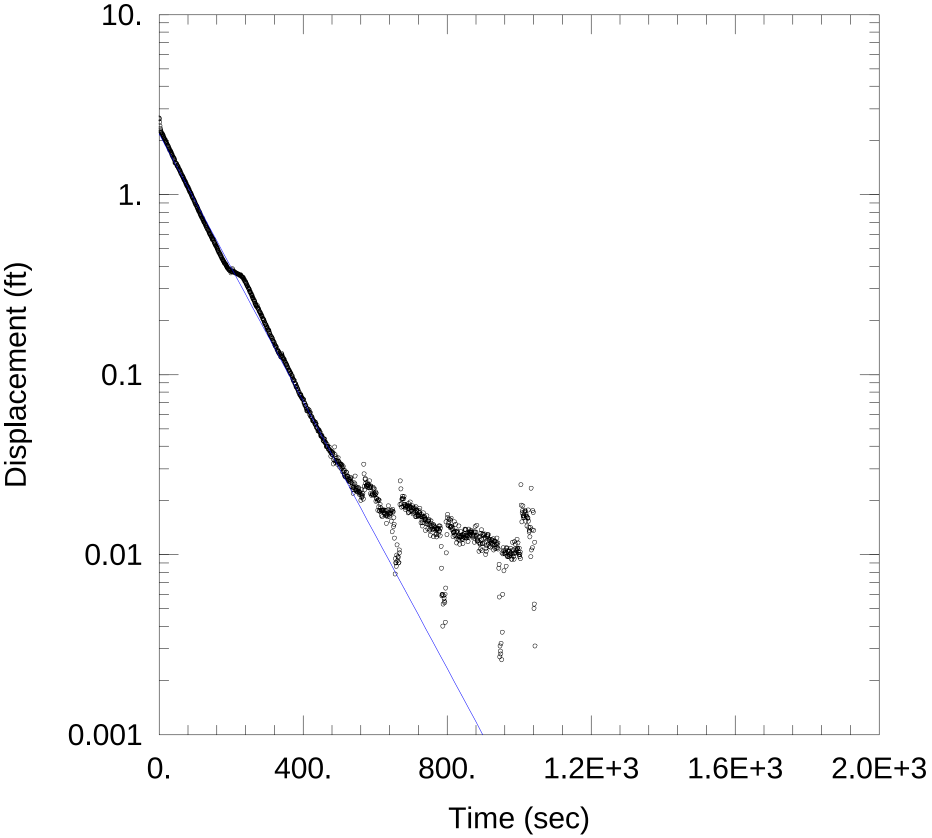
K = 1.769 ft/day
y0 = 2.531 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW_01I)

Initial Displacement: 6.52 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.87 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW_01I_SLUGOUT_1

Data Set: T:\...\UFMW_01I_slugout_1.aqt
Date: 05/10/17 Time: 14:53:30

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW_01I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

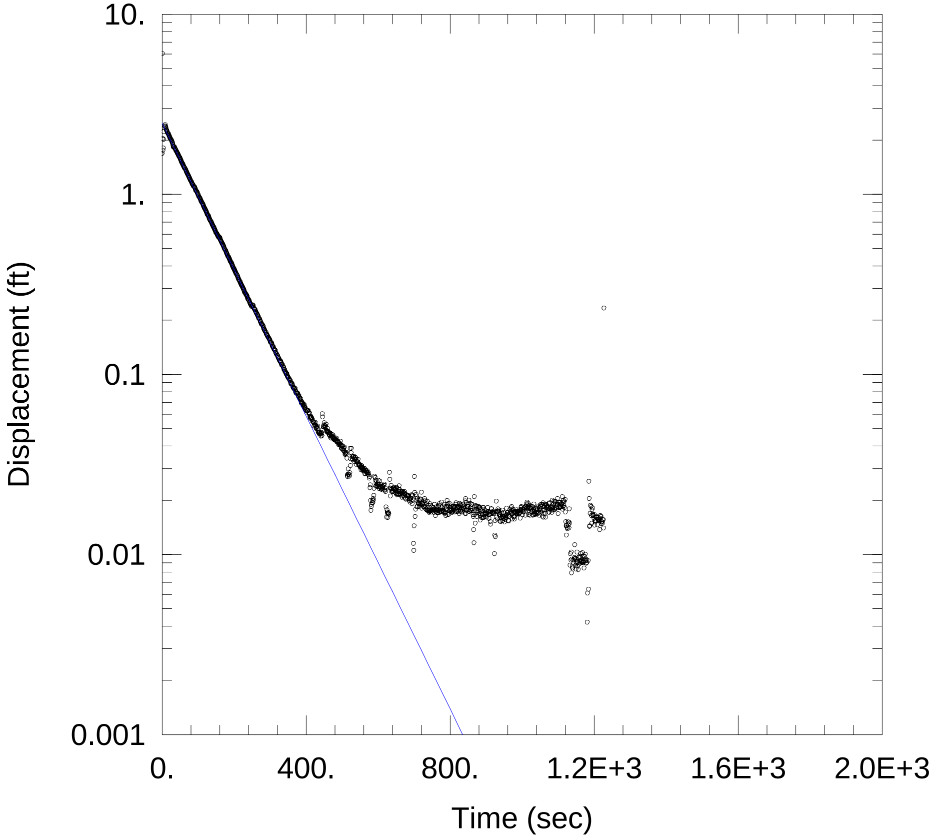
K = 1.841 ft/day
y0 = 2.176 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW_01I)

Initial Displacement: 2.66 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.87 ft
Screen Length: 5. ft
Well Radius: 0.25 ft



UFMW_01I_SLUGOUT_2

Data Set: T:\...\UFMW_01I_slugout_2.aqt
Date: 05/10/17 Time: 14:54:11

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW_01I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

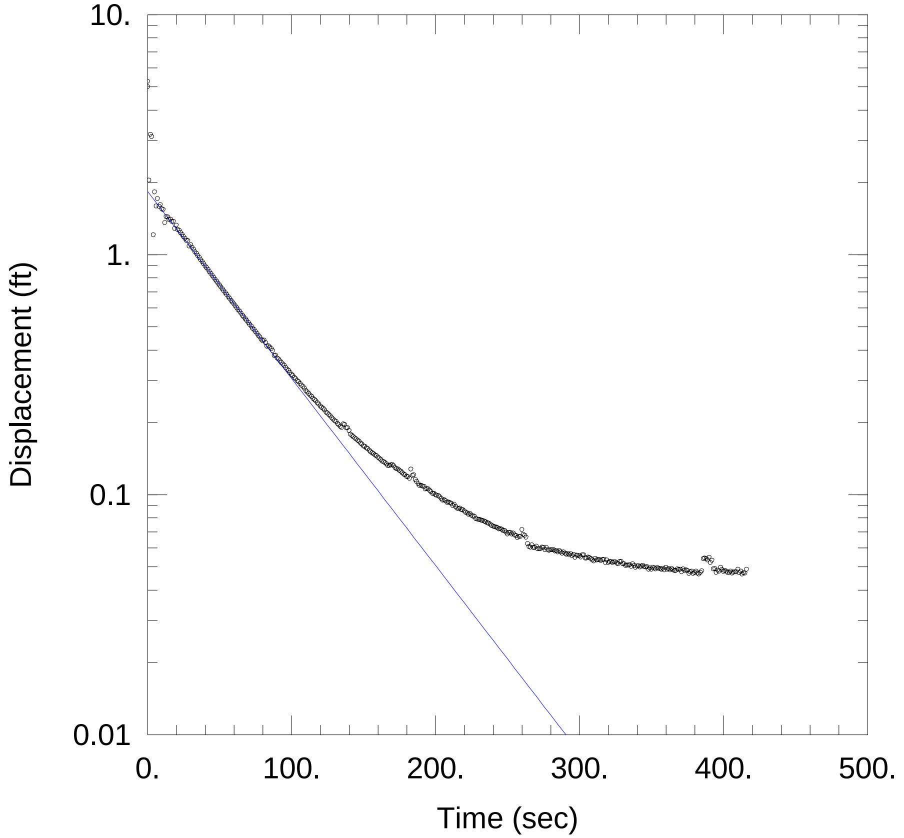
K = 1.692 ft/day
y0 = 2.482 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW_01I)

Initial Displacement: 1.68 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.87 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW_03I_SLUGIN_1

Data Set: T:\...\UFMW_03I_slugin_1.aqt
Date: 05/10/17 Time: 14:55:57

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-03I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 1.814 ft/day
y0 = 1.833 ft

AQUIFER DATA

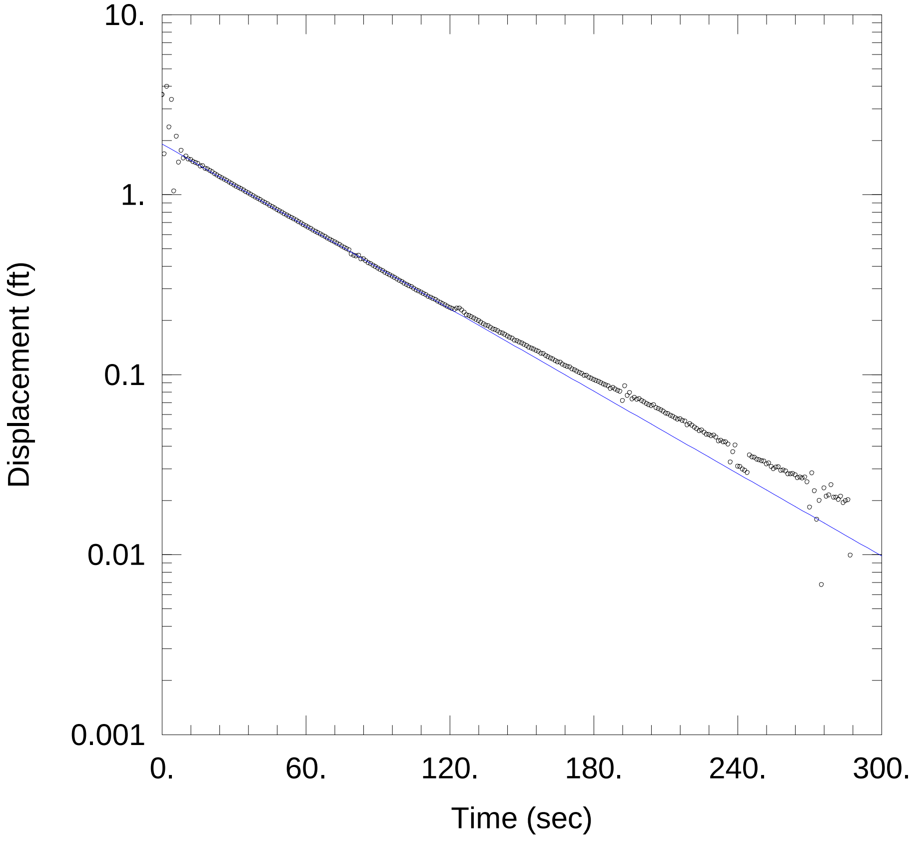
Saturated Thickness: 10.5 ft

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-03I)

Initial Displacement: 5. ft
Total Well Penetration Depth: 14. ft
Casing Radius: 0.083 ft

Static Water Column Height: 13.86 ft
Screen Length: 10. ft
Well Radius: 0.5 ft



UFMW_03I_SLUGIN_2

Data Set: T:\...\UFMW_03I_slugin_2.aqt
Date: 04/27/17 Time: 10:43:12

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-03I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

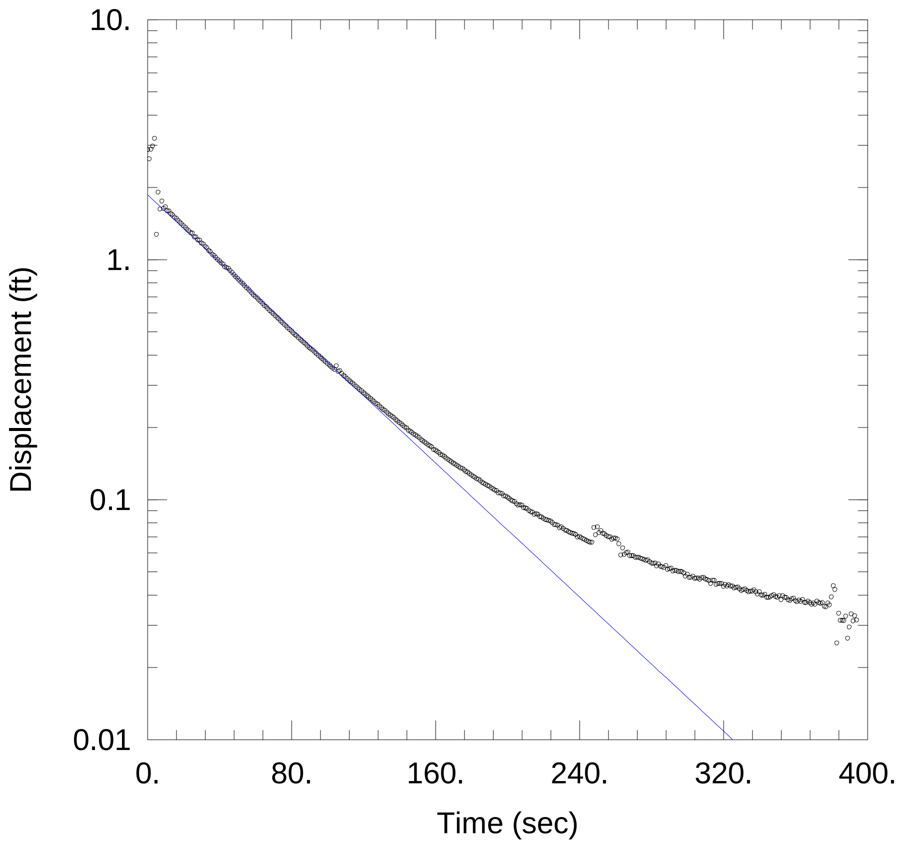
K = 1.581 ft/day
y0 = 1.913 ft

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-03I)

Initial Displacement: 3.6 ft
Total Well Penetration Depth: 14. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.86 ft
Screen Length: 10. ft
Well Radius: 0.25 ft



UFMW_03I_SLUGIN_3

Data Set: T:\...\UFMW_03I_slugin_3.aqt
Date: 05/10/17 Time: 14:57:08

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-03I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

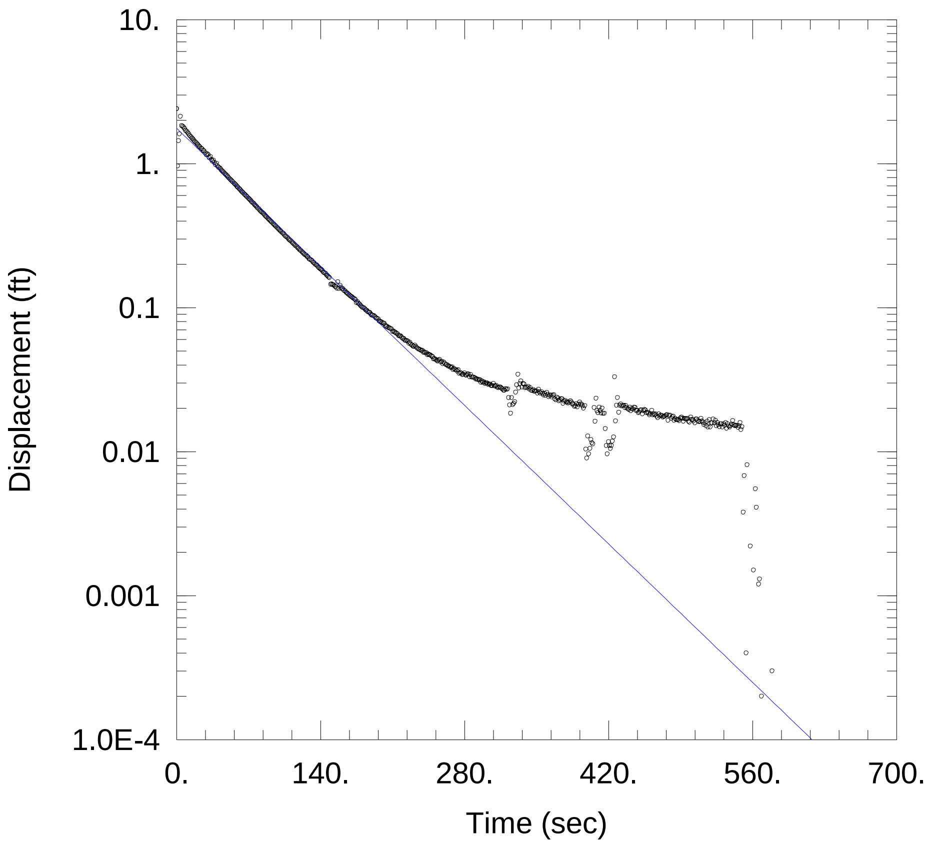
K = 1.626 ft/day
y0 = 1.863 ft

AQUIFER DATA

Saturated Thickness: 10.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-03I)

Initial Displacement: 2.87 ft
Total Well Penetration Depth: 14. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.86 ft
Screen Length: 10. ft
Well Radius: 0.5 ft



UFMW_03I_SLUGOUT_1

Data Set: T:\...\UFMW_03I_slugout_1.aqt
Date: 05/10/17 Time: 14:58:13

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-03I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

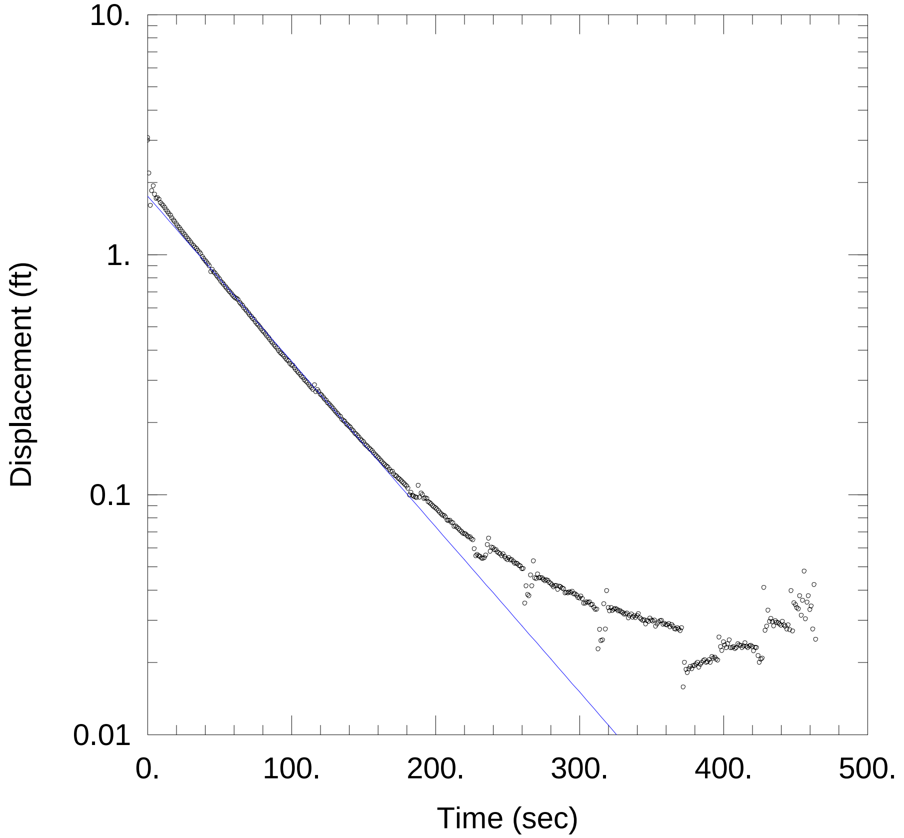
K = 1.599 ft/day
y0 = 1.759 ft

AQUIFER DATA

Saturated Thickness: 10.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-03I)

Initial Displacement: 2.4 ft
Total Well Penetration Depth: 14. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.86 ft
Screen Length: 10. ft
Well Radius: 0.5 ft



UFMW_03I_SLUGOUT_2

Data Set: T:\...\UFMW_03I_slugout_2.aqt
Date: 05/10/17 Time: 15:03:34

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-03I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

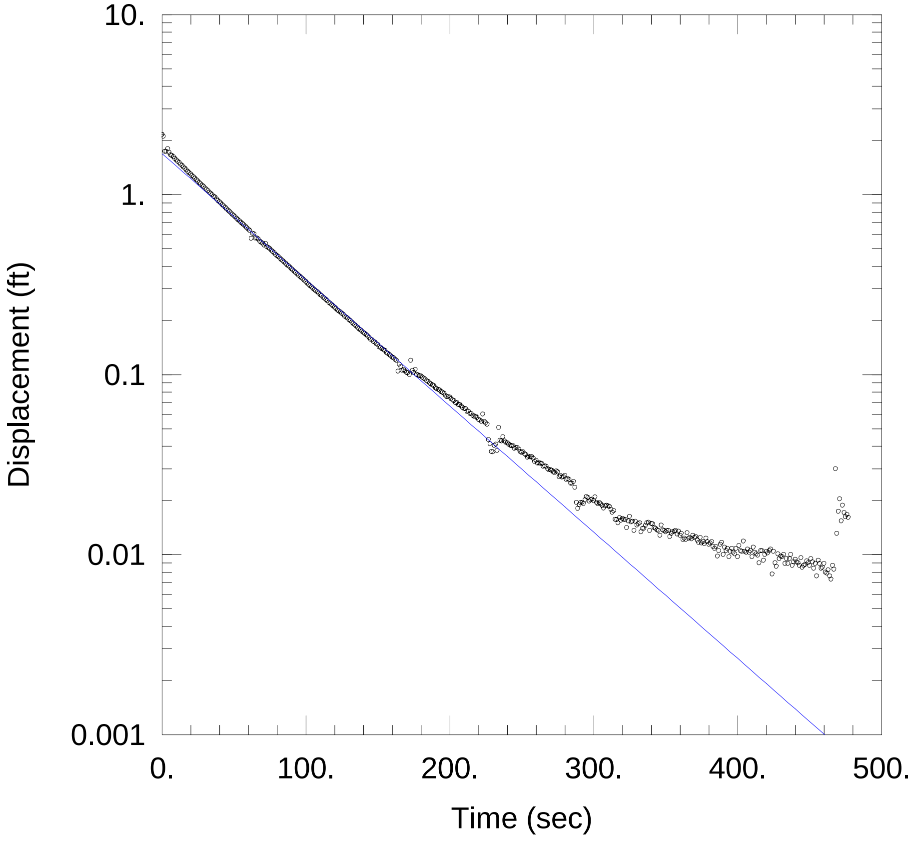
K = 1.603 ft/day
y0 = 1.753 ft

AQUIFER DATA

Saturated Thickness: 10.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-03I)

Initial Displacement: 3. ft
Total Well Penetration Depth: 14. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.86 ft
Screen Length: 10. ft
Well Radius: 0.5 ft



UFMW_03I_SLUGOUT_3

Data Set: T:\...\UFMW_03I_slugout_3.aqt
Date: 05/10/17 Time: 15:04:08

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-03I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

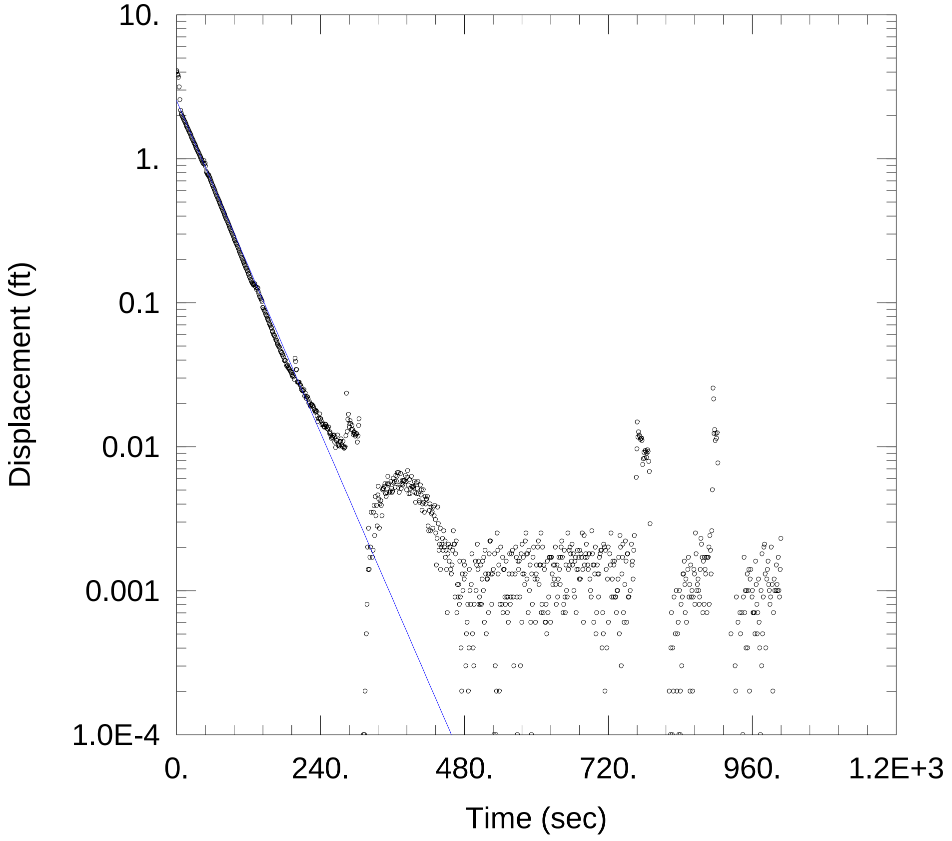
K = 1.632 ft/day
y0 = 1.691 ft

AQUIFER DATA

Saturated Thickness: 10.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-03I)

Initial Displacement: 2.16 ft
Total Well Penetration Depth: 14. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.86 ft
Screen Length: 10. ft
Well Radius: 0.5 ft



UFMW_04I_SLUGIN_1

Data Set: T:\...\UFMW_04I_slugin_1.aqt
Date: 05/10/17 Time: 15:06:10

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-04I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

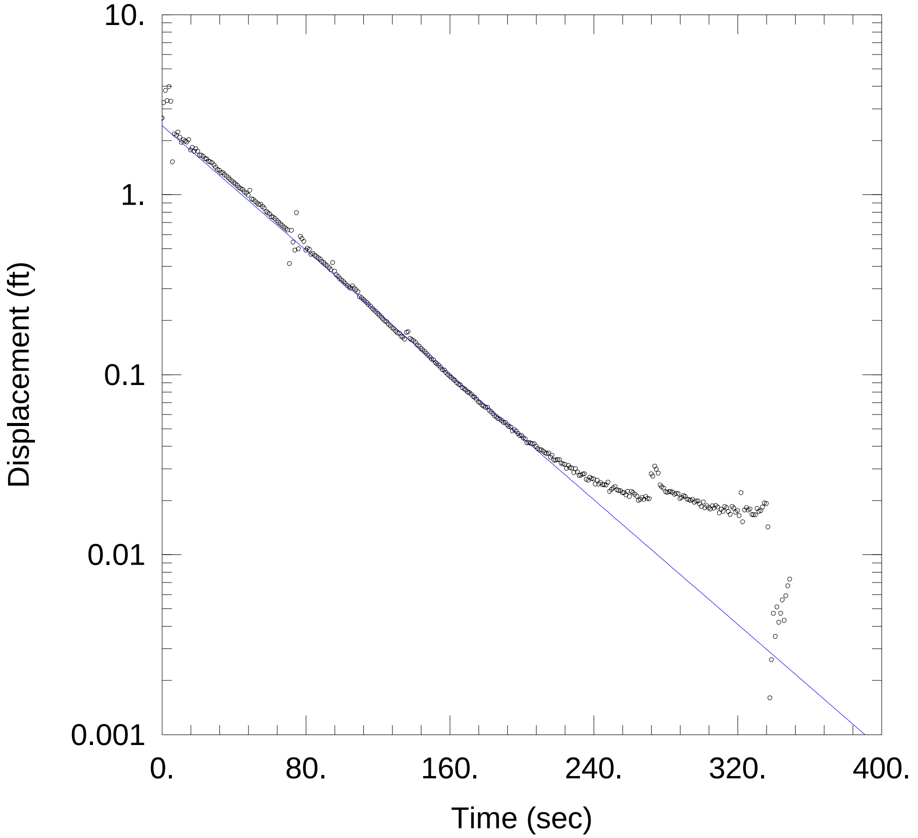
K = 4. ft/day
y0 = 2.53 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-04I)

Initial Displacement: 4. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.9 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW_04I_SLUGIN_2

Data Set: T:\...\UFMW_04I_slugin_2.aqt
Date: 05/10/17 Time: 15:06:51

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-04I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

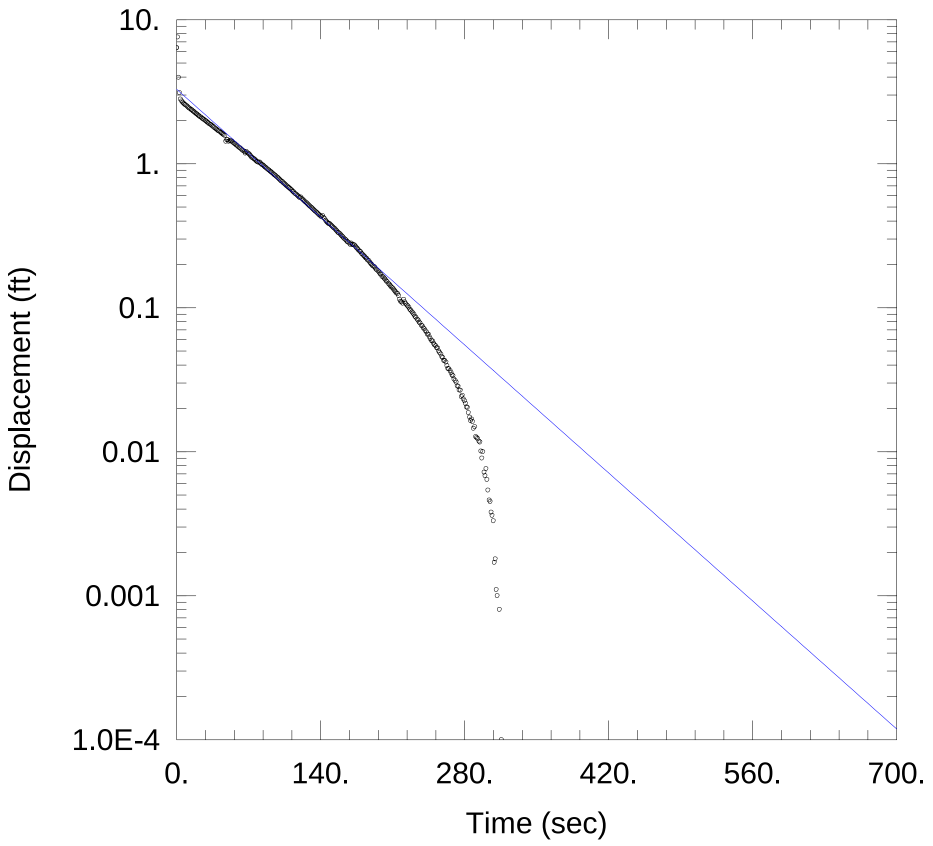
K = 3.605 ft/day
y0 = 2.418 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-04I)

Initial Displacement: 2.66 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.9 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW_04I_SLUGOUT_1

Data Set: T:\...\UFMW_04I_slugout_1.aqt
Date: 05/10/17 Time: 15:07:35

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-04I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

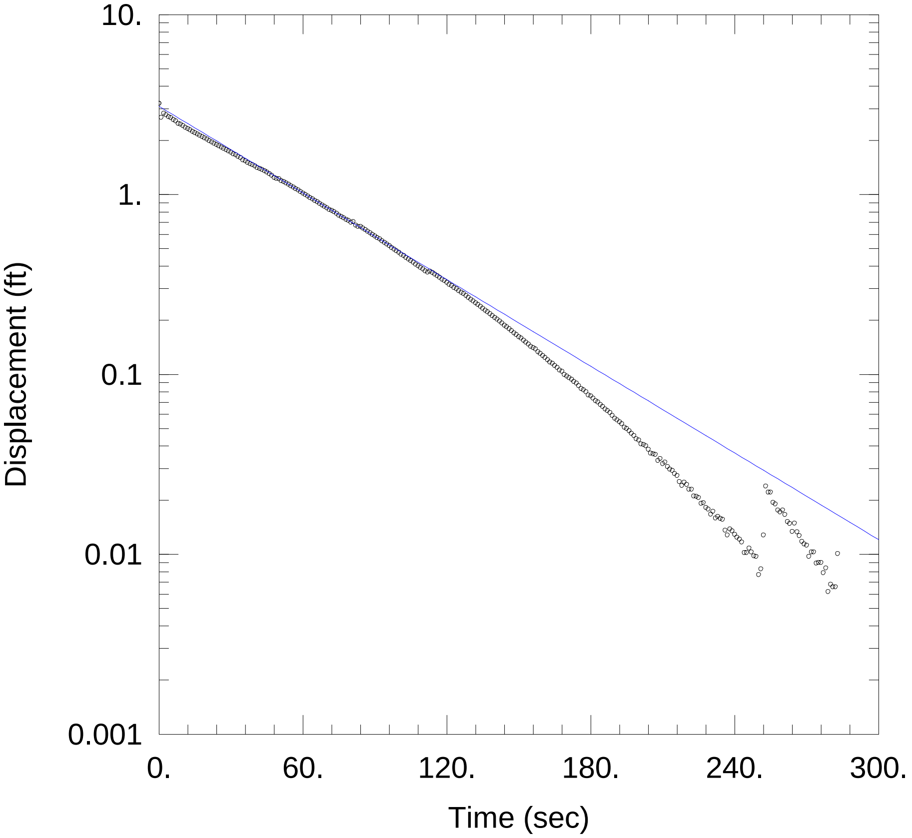
K = 2.643 ft/day
y0 = 3.291 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-04I)

Initial Displacement: 6.37 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.9 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW_04I_SLUGOUT_2

Data Set: T:\...\UFMW_04I_slugout_2.aqt
Date: 05/10/17 Time: 15:08:16

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-04I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

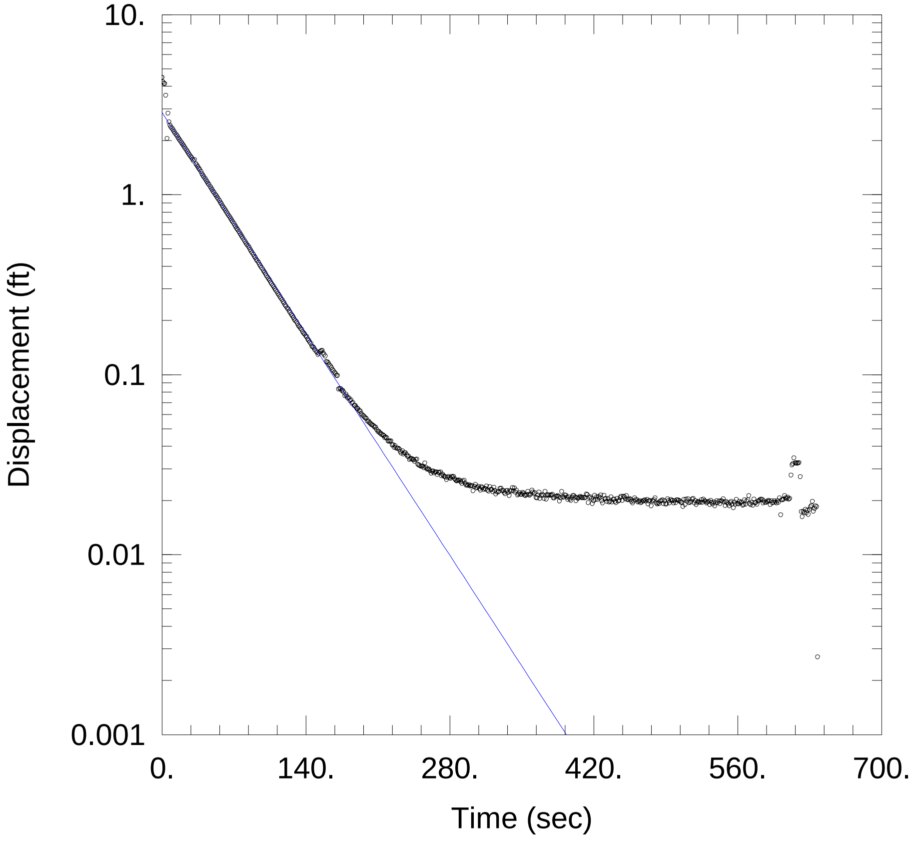
K = 3.344 ft/day
y0 = 3.095 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-04I)

Initial Displacement: 3.21 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.9 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW_06I_SLUGIN_1

Data Set: T:\...\UFMW_06I_slugin_1_MBQC.aqt
Date: 05/10/17 Time: 15:09:19

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-06I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

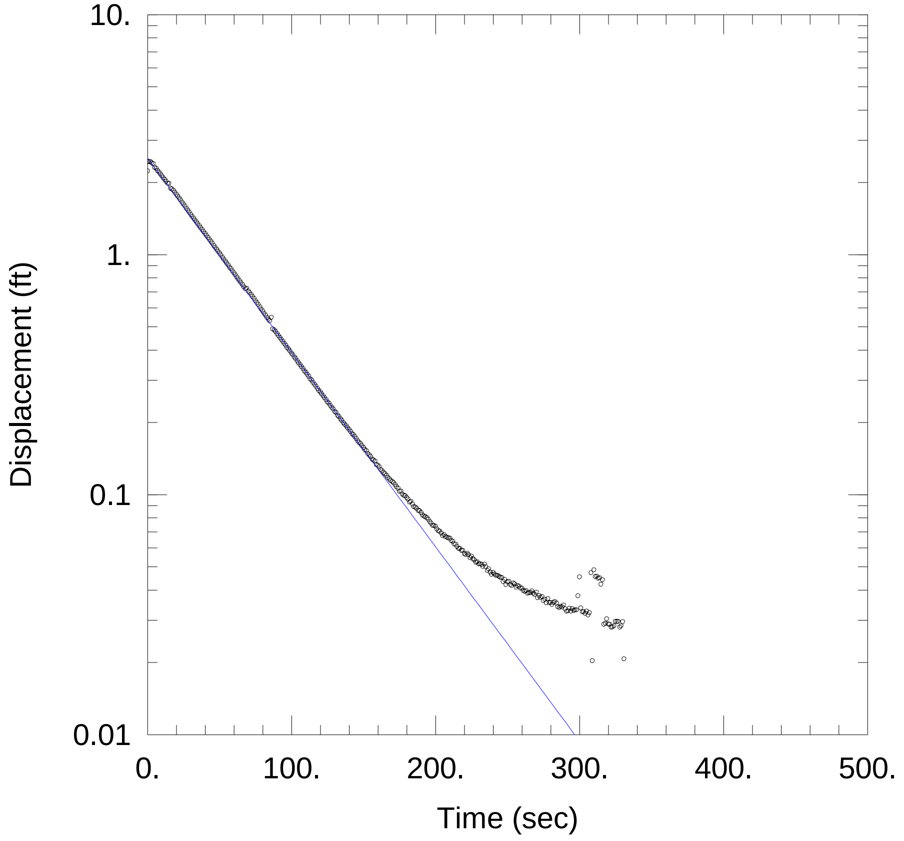
K = 3.659 ft/day
y0 = 2.862 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-06I)

Initial Displacement: 4.47 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.34 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW_06I_SLUGIN_2

Data Set: T:\...\UFMW_06I_slugin_2.aqt
Date: 04/27/17 Time: 11:01:24

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-06I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

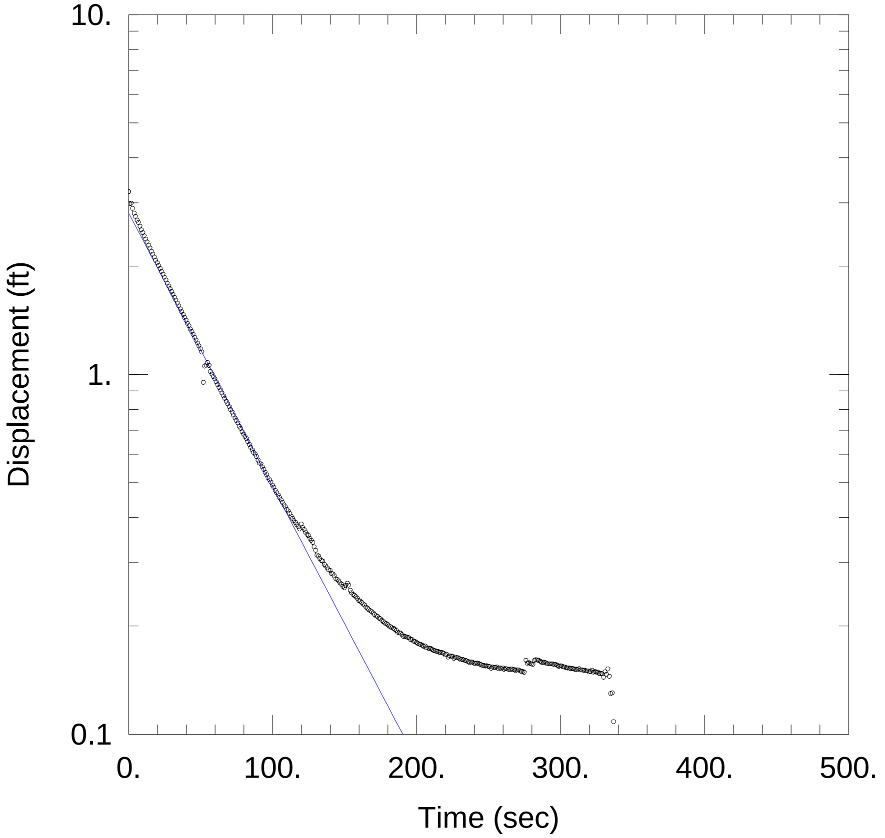
K = 2.167 ft/day
y0 = 2.522 ft

AQUIFER DATA

Saturated Thickness: 11. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-06I)

Initial Displacement: 2.44 ft
Total Well Penetration Depth: 13. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.34 ft
Screen Length: 10. ft
Well Radius: 0.25 ft



UFMW_06I_SLUGOUT_1

Data Set: T:\...\UFMW_06I_slugout_1.aqt
Date: 05/10/17 Time: 15:10:04

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-06I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

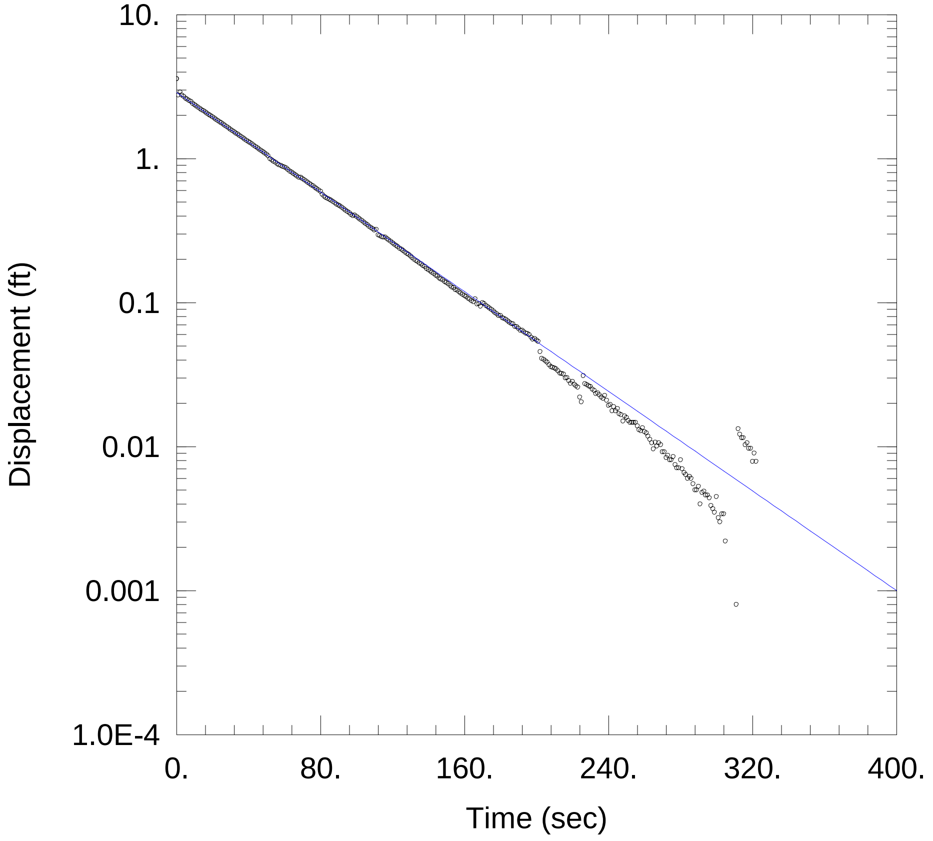
K = 3.169 ft/day
y0 = 2.811 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-06I)

Initial Displacement: 3.22 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.34 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW_06I_SLUGOUT_2

Data Set: T:\...\UFMW_06I_slugout_2.aqt
Date: 05/10/17 Time: 15:10:33

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-06I
Test Date: 4/11/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

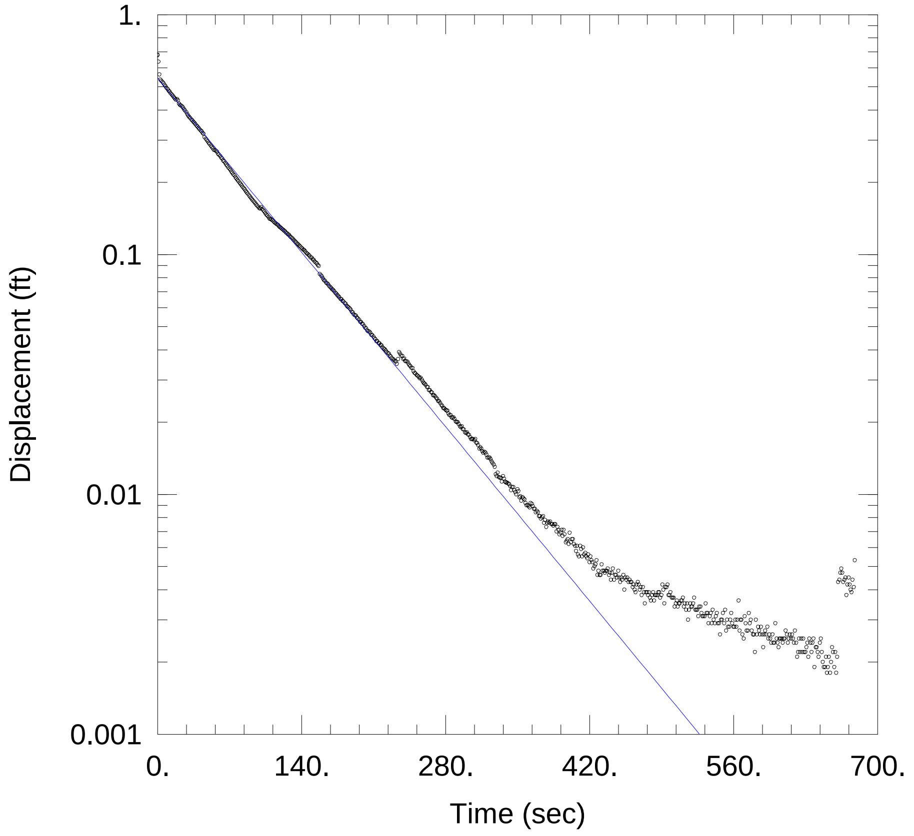
K = 3.601 ft/day
y0 = 2.882 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-06I)

Initial Displacement: 3.58 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.34 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-01D SLUG IN

Data Set: \...\UFMW_01D_slugin_1.aqt
Date: 10/25/17 Time: 10:46:16

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-01D
Test Date: 10/6/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

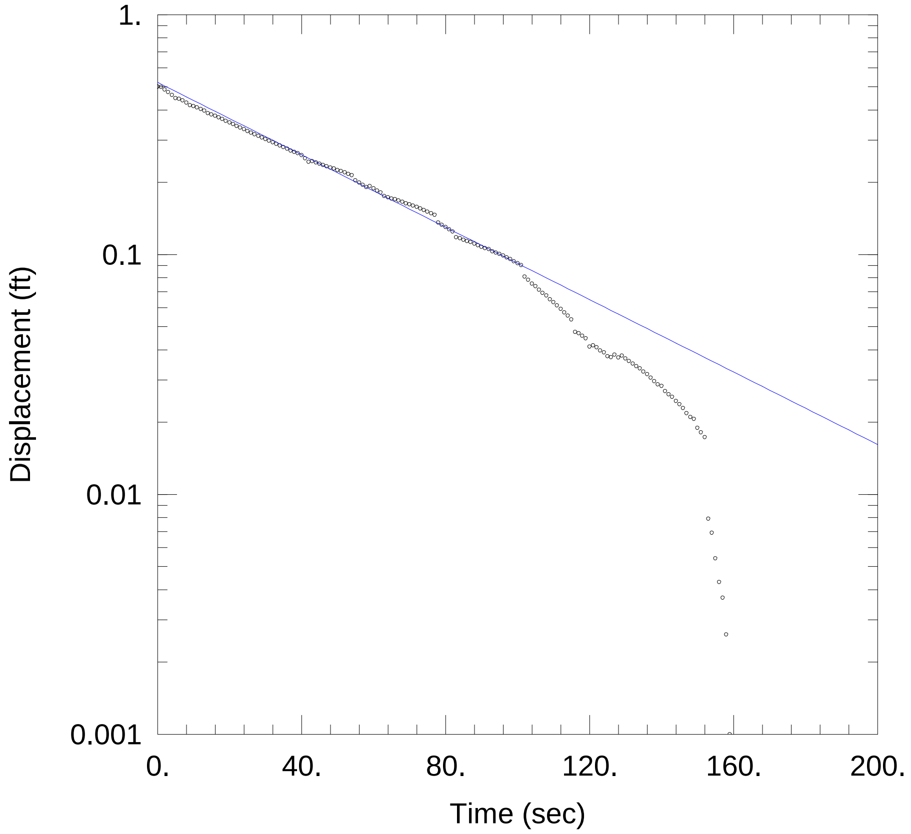
K = 2.409 ft/day
y0 = 0.5446 ft

AQUIFER DATA

Saturated Thickness: 8. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-01D)

Initial Displacement: 0.68 ft
Total Well Penetration Depth: 18.3 ft
Casing Radius: 0.083 ft
Static Water Column Height: 18.3 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-01D SLUG OUT

Data Set: \...\UFMW_01D_slugout_1.aqt
Date: 10/25/17 Time: 10:46:28

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-01D
Test Date: 10/6/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

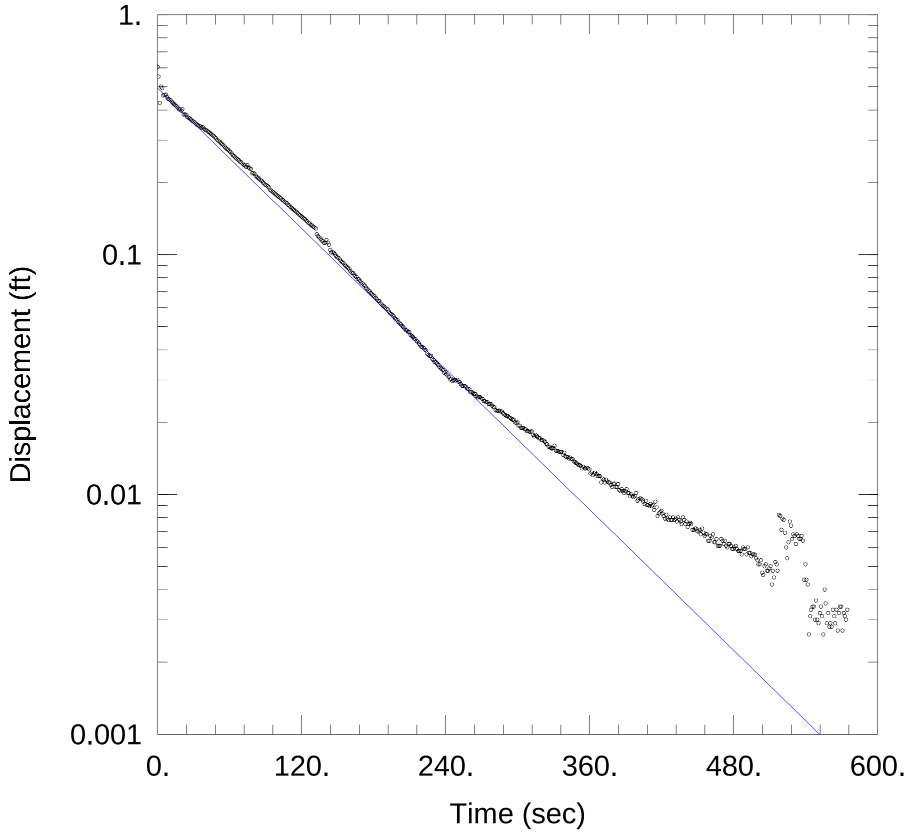
K = 3.502 ft/day
y0 = 0.5219 ft

AQUIFER DATA

Saturated Thickness: 8. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-01D)

Initial Displacement: 0.4997 ft
Total Well Penetration Depth: 18.3 ft
Casing Radius: 0.083 ft
Static Water Column Height: 18.3 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-01I SLUG IN

Data Set: \...\UFMW_01I_slugin_1.aqt
Date: 10/25/17 Time: 10:46:41

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-01I
Test Date: 10/6/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

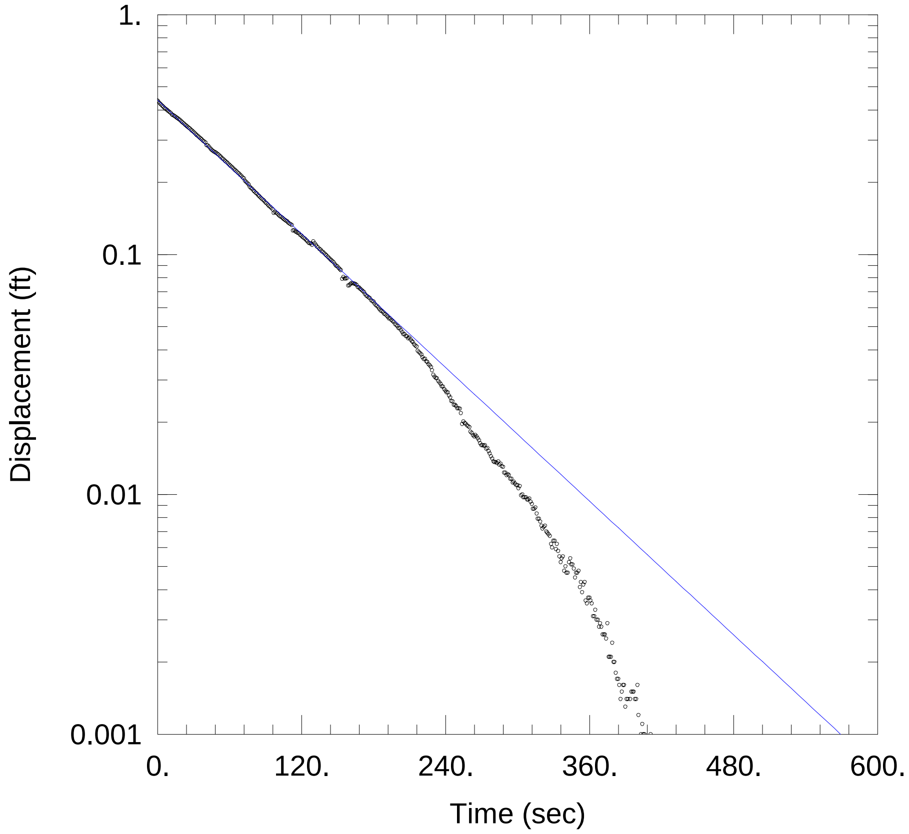
K = 1.97 ft/day
y0 = 0.4944 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-01I)

Initial Displacement: 0.6053 ft
Total Well Penetration Depth: 8.53 ft
Casing Radius: 0.083 ft
Static Water Column Height: 8.53 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-01I SLUG IN

Data Set: \...\UFMW_01I_slugout_1.aqt
Date: 10/25/17 Time: 10:46:52

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-01I
Test Date: 10/6/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

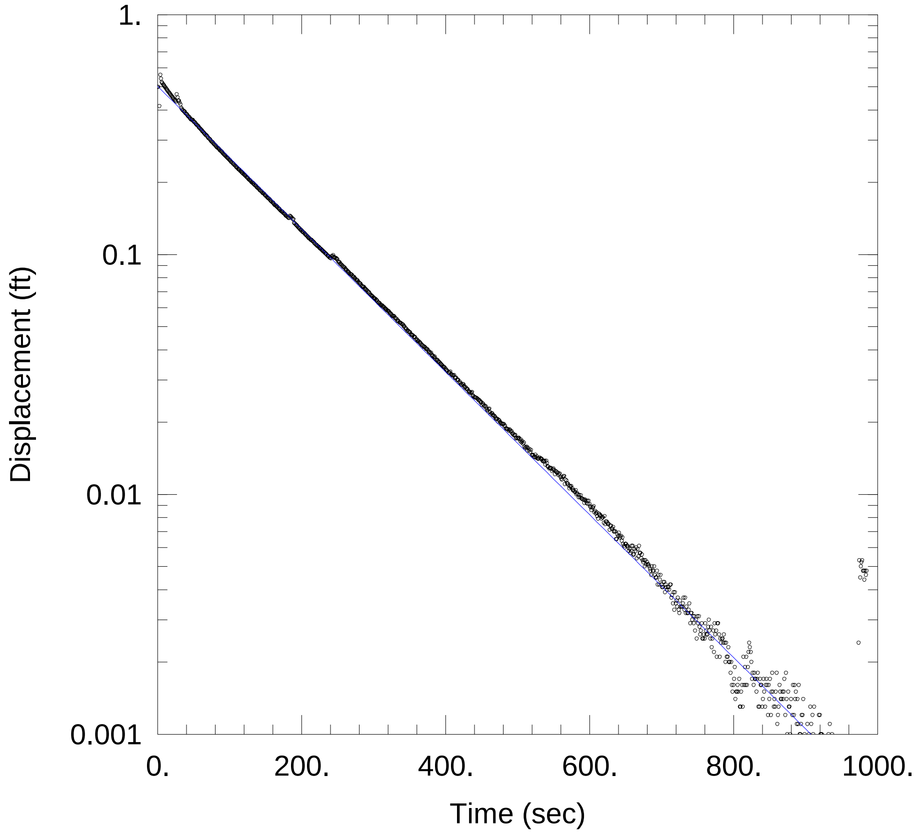
K = 1.873 ft/day
y0 = 0.4397 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-01I)

Initial Displacement: 0.4369 ft
Total Well Penetration Depth: 8.53 ft
Casing Radius: 0.083 ft
Static Water Column Height: 8.53 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-02D SLUG IN

Data Set: \...\UFMW_02D_slugin_1.aqt
Date: 10/25/17 Time: 10:47:06

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-02D
Test Date: 10/6/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

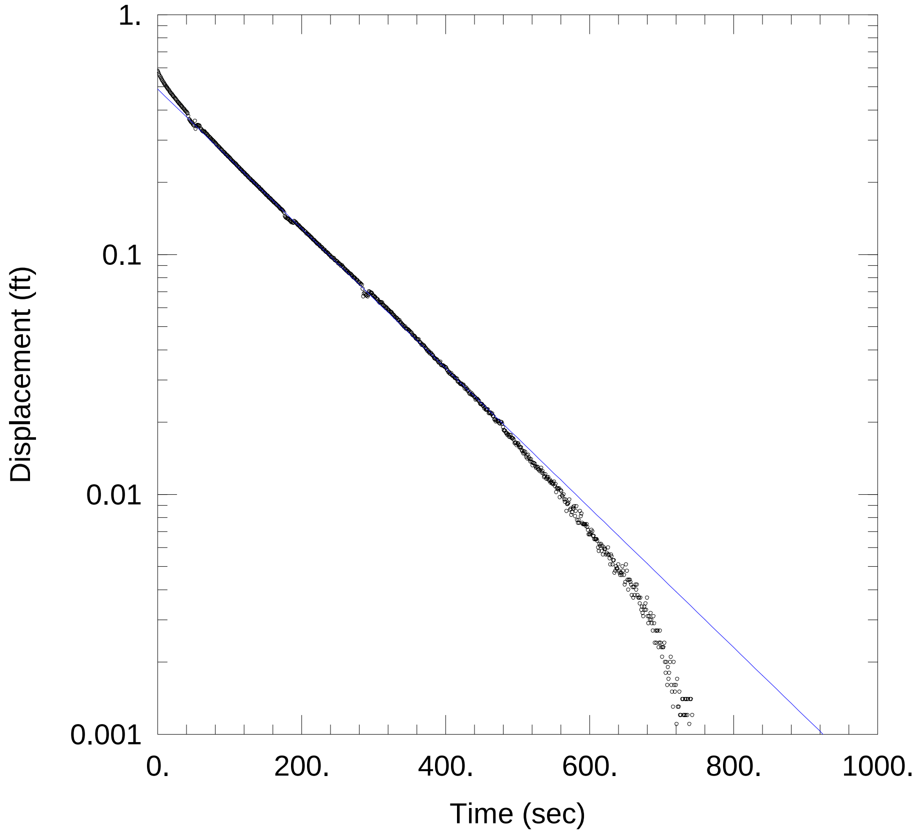
K = 1.371 ft/day
y0 = 0.5029 ft

AQUIFER DATA

Saturated Thickness: 8. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-02D)

Initial Displacement: 0.4994 ft
Total Well Penetration Depth: 17.53 ft
Casing Radius: 0.083 ft
Static Water Column Height: 17.53 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-02D SLUG OUT

Data Set: \...\UFMW_02D_slugout_1.aqt
Date: 10/25/17 Time: 10:47:18

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-02D
Test Date: 10/6/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

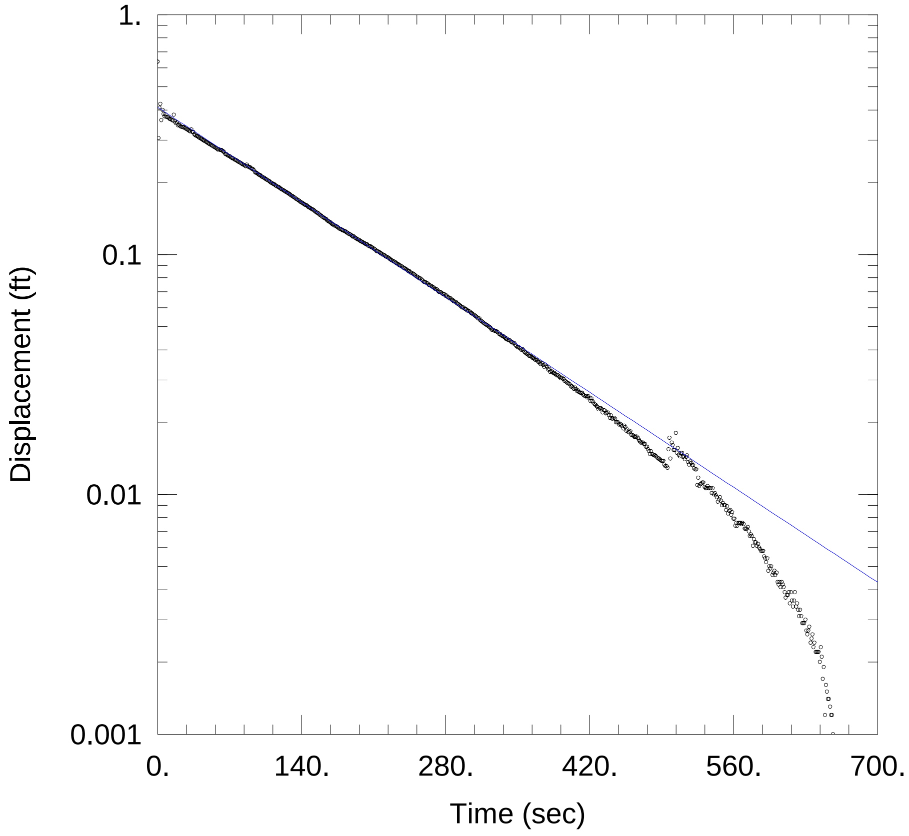
K = 1.341 ft/day
y0 = 0.4899 ft

AQUIFER DATA

Saturated Thickness: 8. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-02D)

Initial Displacement: 0.5823 ft
Total Well Penetration Depth: 17.53 ft
Casing Radius: 0.083 ft
Static Water Column Height: 17.53 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-02I SLUG IN

Data Set: \...\UFMW_02I_slugin_1.aqt
Date: 10/25/17 Time: 10:47:34

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-02I
Test Date: 10/6/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

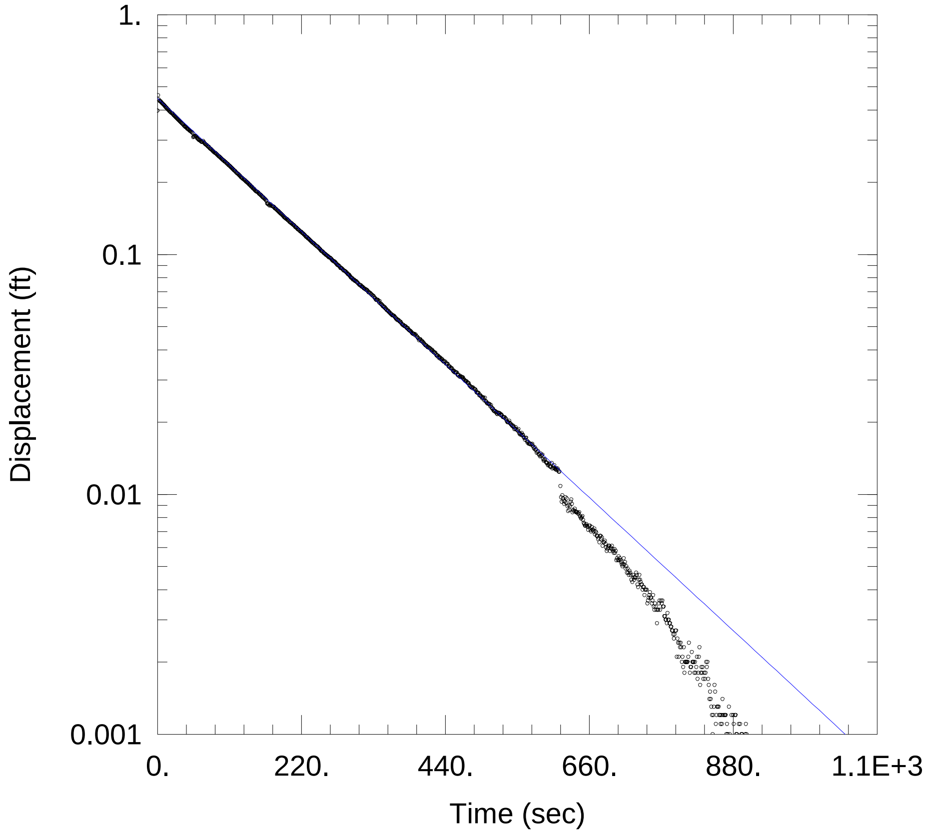
K = 1.193 ft/day
y0 = 0.411 ft

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-02I)

Initial Displacement: 0.6363 ft
Total Well Penetration Depth: 10.69 ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.69 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-02I SLUG OUT

Data Set: \...\UFMW_02I_slugout_1.aqt
Date: 10/25/17 Time: 10:47:45

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-02I
Test Date: 10/6/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

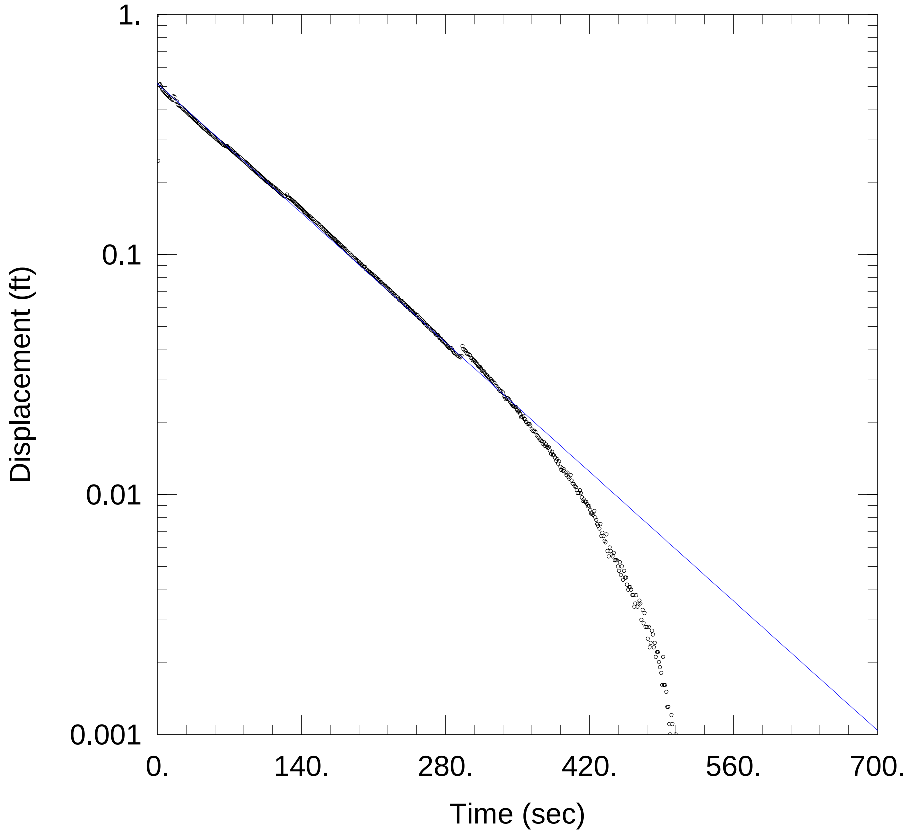
K = 1.064 ft/day
y0 = 0.4485 ft

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-02I)

Initial Displacement: 0.3977 ft
Total Well Penetration Depth: 10.69 ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.69 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-03D SLUG IN

Data Set: \...\UFMW_03D_slugin_1.aqt
Date: 10/25/17 Time: 10:47:58

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-03D
Test Date: 10/6/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

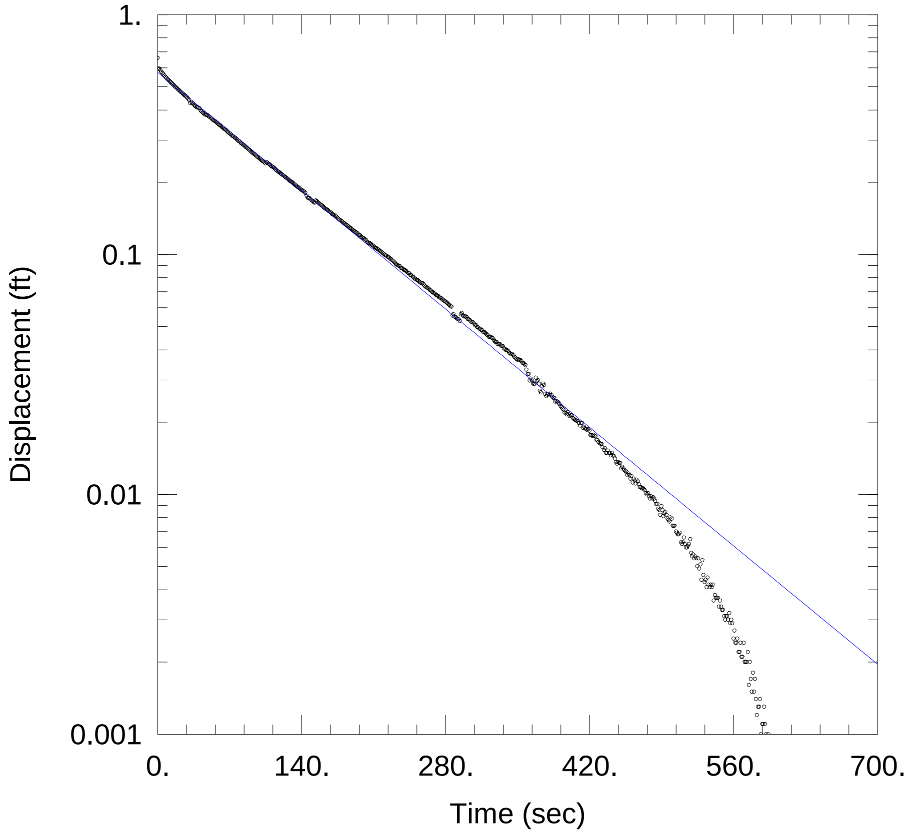
K = 1.829 ft/day
y0 = 0.5149 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-03D)

Initial Displacement: 0.9933 ft
Total Well Penetration Depth: 21.23 ft
Casing Radius: 0.083 ft
Static Water Column Height: 21.23 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-03D SLUG OUT

Data Set: \...\UFMW_03D_slugout_1.aqt
Date: 10/25/17 Time: 10:53:33

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-03D
Test Date: 10/6/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

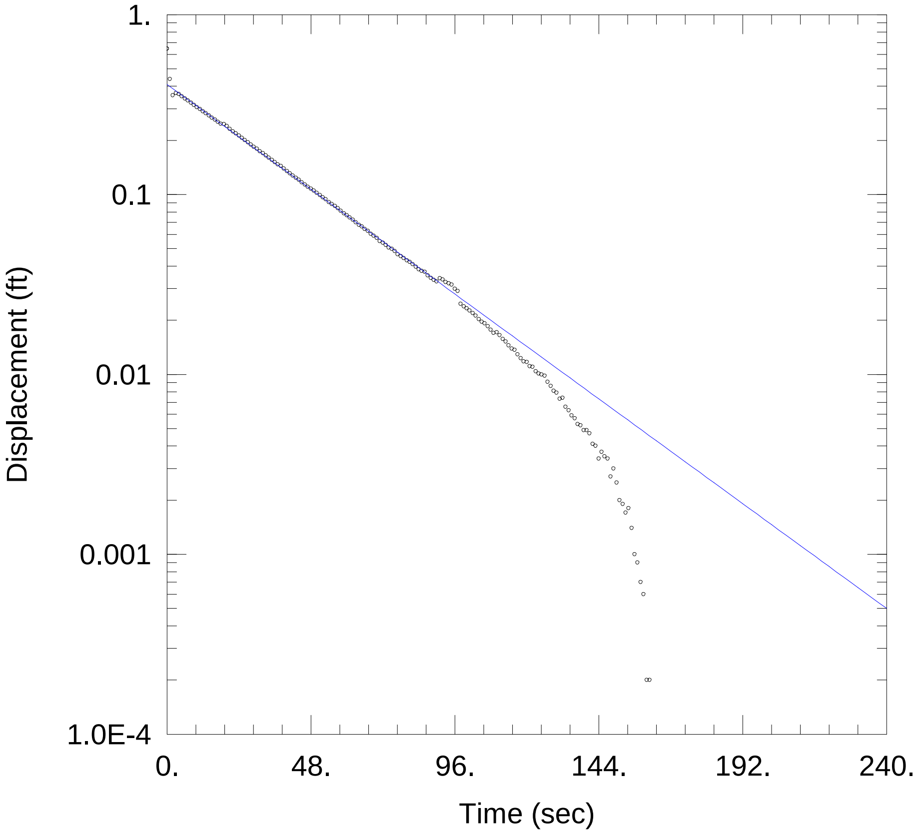
K = 1.676 ft/day
y0 = 0.5754 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-03D)

Initial Displacement: 0.6606 ft
Total Well Penetration Depth: 21.23 ft
Casing Radius: 0.083 ft
Static Water Column Height: 21.23 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-03I SLUG IN

Data Set: \...\UFMW_03I_slugin_1.aqt
Date: 10/25/17 Time: 10:48:22

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-03I
Test Date: 10/6/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

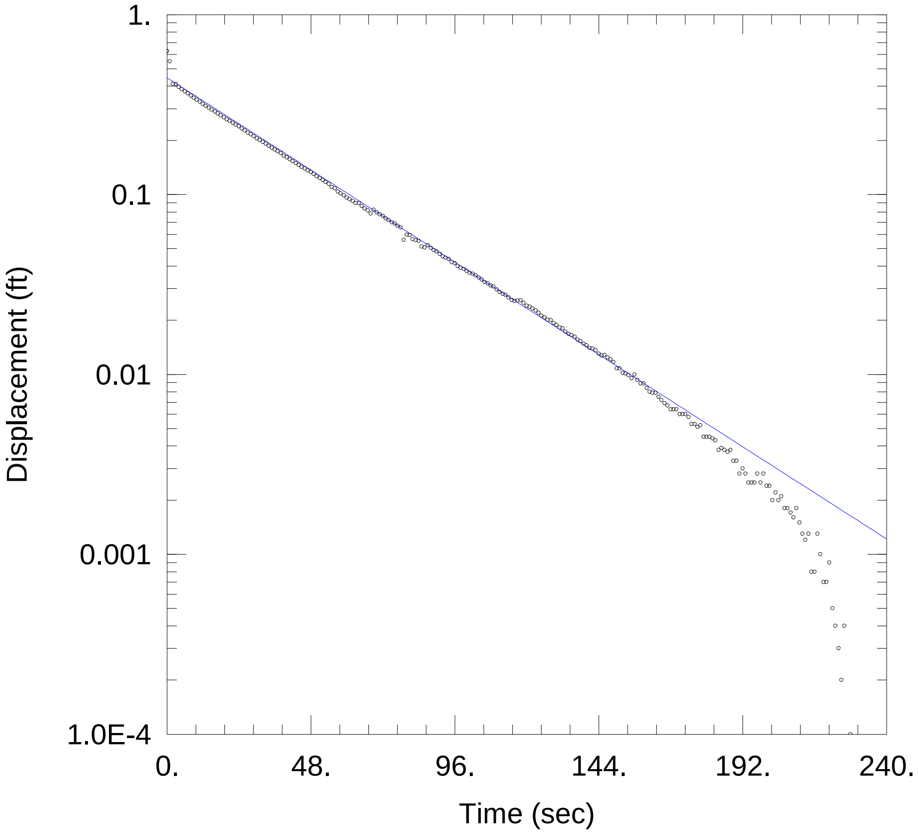
K = 1.906 ft/day
y0 = 0.409 ft

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-03I)

Initial Displacement: 0.6461 ft
Total Well Penetration Depth: 11.25 ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.25 ft
Screen Length: 10. ft
Well Radius: 0.5 ft



UFMW-03I SLUG OUT

Data Set: \...\UFMW_03I_slugout_1.aqt
Date: 10/25/17 Time: 10:48:35

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-03I
Test Date: 10/6/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

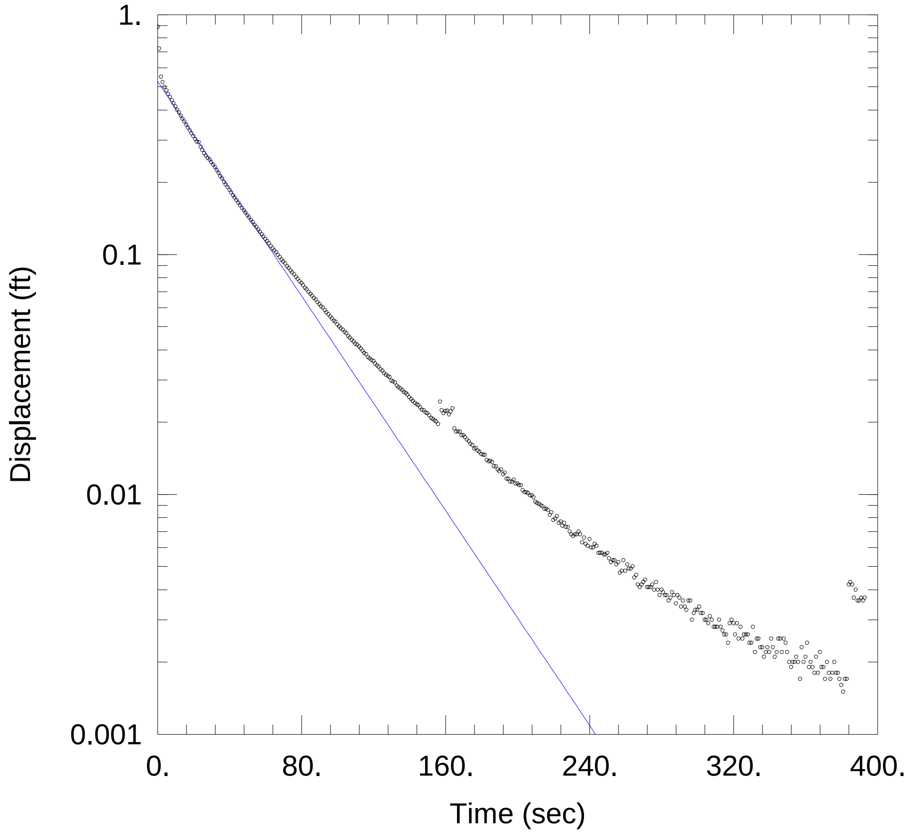
K = 1.678 ft/day
y0 = 0.4461 ft

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-03I)

Initial Displacement: 0.6268 ft
Total Well Penetration Depth: 11.25 ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.25 ft
Screen Length: 10. ft
Well Radius: 0.5 ft



UFMW-04D SLUG IN

Data Set: \...\UFMW_04D_slugin_1.aqt
Date: 10/25/17 Time: 10:48:47

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-04D
Test Date: 10/5/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

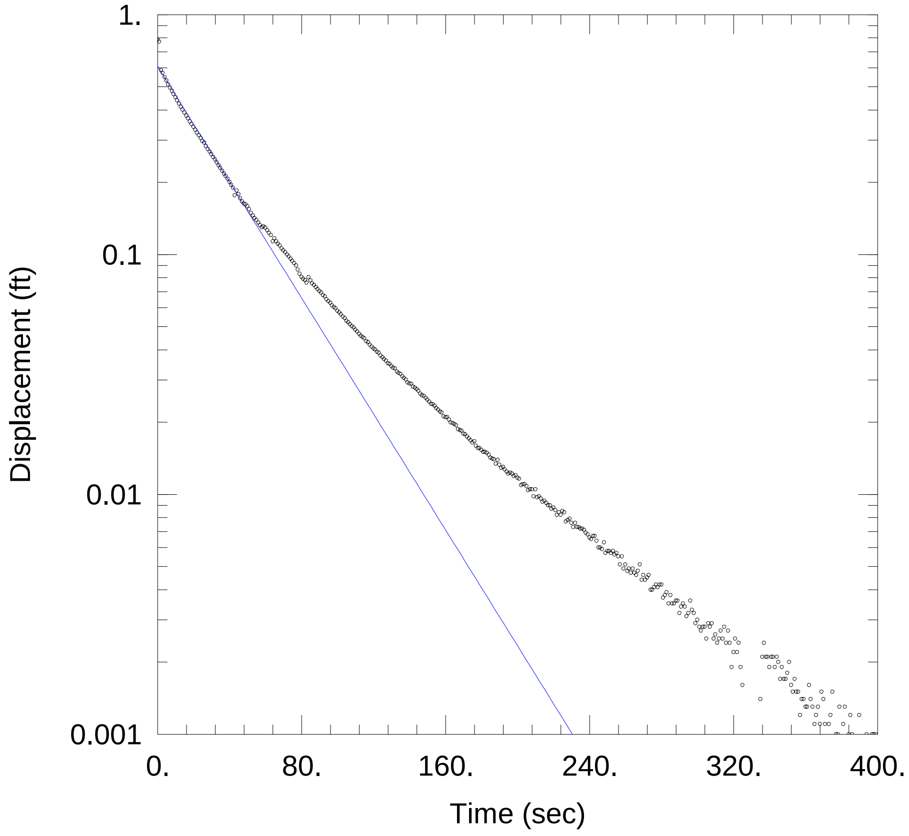
K = 5.237 ft/day
y0 = 0.5271 ft

AQUIFER DATA

Saturated Thickness: 8. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-04D)

Initial Displacement: 0.8879 ft
Total Well Penetration Depth: 19.35 ft
Casing Radius: 0.083 ft
Static Water Column Height: 19.35 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-04D SLUG OUT

Data Set: \...\UFMW_04D_slugout_1.aqt
Date: 10/25/17 Time: 10:48:57

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-04D
Test Date: 10/5/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

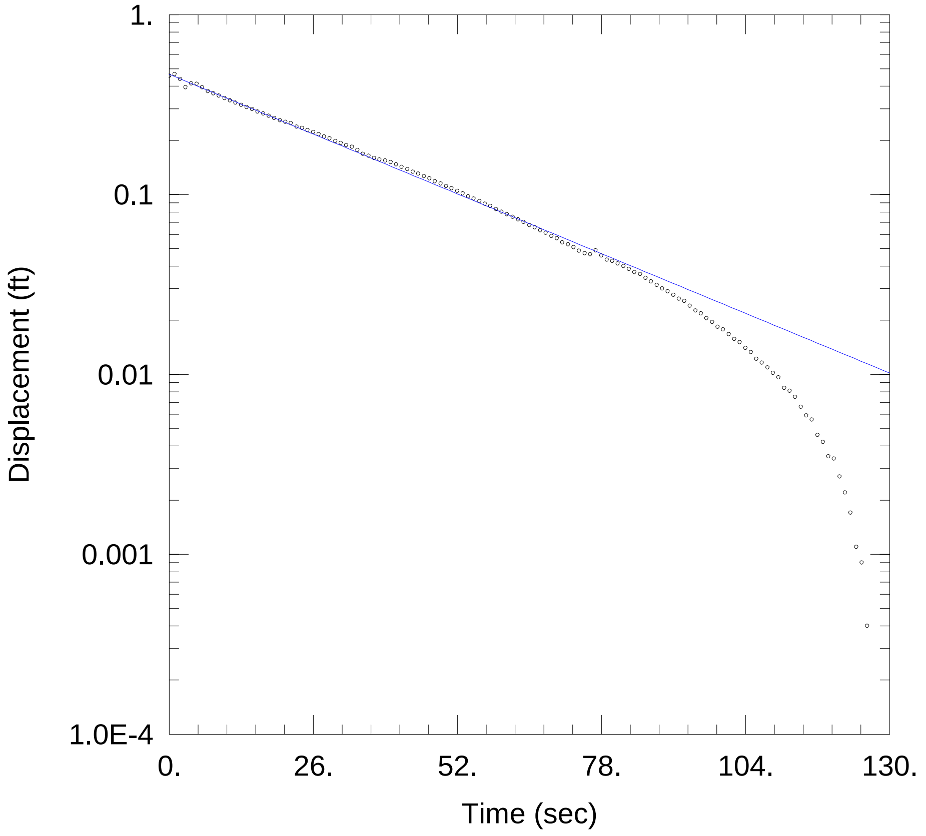
K = 5.658 ft/day
y0 = 0.6099 ft

AQUIFER DATA

Saturated Thickness: 8. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-04D)

Initial Displacement: 0.7861 ft
Total Well Penetration Depth: 19.35 ft
Casing Radius: 0.083 ft
Static Water Column Height: 19.35 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-04I SLUG IN

Data Set: \...\UFMW_04I_slugin_1.aqt
Date: 10/25/17 Time: 10:49:11

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-04I
Test Date: 10/5/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

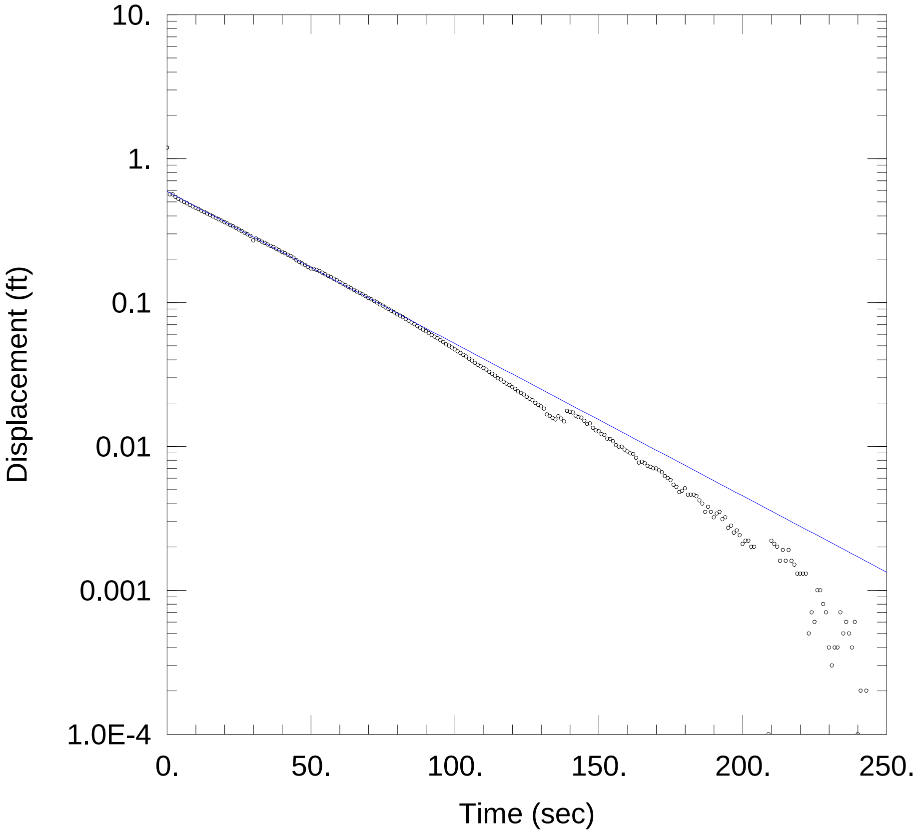
K = 5.253 ft/day
y0 = 0.4658 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-04I)

Initial Displacement: 0.4568 ft
Total Well Penetration Depth: 9.39 ft
Casing Radius: 0.083 ft
Static Water Column Height: 9.39 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-04I SLUG OUT

Data Set: \...\UFMW_04I_slugout_1.aqt
Date: 10/25/17 Time: 10:49:21

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-04I
Test Date: 10/5/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

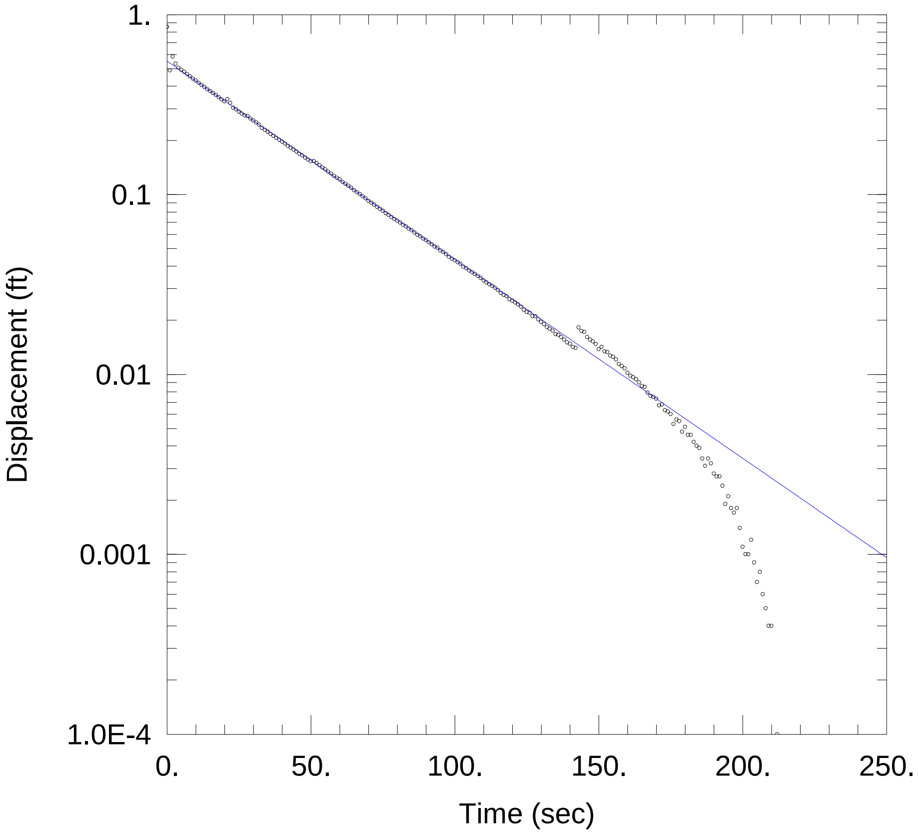
K = 4.352 ft/day
y0 = 0.5918 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-04I)

Initial Displacement: 1.189 ft
Total Well Penetration Depth: 9.39 ft
Casing Radius: 0.083 ft
Static Water Column Height: 9.39 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-05D SLUG IN

Data Set: \...\UFMW_05D_slugin_1.aqt
Date: 10/25/17 Time: 10:49:34

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-05D
Test Date: 10/6/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

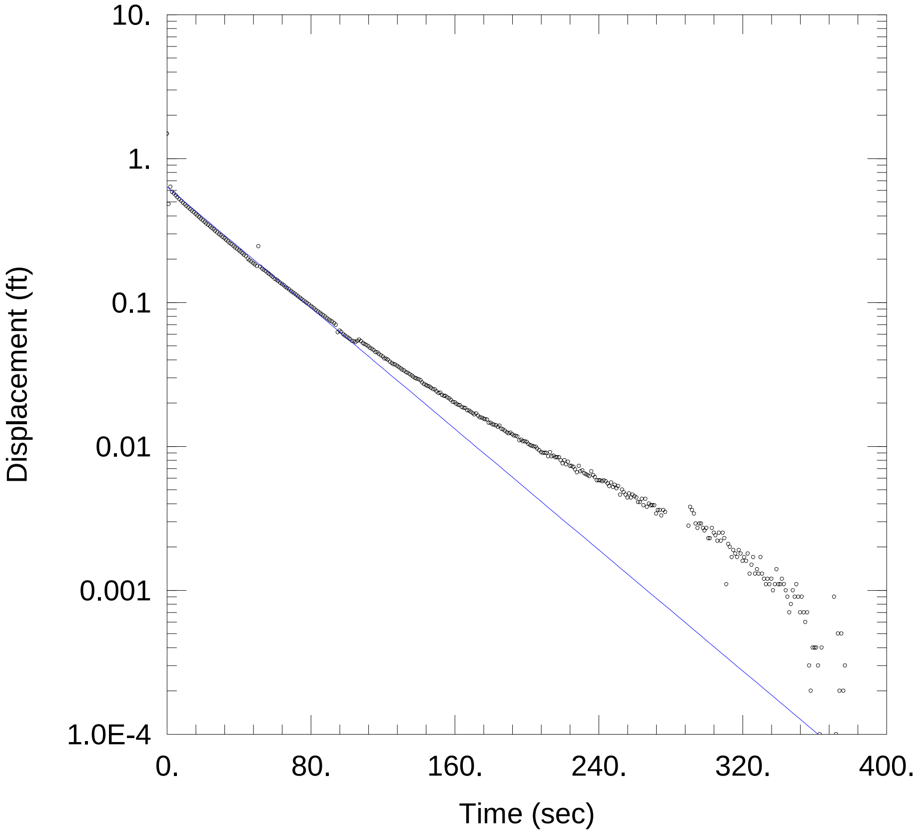
K = 5.24 ft/day
y0 = 0.5516 ft

AQUIFER DATA

Saturated Thickness: 7.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-05D)

Initial Displacement: 0.8559 ft
Total Well Penetration Depth: 21.07 ft
Casing Radius: 0.083 ft
Static Water Column Height: 21.07 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-05D SLUG OUT

Data Set: \...\UFMW_05D_slugout_1.aqt
Date: 10/25/17 Time: 10:49:44

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-05D
Test Date: 10/6/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

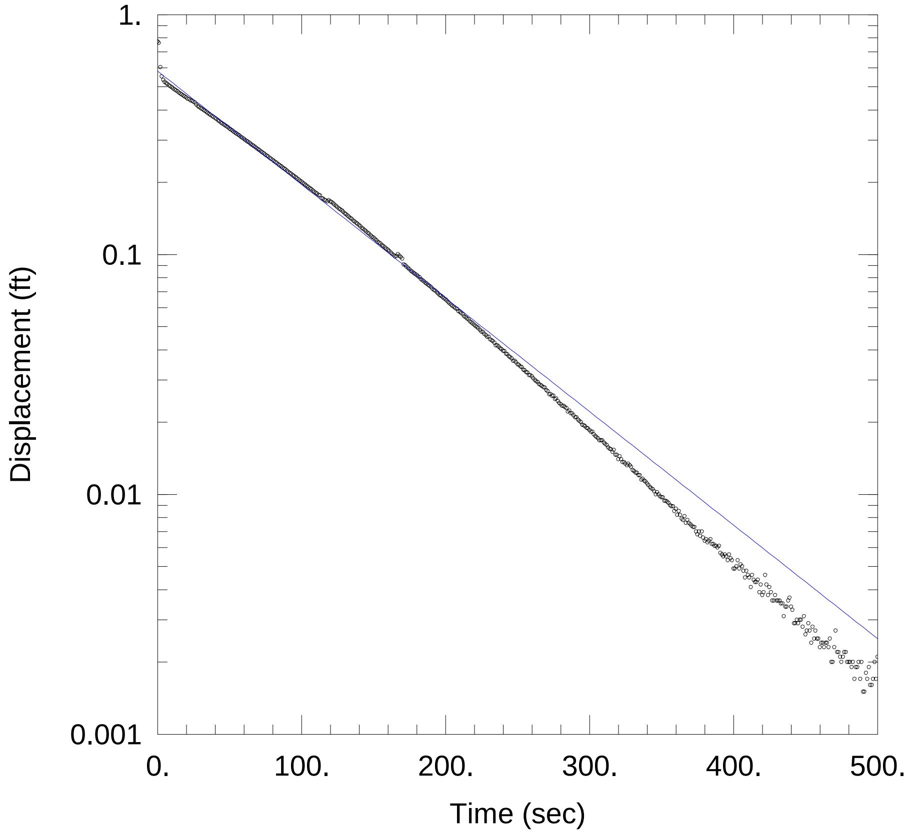
K = 4.988 ft/day
y0 = 0.635 ft

AQUIFER DATA

Saturated Thickness: 7.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-05D)

Initial Displacement: 1.484 ft
Total Well Penetration Depth: 21.07 ft
Casing Radius: 0.083 ft
Static Water Column Height: 21.07 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-05I SLUG IN

Data Set: \...\UFMW_05I_slugin_1.aqt
Date: 10/25/17 Time: 10:49:57

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-05I
Test Date: 10/6/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

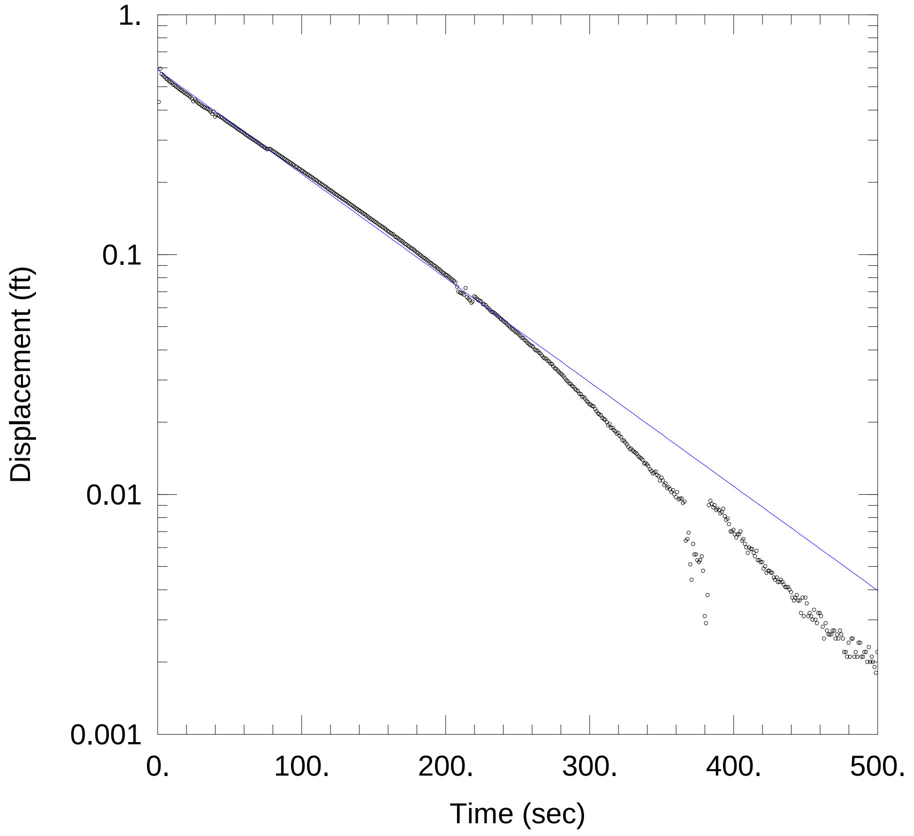
K = 2.006 ft/day
y0 = 0.5817 ft

AQUIFER DATA

Saturated Thickness: 7.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-05I)

Initial Displacement: 0.7705 ft
Total Well Penetration Depth: 10.97 ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.97 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-05I SLUG OUT

Data Set: \...\UFMW_05I_slugout_1.aqt
Date: 10/25/17 Time: 10:50:09

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-05I
Test Date: 10/6/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

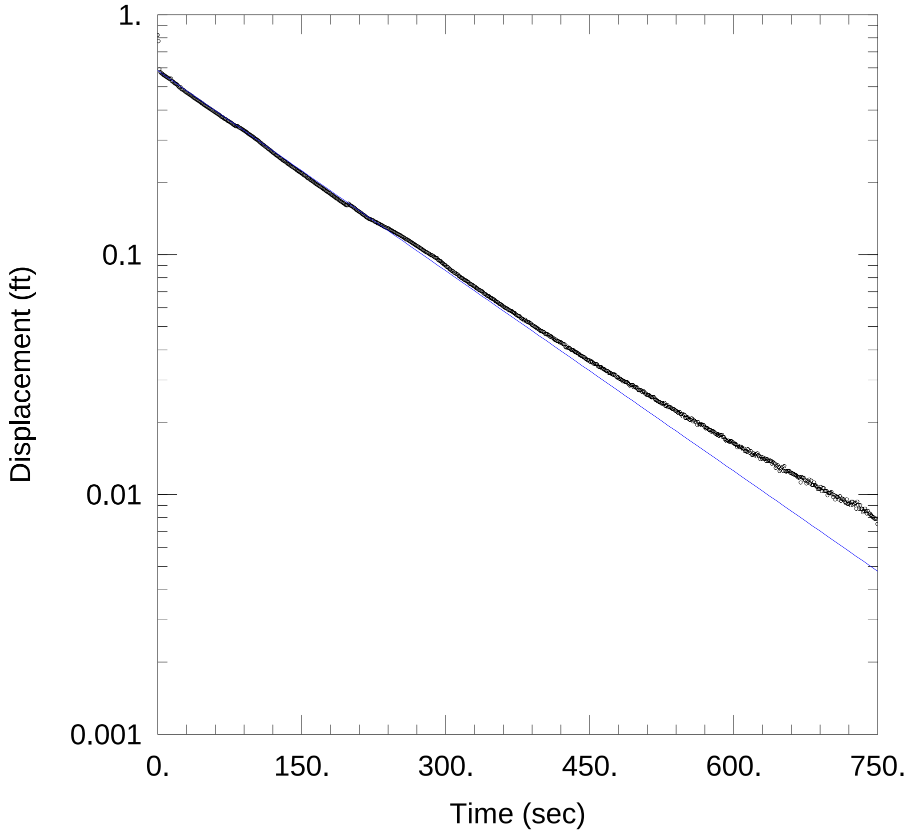
K = 1.84 ft/day
y0 = 0.5894 ft

AQUIFER DATA

Saturated Thickness: 7.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-05I)

Initial Displacement: 1.102 ft
Total Well Penetration Depth: 10.97 ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.97 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-06D SLUG IN

Data Set: \...\UFMW_06D_slugin_1.aqt
Date: 10/25/17 Time: 10:50:21

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-06D
Test Date: 10/5/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

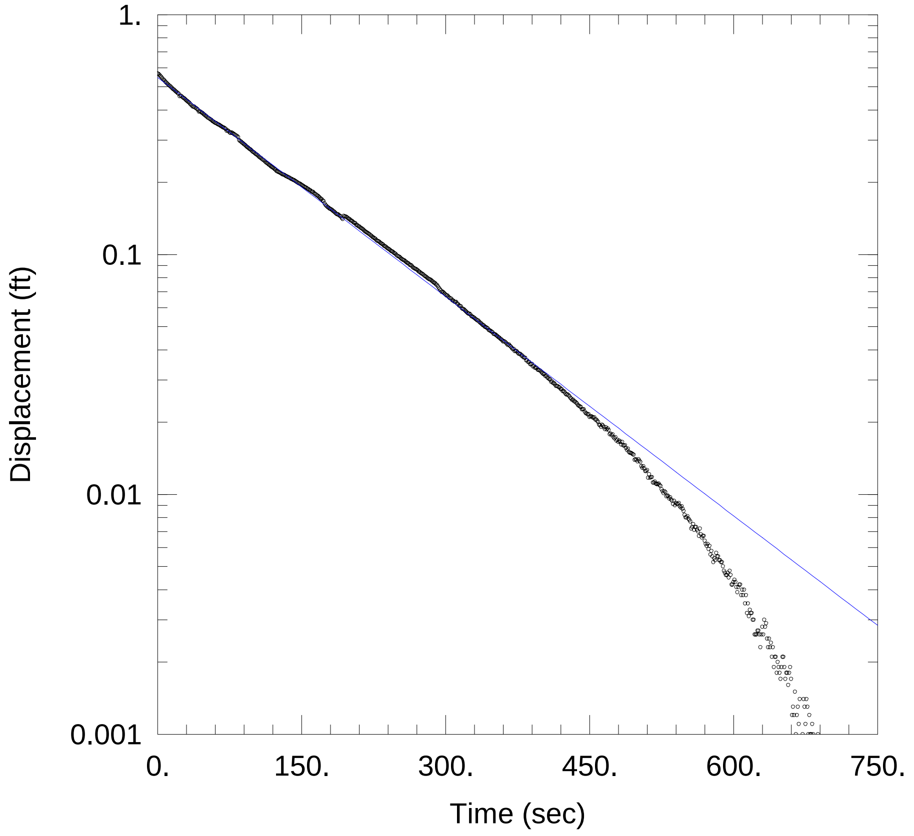
K = 0.9189 ft/day
y0 = 0.5849 ft

AQUIFER DATA

Saturated Thickness: 4. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-06D)

Initial Displacement: 0.8207 ft
Total Well Penetration Depth: 23.15 ft
Casing Radius: 0.083 ft
Static Water Column Height: 23.15 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-06D SLUG OUT

Data Set: \...\UFMW_06D_slugout_1.aqt
Date: 10/25/17 Time: 10:50:31

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-06D
Test Date: 10/5/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

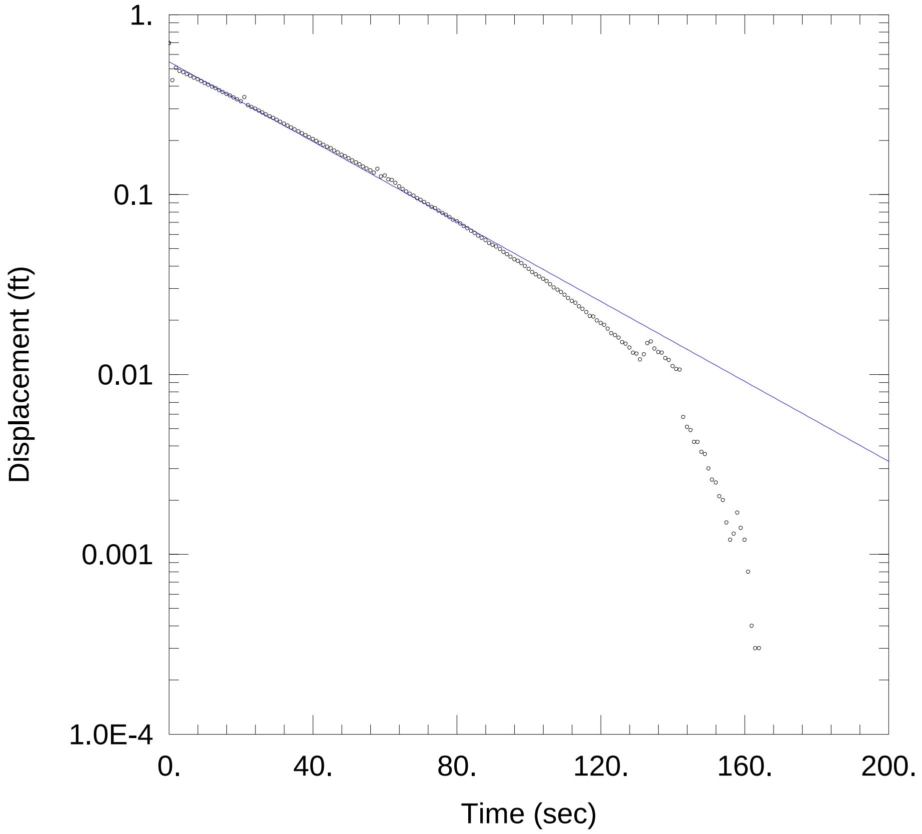
K = 1.006 ft/day
y0 = 0.5474 ft

AQUIFER DATA

Saturated Thickness: 4. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-06D)

Initial Displacement: 0.5672 ft
Total Well Penetration Depth: 23.15 ft
Casing Radius: 0.083 ft
Static Water Column Height: 23.15 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-06I SLUG IN

Data Set: \...\UFMW_06I_slugin_1.aqt
Date: 10/25/17 Time: 10:50:45

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-06I
Test Date: 10/5/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

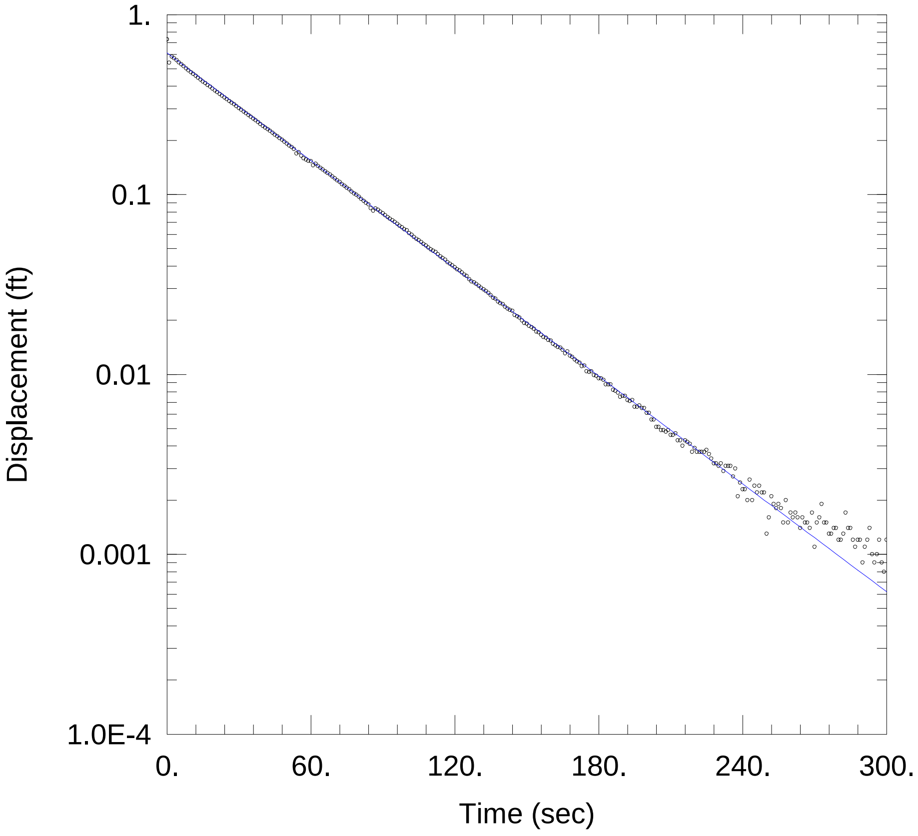
K = 5.062 ft/day
y0 = 0.5478 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-06I)

Initial Displacement: 0.6944 ft
Total Well Penetration Depth: 16.43 ft
Casing Radius: 0.083 ft
Static Water Column Height: 16.43 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



UFMW-06I SLUG OUT

Data Set: \...\UFMW_06I_slugout_1.aqt
Date: 10/25/17 Time: 10:50:54

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-06I
Test Date: 10/5/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

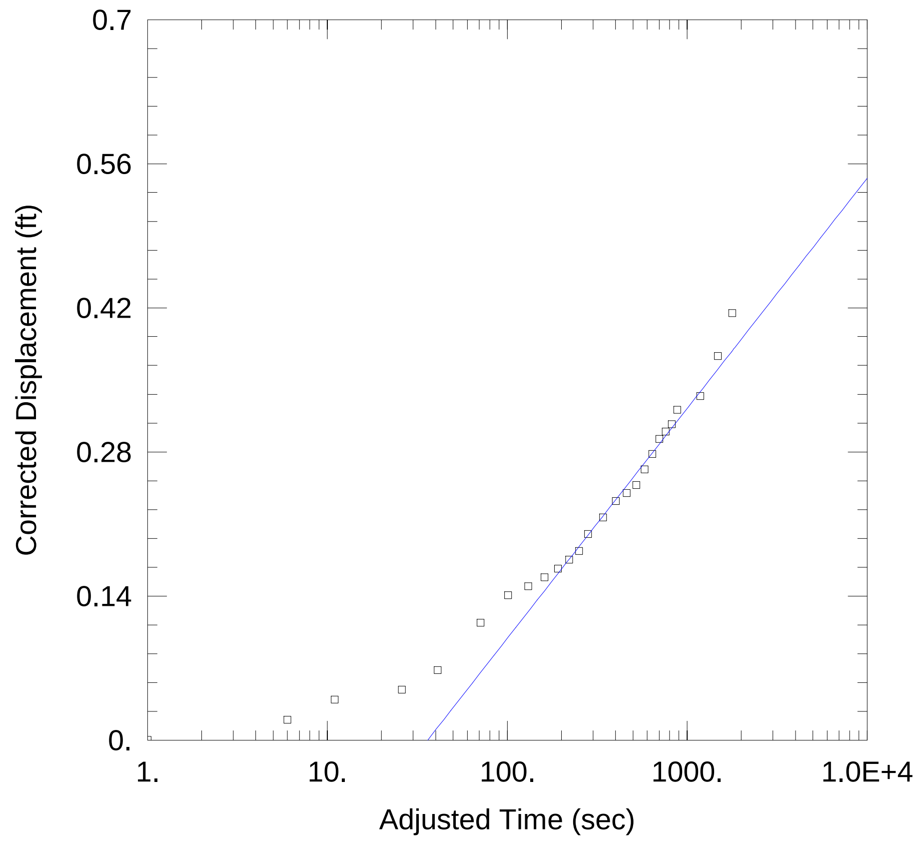
K = 4.549 ft/day
y0 = 0.6124 ft

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFMW-06I)

Initial Displacement: 0.7275 ft
Total Well Penetration Depth: 16.43 ft
Casing Radius: 0.083 ft
Static Water Column Height: 16.43 ft
Screen Length: 5. ft
Well Radius: 0.5 ft



PUMPING TEST FOR UFMW-05S (0.5 L/MIN)

Data Set: \...\UFMW-05S 0.5.aqt
Date: 10/26/17 Time: 08:41:46

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-05S
Test Date: 10/10/2017

SOLUTION

Aquifer Model: Unconfined
Solution Method: Cooper-Jacob

T = 20.52 ft^2/day
S = 0.3081

AQUIFER DATA

Saturated Thickness: 1.22 ft

Anisotropy Ratio (Kz/Kr): 0.1

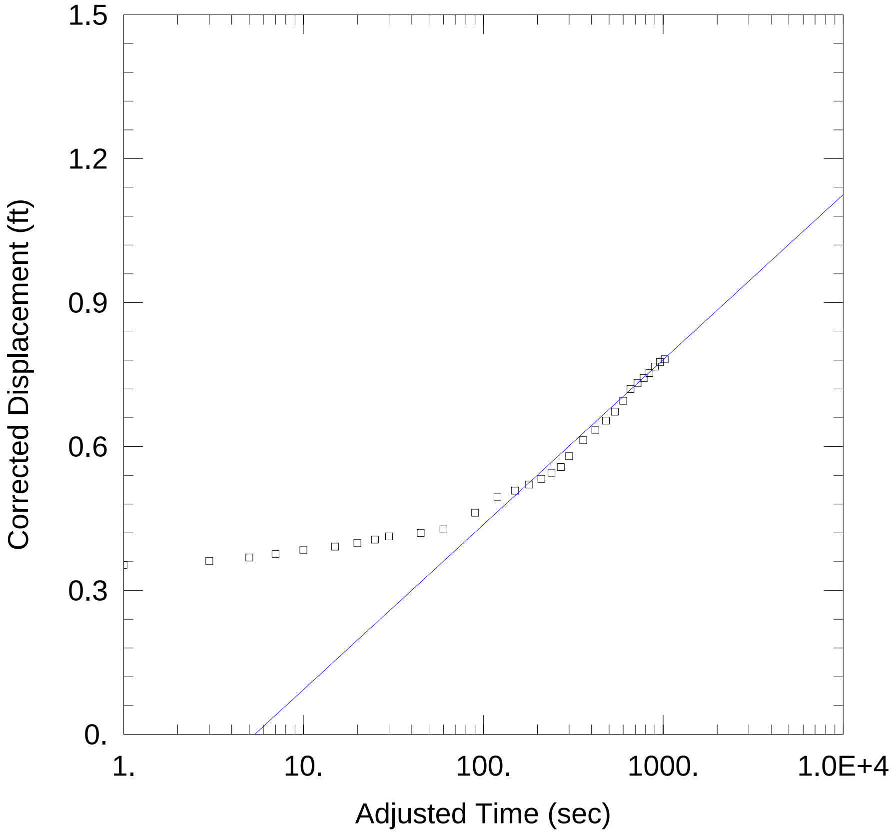
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
UFMW-05S	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ UFMW-05S	0	0



PUMPING TEST FOR UFMW-06S

Data Set: \...\UFMW-06S.aqt
Date: 10/26/17 Time: 08:47:25

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFMW-06S
Test Date: 10/10/2017

SOLUTION

Aquifer Model: Unconfined
Solution Method: Cooper-Jacob

T = 26.67 ft^2/day
S = 0.01489

AQUIFER DATA

Saturated Thickness: 1.71 ft

Anisotropy Ratio (Kz/Kr): 0.1

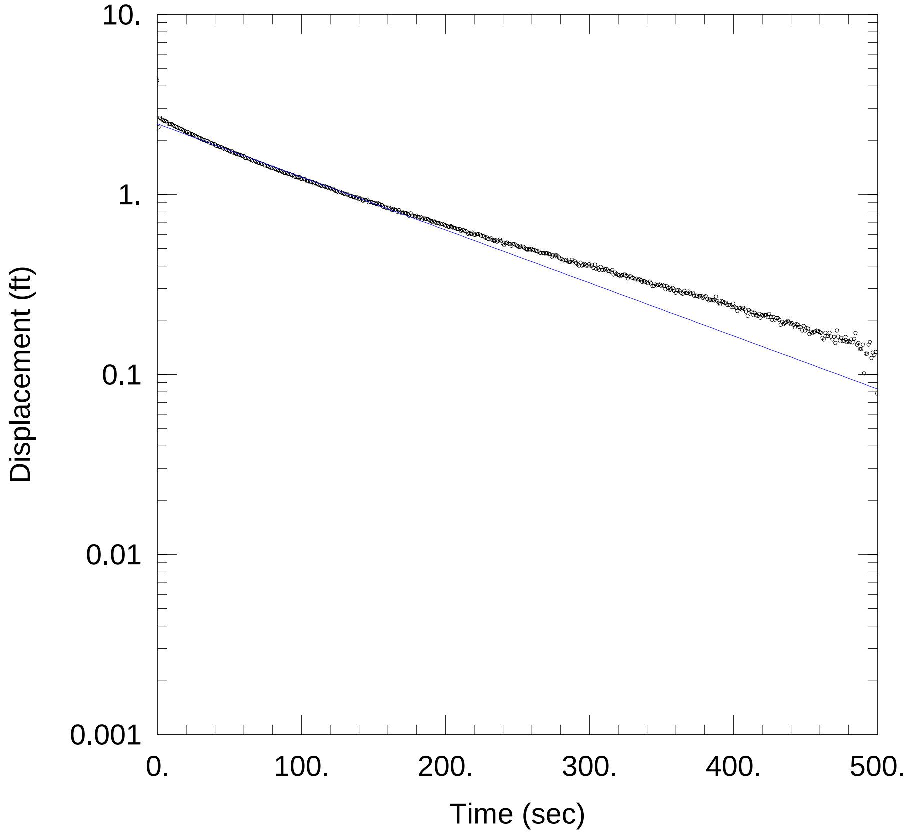
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
UFMW-06S	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ UFMW-06S	0	0



UFIW-01I SLUG IN 1

Data Set: \...\UFIW_01I_slugin_1.aqt
Date: 11/02/17 Time: 14:01:46

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-01I
Test Date: 11/02/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

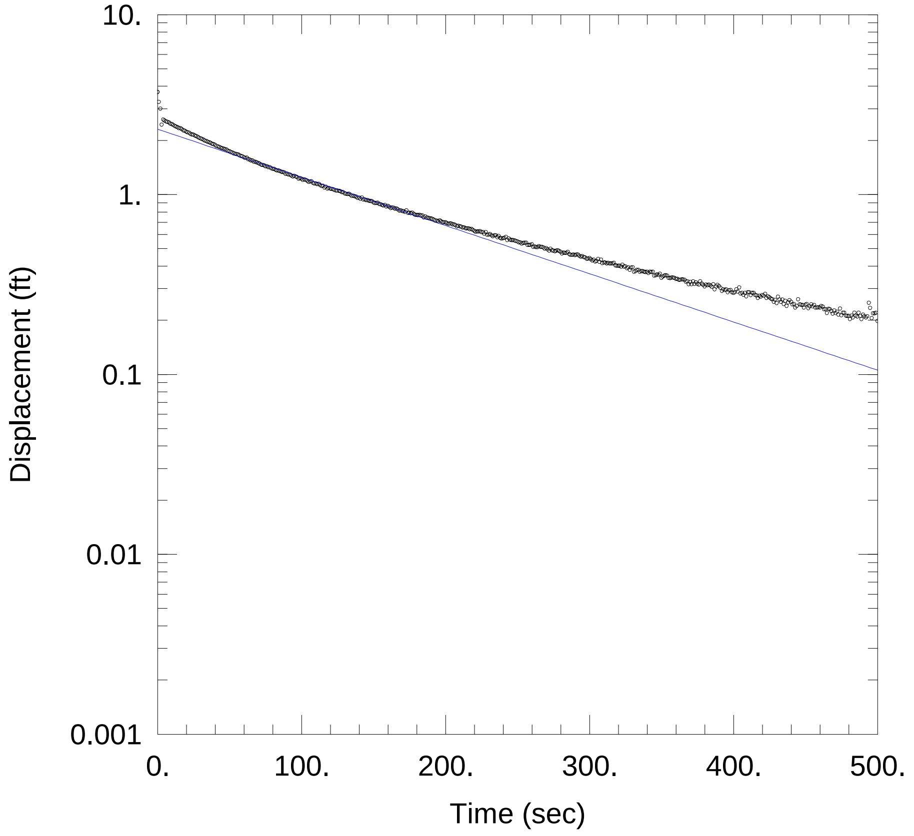
K = 1.432 ft/day
y0 = 2.466 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-01I)

Initial Displacement: 4.291 ft
Total Well Penetration Depth: 8.92 ft
Casing Radius: 0.083 ft
Static Water Column Height: 8.92 ft
Screen Length: 5. ft
Well Radius: 0.25 ft



UFIW-01I SLUG IN 2

Data Set: \...\UFIW_01I_slugin_2.aqt
Date: 11/02/17 Time: 14:02:00

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-01I
Test Date: 11/02/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

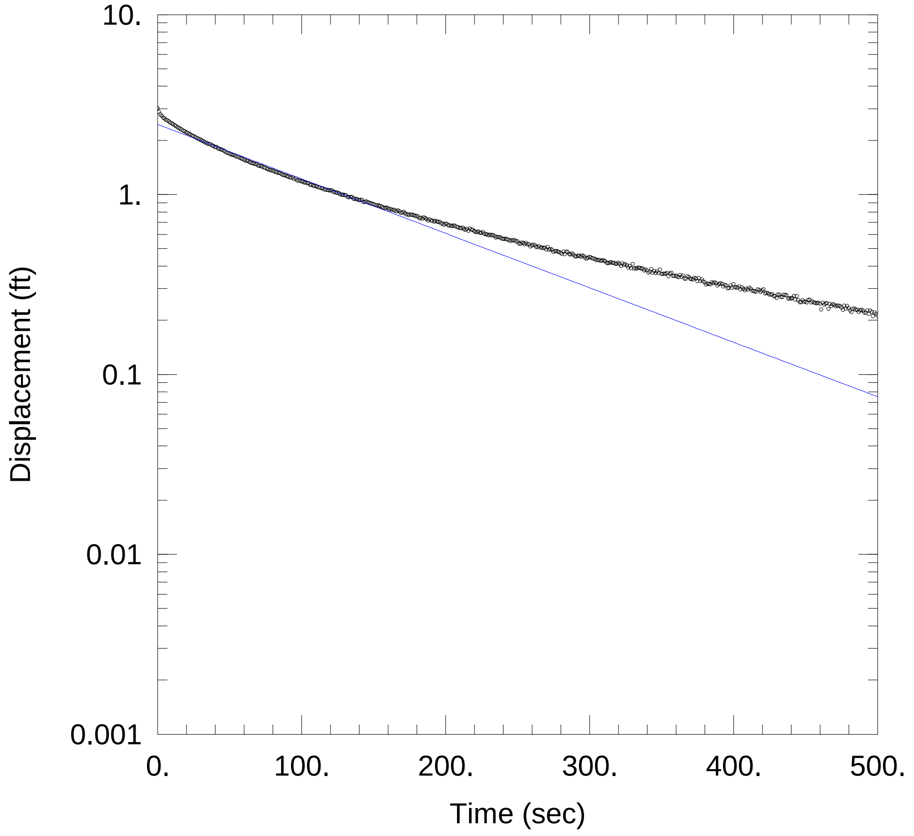
K = 1.303 ft/day
y0 = 2.307 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-01I)

Initial Displacement: 3.708 ft
Total Well Penetration Depth: 8.92 ft
Casing Radius: 0.083 ft
Static Water Column Height: 8.92 ft
Screen Length: 5. ft
Well Radius: 0.25 ft



UFIW-01I SLUG OUT 1

Data Set: \...\UFIW_01I_slugout_1.aqt
Date: 11/02/17 Time: 14:02:18

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-01I
Test Date: 11/02/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

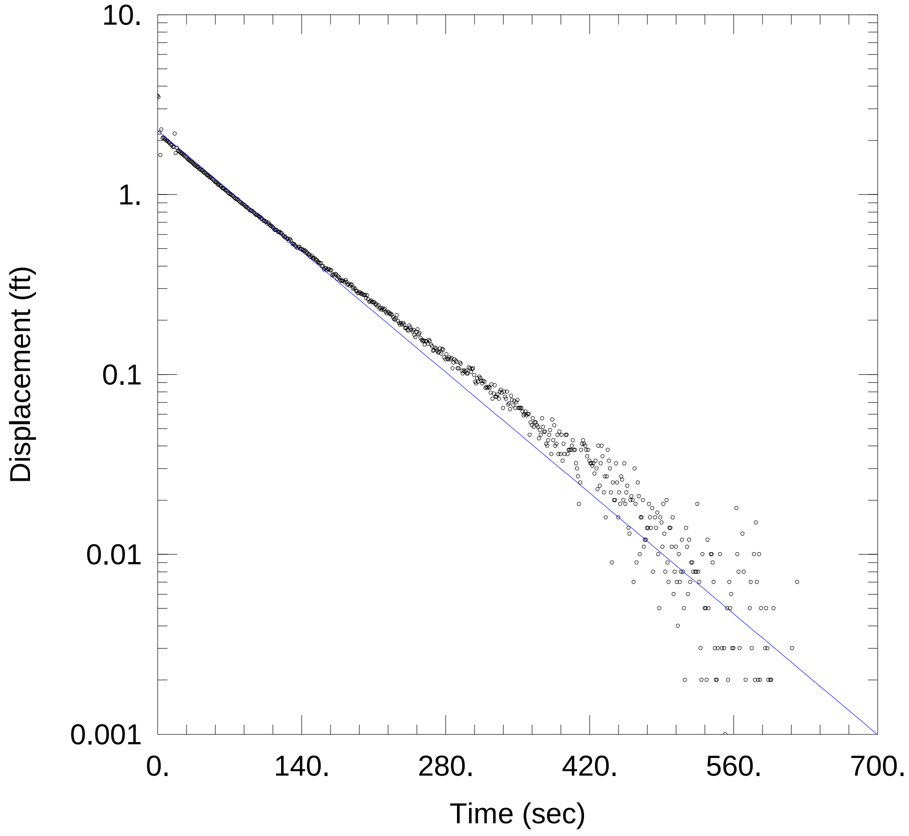
K = 1.472 ft/day
y0 = 2.452 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-01I)

Initial Displacement: 3.012 ft
Total Well Penetration Depth: 8.92 ft
Casing Radius: 0.083 ft
Static Water Column Height: 8.92 ft
Screen Length: 5. ft
Well Radius: 0.25 ft



UFIW-04I SLUG IN 1

Data Set: \...\UFIW_04I_slugin_1.aqt
Date: 11/02/17 Time: 14:04:00

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-04I
Test Date: 11/2/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

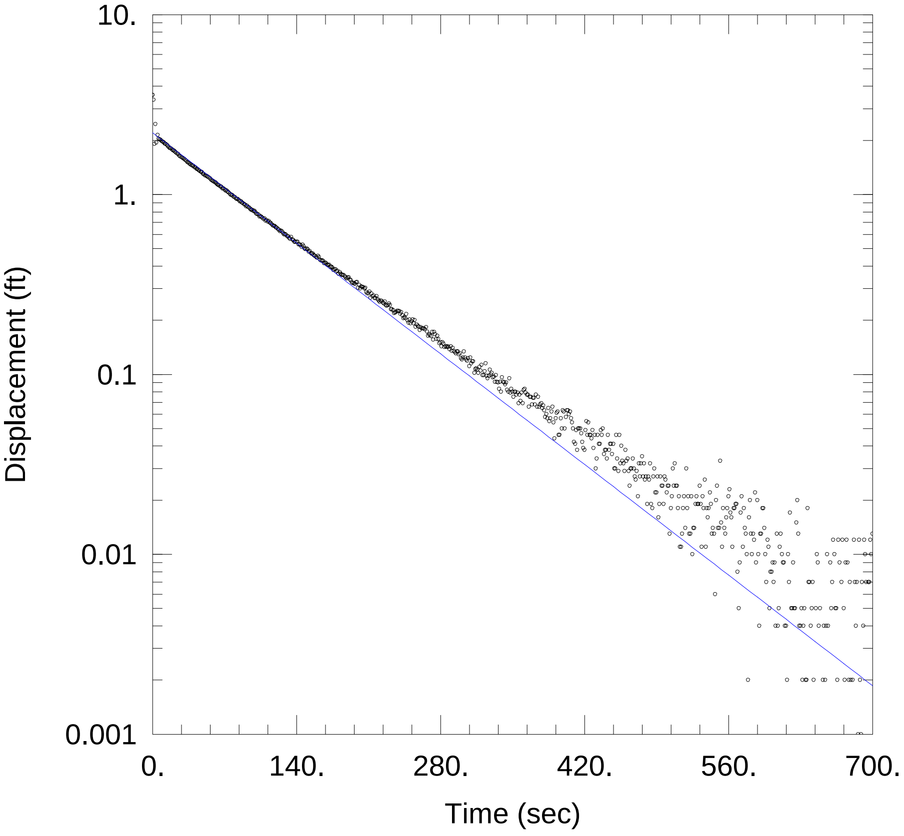
K = 2.215 ft/day
y0 = 2.269 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-04I)

Initial Displacement: 3.525 ft
Total Well Penetration Depth: 9.61 ft
Casing Radius: 0.083 ft
Static Water Column Height: 9.61 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-04I SLUG IN 2

Data Set: \...\UFIW_04I_slugin_2.aqt
Date: 11/02/17 Time: 14:04:13

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-04I
Test Date: 11/2/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

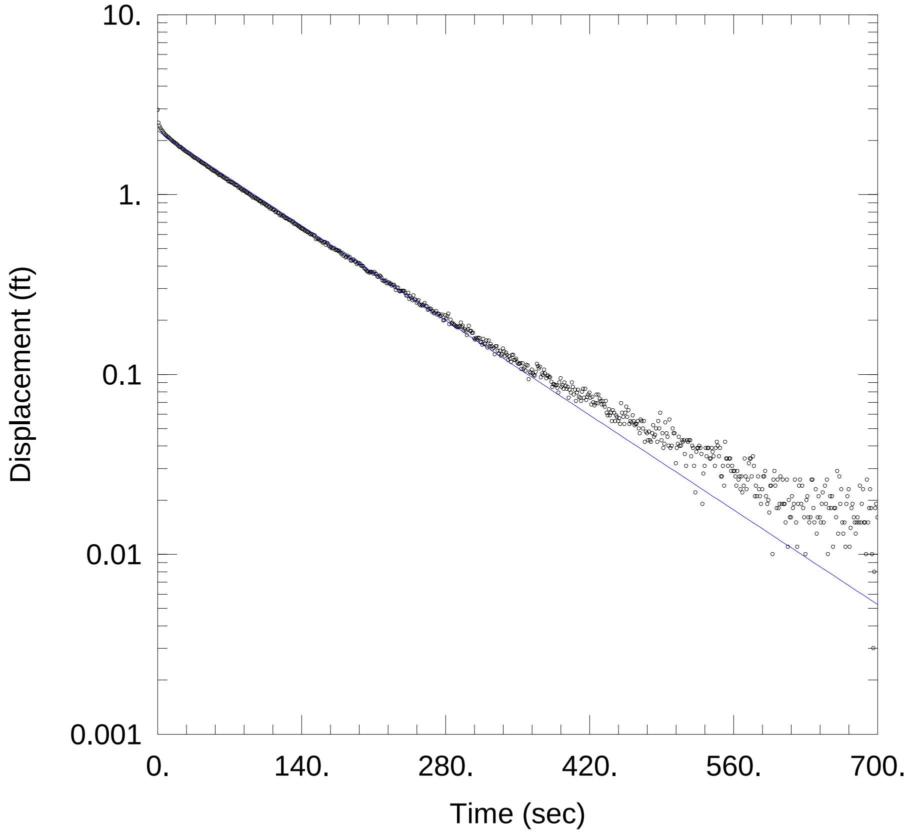
K = 2.028 ft/day
y0 = 2.207 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-04I)

Initial Displacement: 3.569 ft
Total Well Penetration Depth: 9.61 ft
Casing Radius: 0.083 ft
Static Water Column Height: 9.61 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-04I SLUG OUT 1

Data Set: \...\UFIW_04I_slugout_1.aqt
Date: 11/02/17 Time: 14:04:27

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-04I
Test Date: 11/2/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

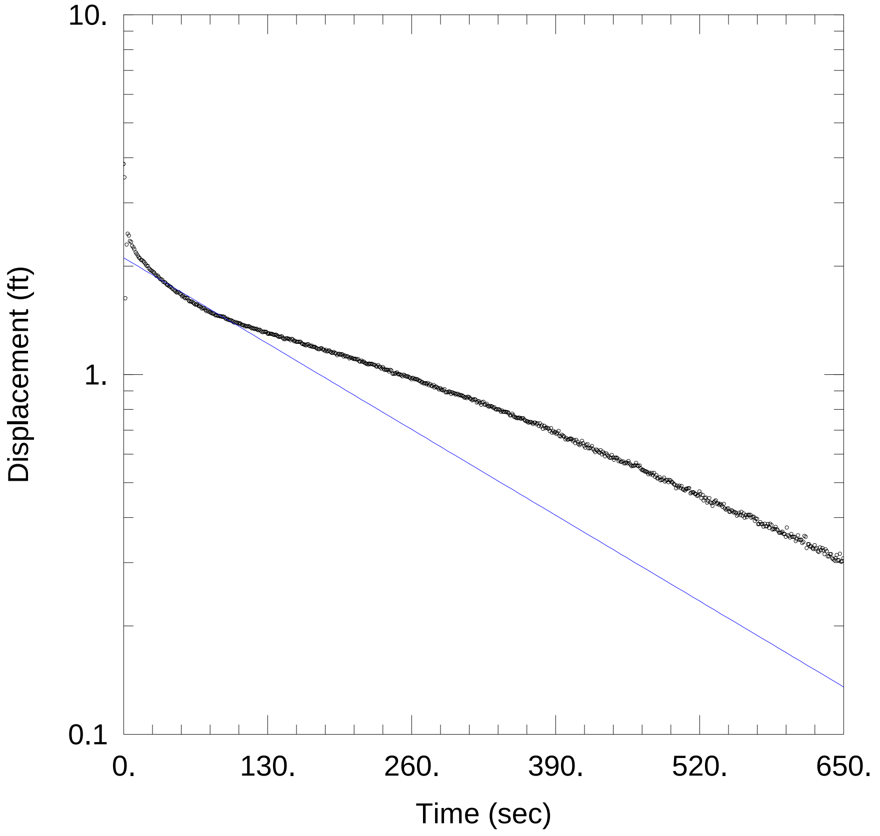
K = 1.736 ft/day
y0 = 2.255 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-04I)

Initial Displacement: 2.95 ft
Total Well Penetration Depth: 9.61 ft
Casing Radius: 0.083 ft
Static Water Column Height: 9.61 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-05I SLUG IN 1

Data Set: \...\UFIW_05I_slugin_1.aqt
Date: 11/02/17 Time: 15:07:01

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-05I
Test Date: 11/2/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.8686 ft/day
y0 = 2.11 ft

AQUIFER DATA

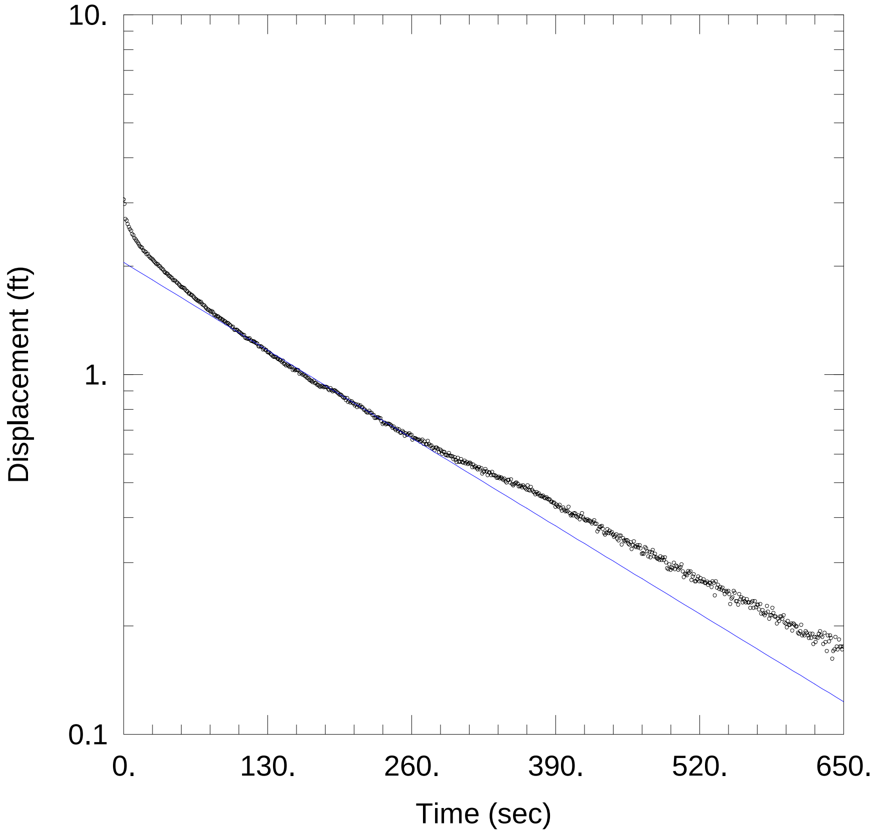
Saturated Thickness: 6.5 ft

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-05I)

Initial Displacement: 3.839 ft
Total Well Penetration Depth: 11.04 ft
Casing Radius: 0.083 ft

Static Water Column Height: 11.04 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-05I SLUG OUT 1

Data Set: \...\UFIW_05I_slugout_1.aqt
Date: 11/02/17 Time: 14:15:25

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-05I
Test Date: 11/2/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

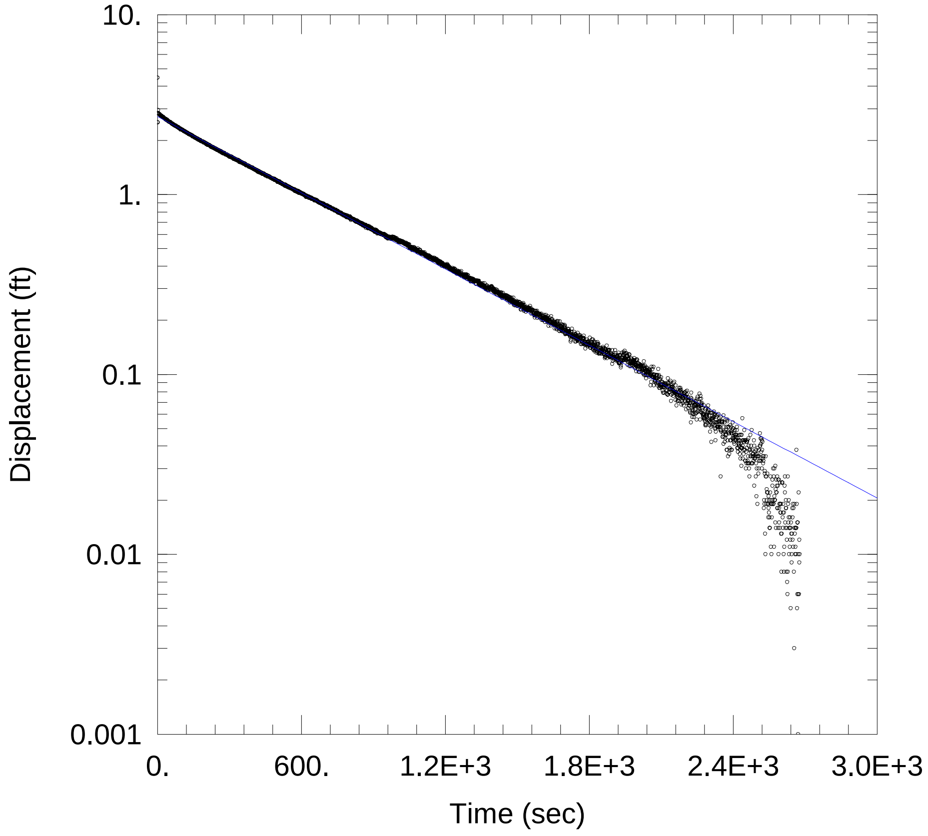
K = 0.8891 ft/day
y0 = 2.048 ft

AQUIFER DATA

Saturated Thickness: 6.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-05I)

Initial Displacement: 3.059 ft
Total Well Penetration Depth: 11.04 ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.04 ft
Screen Length: 5. ft
Well Radius: 0.33 ft



UFIW-08I SLUG IN 1

Data Set: \...\UFIW_08I_slugin_1.aqt
Date: 11/02/17 Time: 14:21:52

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-08I
Test Date: 11/2/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

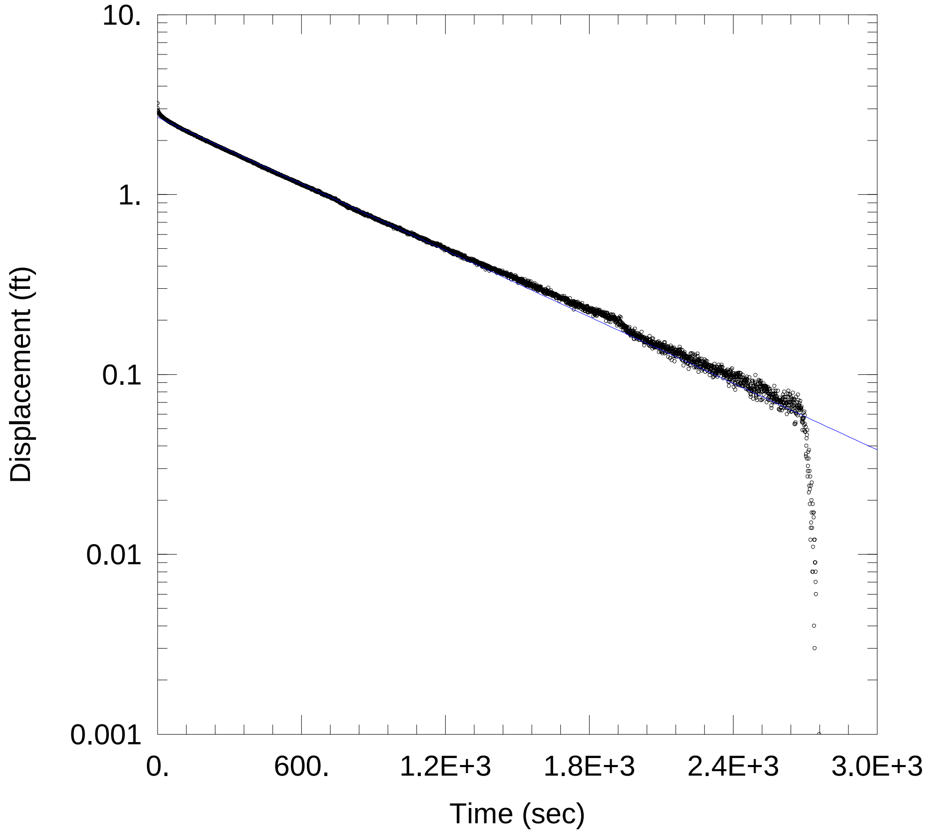
K = 0.3604 ft/day
y0 = 2.714 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-08I)

Initial Displacement: 4.457 ft
Total Well Penetration Depth: 11.82 ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.82 ft
Screen Length: 5. ft
Well Radius: 0.25 ft



UFIW-08I SLUG OUT 1

Data Set: \...\UFIW_08I_slugout_1.aqt
Date: 11/02/17 Time: 14:21:27

PROJECT INFORMATION

Company: Tetra Tech
Client: NERT
Location: Henderson, NV
Test Well: UFIW-08I
Test Date: 11/2/2017

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.3143 ft/day
y0 = 2.688 ft

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (UFIW-08I)

Initial Displacement: 3.209 ft
Total Well Penetration Depth: 11.82 ft
Casing Radius: 0.083 ft
Static Water Column Height: 11.82 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

Appendix D

Injection Logs

CASCADE
DRILLING | TECHNICAL SERVICES

REMEDIATION FIELD SERVICES REPORT

Nevada Environmental Response Trust Site
In-Situ Chromium Treatability Study
510 South 4th Street
Henderson, Nevada 89015

Date:
May 17, 2017 Rev1

Project Number:
304-17-1049

Prepared For:
Tetra Tech, Inc.
17885 Von Karman Avenue, Suite 500
Irvine, California 92614

Prepared by:
Cascade Technical Services
1225 East McFadden Avenue
Santa Ana, California 92705

EXCELLENCE AT EVERY LEVEL™

CASCADE
DRILLING | TECHNICAL SERVICES

May 17, 2017 Rev1
Project No. 304-17-1049

Mr. Carl Lenker
Tetra Tech, Inc.
17885 Von Karman Avenue, Suite 500
Irvine, California 92614

Subject: Remediation Field Services Report
Nevada Environmental Response Trust Site
In-Situ Chromium Treatability Study
510 South 4th Street
Henderson, Nevada 89015

Dear Mr. Lenker

In accordance with your request and authorization, Cascade Technical Services (Cascade) has performed remediation field services for the subject site. The field services were performed in general accordance with Cascade's proposal dated April 10, 2017.

Cascade appreciates the opportunity to provide our services to you. If you have any questions or comments regarding this report, please contact the undersigned at your convenience.

Respectfully submitted,
Cascade Technical Services

Michael Gerber
Operations Manager

Distribution: (1) Addressee (via e-mail)
JP/MG

Table of Contents

Appendices
Appendix A – Injection Summary and Logs

1 INTRODUCTION

Tetra Tech, Inc. (client), subcontracted Cascade Technical Services (Cascade) to perform remediation field services at the subject site located at 510 South 4th Street, Henderson, Nevada. Field services were conducted in general accordance with Cascade's proposal dated April 10, 2017.

2 REMEDIATION APPROACH

An emulsified vegetable oil (EOS$_{PRO}$) solution mixed with granular sugar, fructose solution, sodium sulfite, phosphates (Aquapure®) and water was mixed onsite at varying concentrations (see injection logs for details) on a custom build injection platform. The solution was pumped into three 2-inch onsite injection wells screened between 20 and 25 and three 2-inch wells screened between 35 and 50 feet belowground surface (bgs).

3 PROJECT ACTIVITIES

The following sections describe the field activities conducted at the site. The activities were conducted between April 17 and 21, 2017.

3.1 PRE-MOBILIZATION ACTIVITIES

A site-specific health and safety plan was prepared to address worker and general public safety.

3.2 ONSITE ACTIVITIES

On April 17, 2017, Cascade mobilized a custom-built injection platform to the site. Prior to the commencement of field activities, a tailgate safety meeting was performed. The safety meeting was followed by a site walk to review the injection well locations. The injection platform was placed inside a containment berm located within an open field. Spill kits and portable vacuums were placed within the work area for immediate deployment. Injection material transportation and handling were coordinated by the client with the exception of the fructose solution which was transported by Cascade.

The scope of work performed by Cascade included a 25 gallon water injection test performed at injection well CTIW-02D. The injection test was done to check for leaks throughout the injection system including the hose fittings and connections. Approximately 8,459 gallons of the solution was injected into the six onsite injection wells. The three shallow wells (CTIW-01S, CTIW-02S and CTIW-03S) received approximately 950 gallons of the solution and the three deep wells (CTIW-01D, CTIW-02D and CTIW-03D) received between 1,700 and 1,900 gallons of the solution (see injection logs for details). Throughout the injection activities, the injection lines were flushed with water at various quantities (see injection logs for specific quantities by well). Total volume injected into the six onsite injection wells was approximately 13,817 gallons (8,459 gallons of the solution and 5,358 gallons of test/flush water).

Remediation activities were successfully completed on April 21, 2017.

3.3 SITE RESTORATION

Investigation-derived waste was not generated during remediation activities at the site. Other waste (i.e. personal protective equipment, packaging materials, etc.) was collected in large trash bags and disposed as municipal solid waste.

4 LIMITATIONS

The implementation of the scope of work was performed in accordance with the clients design specification as described above (Section 2) and supporting injection logs (Appendix A). Cascade bears no responsibility for remediation results or impact to existing conditions.

APPENDIX A
Injection Summary and Logs

PROJECT SUMMARY

PROJECT NAME/NUMBER: TETRA TECH HENDERSON NV/30417-1049

Day	Date	On-site Time	Off-site Time	Locations Completed	% Solution						% Solution Injected (Gallons)	Test/Flush Water Injected (Gallons)	Total Injected (Gallons)
					EOS (Gallons)	Sugar (Pounds)	Juice (Gallons)	Sodium Sulfite (Pounds)	Aquapure (Gallons)	Water (Gallons)			
Monday	4/17/2017	1:00 PM	6:00 PM	0	0	0	0	0	0	0	0	0	0
Tuesday	4/18/2017	7:00 AM	5:30 PM	0	324	1,225	0	1	9	1,307	1,659	75	1,734
Wednesday	4/19/2017	7:00 AM	5:15 PM	0	276	1,278	2,217	2	21	620	3,000	75	3,075
Thursday	4/20/2017	6:30 AM	6:30 PM	0	0	0	3,800	26	0	0	3,800	350	4,150
Friday	4/21/2017	6:30 AM	4:30 PM	6	0	0	0	26	0	0	0	4,858	4,858
			TOTALS	6	600	2,503	6,017	55	30	1,927	8,459	5,358	13,817

INJECTION FIELD LOGS

PROJECT NAME/NUMBER: TETRA TECH HENDERSON NV/30417-1049

Location ID	Start Date	Start Time	End Time	Injection Interval	Initial Pressure (PSI)	Sustained Pressure (PSI)	Average Flow Rate (GPM)	% Solution						% Solution Injected (Gallons)	Test/Flush Water Injected (Gallons)	Total Injected (Gallons)
								EOS (Gallons)	Sugar (Pounds)	Juice (Gallons)	Sodium Sulfite (Pounds)	Aquapure (Gallons)	Water Gallons			
CTIW-01S	4/18/2017	12:30 PM	2:33 PM	20 to 25	0	0	1.5	36	150	0	0.1	1	144	180		180
	4/19/2017	7:41 AM	9:31 AM		0	20	1.8	0	150	0	0.1	1	200	200		200
	4/19/2017	11:16 AM	12:06 PM		7	7	2.0	20	0	80	0.1	2	0	100		100
	4/19/2017	2:19 PM	3:17 PM		0	0	2.3	0	132	118	0.1	0	0	132		132
	4/20/2017	1:54 PM	2:17 PM		3	3	3.1	0	0	0	0.0	0	0	0	66	66
	4/20/2017	2:20 PM	4:27 PM		0	0	2.6	0	0	334	3.0	0	0	334	25	359
	4/21/2017	9:41 AM	9:55 AM		5	5	3.6	0	0	0	1.0	0	0	0	50	50
	4/21/2017	10:18 AM	11:05 AM		5	5	2.4	0	0	0	1.0	0	0	0	115	115
	4/21/2017	11:19 AM	2:32 PM		0	0	2.7	0	0	0	1.0	0	0	0	526	526
							TOTALS	**56**	**432**	**532**	**6.4**	**4**	**344**	**946**	**782**	**1,728**

Location ID	Start Date	Start Time	End Time	Injection Interval	Initial Pressure (PSI)	Sustained Pressure (PSI)	Average Flow Rate (GPM)	EOS (Gallons)	Sugar (Pounds)	Juice (Gallons)	Sodium Sulfite (Pounds)	Aquapure (Gallons)	Water Gallons	% Solution Injected (Gallons)	Test/Flush Water Injected (Gallons)	Total Injected (Gallons)
CTIW-01D	4/18/2017	10:39 AM	12:13 PM	35 to 50	0	5	1.9	36	150	0	0.1	1	144	180		180
	4/18/2017	2:43 PM	3:47 PM		7	7	3.3	37	0	0	0.1	1	150	187	25	212
	4/19/2017	9:53 AM	11:01 AM		8	8	2.9	40	150	160	0.1	1	0	200		200
	4/19/2017	12:23 PM	2:15 PM		0	2	1.5	31	17	134	0.2	2	0	166		166
	4/19/2017	3:29 PM	4:31 PM		0	0	3.2	0	33	179	0.1	0	0	200	25	225
	4/20/2017	8:34 AM	11:18 AM		3	7	2.0	0	0	333	0.2	0	0	333		333
	4/20/2017	11:33 AM	1:12 PM		3	3	2.0	0	0	200	0.2	0	0	200		200
	4/20/2017	4:42 PM	6:02 PM		5	5	3.3	0	0	266	5.0	0	0	266	25	291
	4/21/2017	7:05 AM	8:40 AM		4	10	1.8	0	0	0	1.0	0	0	0	167	167
	4/21/2017	8:48 AM	10:17 AM		8	8	1.7	0	0	0	1.0	0	0	0	152	152
	4/21/2017	11:19 AM	3:10 PM		0	0	1.4	0	0	0	1.0	0	0	0	333	333
							TOTALS	**144**	**350**	**1,272**	**9.0**	**5**	**294**	**1,732**	**727**	**2,459**

Location ID	Start Date	Start Time	End Time	Injection Interval	Initial Pressure (PSI)	Sustained Pressure (PSI)	Average Flow Rate (GPM)	EOS (Gallons)	Sugar (Pounds)	Juice (Gallons)	Sodium Sulfite (Pounds)	Aquapure (Gallons)	Water Gallons	% Solution Injected (Gallons)	Test/Flush Water Injected (Gallons)	Total Injected (Gallons)
CTIW-02S	4/18/2017	9:46 AM	12:17 PM	20 to 25	0	5	1.3	38	150	0	0.1	1	152	190		190
	4/19/2017	7:44 AM	9:38 AM		0	0	1.8	0	150	200	0.1	2	200	200		200
	4/19/2017	11:14 AM	12:11 PM		5	5	1.8	20	80	80	0.1	2	80	100		100
	4/19/2017	2:19 PM	3:05 PM		7	7	2.9	0	132	119	0.1	0	0	132		132
	4/20/2017	1:54 PM	2:19 PM		0	0	3.2	0	0	0	0.0	0	0	0	67	67
	4/20/2017	2:20 PM	4:35 PM		0	3	2.5	0	0	333	3.0	0	0	333	25	358
	4/21/2017	9:26 AM	9:56 AM		5	5	1.7	0	0	0	1.0	0	0	0	50	50
	4/21/2017	10:18 AM	11:05 AM		7	7	1.2	0	0	0	2.0	0	0	0	56	56
	4/21/2017	11:19 AM	2:46 PM		7	7	3.4	0	0	0	1.0	0	0	0	712	712
							TOTALS	**58**	**512**	**732**	**7.4**	**5**	**432**	**955**	**910**	**1,865**

INJECTION FIELD LOGS

PROJECT NAME/NUMBER: TETRA TECH HENDERSON NV/30417-1049

Location ID	Start Date	Start Time	End Time	Injection Interval	Initial Pressure (PSI)	Sustained Pressure (PSI)	Average Flow Rate (GPM)	% Solution						% Solution Injected (Gallons)	Test/Flush Water Injected (Gallons)	Total Injected (Gallons)
								EOS (Gallons)	Sugar (Pounds)	Juice (Gallons)	Sodium Sulfite (Pounds)	Aquapure (Gallons)	Water Gallons			
CTIW-02D	4/18/2017	12:28 PM	4:43 PM	35 to 50	0	5	1.6	73	325	0	0.2	2	299	374	25	399
	4/19/2017	9:51 AM	11:01 AM		0	0	2.9	40	0	160	0.1	1	0	200		200
	4/19/2017	12:22 PM	2:10 PM		0	6	1.5	31	17	134	0.2	2	0	167		167
	4/19/2017	3:28 PM	4:40 PM		0	0	2.8	0	33	180	0.1	0	0	200	25	225
	4/20/2017	8:36 AM	11:21 AM		0	8	2.0	0	0	334	1.0	0	0	334		334
	4/20/2017	11:33 AM	1:31 PM		5	5	3.4	0	0	400	1.0	0	0	400		400
	4/20/2017	4:42 PM	6:02 PM		5	5	3.3	0	0	266	5.0	0	0	266	25	291
	4/21/2017	7:05 AM	8:45 AM		9	9	1.7	0	0	0	2.0	0	0	0	165	165
	4/21/2017	8:48 AM	10:16 AM		6	8	1.8	0	0	0	1.0	0	0	0	154	154
	4/21/2017	11:19 AM	3:10 PM		6	6	2.4	0	0	0	1.0	0	0	0	564	564
							TOTALS	**144**	**375**	**1,474**	**11.6**	**5**	**299**	**1,941**	**958**	**2,899**
CTIW-03S	4/18/2017	12:26 PM	2:30 PM	20 to 25	0	0	1.5	34	150	0	0.1	1	124	180		180
	4/19/2017	7:45 AM	9:03 AM		0	0	2.6	0	200	0	0.1	2	140	200		200
	4/19/2017	11:13 AM	12:15 PM		0	0	1.6	20	0	80	0.1	2	0	100		100
	4/19/2017	2:19 PM	3:21 PM		3	3	2.2	0	134	120	0.1	0	0	134		134
	4/20/2017	1:54 PM	2:15 PM		0	0	3.0	0	0	0	0.0	0	0	0	67	67
	4/20/2017	2:20 PM	4:04 PM		0	4	3.2	0	0	334	2.0	0	0	334	25	359
	4/21/2017	9:06 AM	9:55 AM		18	12	1.8	0	0	0	2.0	0	0	0	90	90
	4/21/2017	10:18 AM	11:06 AM		10	10	2.2	0	0	0	2.0	0	0	0	105	105
	4/21/2017	11:38 AM	2:47 PM		0	0	2.9	0	0	0	2.0	0	0	0	545	545
							TOTALS	**54**	**484**	**534**	**8.4**	**5**	**264**	**948**	**832**	**1,780**
CTIW-03D	4/18/2017	9:54 AM	12:10 PM	35 to 50	0	10	1.3	34	150	0	0.1	1	144	180		180
	4/18/2017	2:40 PM	3:31 PM		0	9	4.2	36	150	0	0.1	1	150	188	25	213
	4/19/2017	9:51 AM	10:55 AM		3	3	3.1	40	0	160	0.1	2	0	200		200
	4/19/2017	12:21 PM	2:10 PM		3	3	1.6	34	17	134	0.2	2	0	169		169
	4/19/2017	3:28 PM	4:35 PM		0	0	3.0	0	33	180	0.1	0	0	200	25	225
	4/20/2017	8:36 AM	11:21 AM		3	3	2.0	0	0	333	0.3	0	0	333		333
	4/20/2017	11:31 AM	1:25 PM		5	5	3.5	0	0	400	0.3	0	0	400		400
	4/20/2017	4:42 PM	6:02 PM		3	3	3.3	0	0	267	5.0	0	0	267	25	292
	4/21/2017	7:03 AM	8:47 AM		4	4	1.6	0	0	0	2.0	0	0	0	168	168
	4/21/2017	8:48 AM	10:16 AM		4	4	1.8	0	0	0	2.0	0	0	0	154	154
	4/21/2017	11:19 AM	3:10 PM		6	6	3.3	0	0	0	2.0	0	0	0	752	752
							TOTALS	**143**	**350**	**1,474**	**12.2**	**6**	**294**	**1,937**	**1,149**	**3,086**
							TOTALS	**600**	**2,503**	**6,017**	**55**	**30**	**1,927**	**8,459**	**5,358**	**13,817**

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REMEDIATION FIELD SERVICES REPORT

Nevada Environmental Response Trust Site
In-Situ Chromium Treatability Study
510 South 4th Street
Henderson, Nevada 89015

Date:
July 12, 2017

Project Number:
304-17-1070

Prepared For:
Tetra Tech, Inc.
17885 Von Karman Avenue, Suite 500
Irvine, California 92614

Prepared by:
Cascade Technical Services
1225 East McFadden Avenue
Santa Ana, California 92705
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CASCADE
DRILLING | TECHNICAL SERVICES

1225 East McFadden Avenue
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July 12, 2017
Project No. 304-17-1070

Mr. Carl Lenker
Tetra Tech, Inc.
17885 Von Karman Avenue, Suite 500
Irvine, California 92614

Subject: Remediation Field Services Report
Nevada Environmental Response Trust Site
In-Situ Chromium Treatability Study Event 2
510 South 4th Street
Henderson, Nevada 89015

Dear Mr. Lenker,

In accordance with your request and authorization, Cascade Technical Services (Cascade) has performed remediation field services for the subject site. The field services were performed in general accordance with Cascade's proposal dated April 10, 2017.

Cascade appreciates the opportunity to provide our services to you. If you have any questions or comments regarding this report, please contact the undersigned at your convenience.

Respectfully submitted,
Cascade Technical Services

Michael Gerber
Operations Manager

Frank Allen
Remediation Specialist

Distribution: (1) Addressee (via e-mail)
FA/MG/JP

TABLE OF CONTENTS

Appendices

1 INTRODUCTION

Tetra Tech, Inc. (client), subcontracted Cascade Technical Services (Cascade) to perform remediation field services at the subject site located at 510 South 4th Street, Henderson, Nevada. Field services were conducted in general accordance with Cascade's proposal dated April 10, 2017.

2 REMEDIATION APPROACH

An emulsified vegetable oil (EOS$_{\text{PRO}}$) solution mixed with granular sugar, fructose solution, sodium sulfite, sodium bicarbonate, ascorbic acid, phosphates (Aquapure® and UREA/DAP) and water was mixed onsite at varying concentrations (see injection logs for details) on a custom build injection platform. The solution was pumped into six 2-inch onsite injection wells, the shallow zone screened between 20 and 25 feet belowground surface (bgs) and the deep zone screened between 35 and 50 bgs.

3 PROJECT ACTIVITIES

The following sections describe the field activities conducted at the site. The activities were conducted between June 6 and 9, 2017.

3.1 PRE-MOBILIZATION ACTIVITIES

A site-specific health and safety plan was prepared to address worker and general public safety.

3.2 ONSITE ACTIVITIES

On June 6, 2017, Cascade mobilized a custom-built injection platform to the site. Prior to the commencement of field activities, a tailgate safety meeting was performed. The safety meeting was followed by a site walk to review the injection well locations. The injection platform was placed inside a containment berm located within an open field. Spill kits and portable vacuums were placed within the work area for immediate deployment. Injection material transportation and handling were coordinated by the client with the exception of the fructose solution which was transported by Cascade.

Approximately 8,810 gallons of the solution (not including flush water) was injected into the six onsite injection wells. The three shallow wells (CTIW-01S, CTIW-02S and CTIW-03S) received approximately 737 gallons of the solution each and the three deep wells (CTIW-01D, CTIW-02D and CTIW-03D) each received approximately 2,200 gallons of the solution. Throughout the injection activities, the injection lines were flushed with water at various quantities (see injection logs for specific quantities by well). Total volume injected into the six onsite injection wells was approximately 18,451 gallons (8,810 gallons of the solution and 9,641 gallons of water).

Remediation activities were successfully completed on June 9, 2017.

3.3 SITE RESTORATION

Upon completion of injection activities, the inside of the well boxes and the surrounding area were cleared of debris and the well boxes were secured.

Investigation-derived waste was not generated during remediation activities at the site. Other waste (i.e. personal protective equipment, packaging materials, etc.) was collected in large trash bags and disposed as municipal solid waste.

4 LIMITATIONS

The implementation of the scope of work was performed in accordance with the client's design specification as described above (Section 2) and supporting injection logs (Appendix A). Cascade bears no responsibility for remediation results or impact to existing conditions.

APPENDIX A

Injection Summary and Logs

PROJECT SUMMARY

PROJECT NAME/NUMBER: TETRA-TECH NERT SITE HENDERSON/304-17-1070

					% Solution									
Day	Date	On-site Time	Off-site Time	Wells Completed	EOS (Gallons)	Granular Sugar (Pounds)	Fructose Solution (Gallons)	Ascorbic Acid (Pounds)	Aquapure (Gallons)	Urea/DAP Solution (Gallons)	Sodium Bicarbonate (Pounds)	% Solution Injected (Gallons)	Flush Water Injected (Gallons)	Total Injected (Gallons)
Tuesday	6/6/2017	7:00 AM	6:00 PM	0	150	750	750	6	6	0	30	900	0	900
Wednesday	6/7/2017	7:00 AM	5:30 PM	0	350	1,750	2,915	44	29	0	114	3,300	0	3,300
Thursday	6/8/2017	7:00 AM	6:00 PM	0	0	0	4,280	0	0	220	156	4,500	0	4,500
Friday	6/9/2017	7:00 AM	3:30 PM	6	0	0	0	0	0	110	50	110	9,641	9,751
			PROJECT TOTALS	6	500	2,500	7,945	50	35	320	350	8,810	9,641	18,451

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INJECTION FIELD LOGS

PROJECT NAME/NUMBER: TETRA-TECH NERT SITE HENDERSON/304-17-1070

											% Solution									
Well ID	Start Date	Start Time	End Date	End Time	Injection Interval			Initial Pressure (PSI)	Sustained Pressure (PSI)	Average Flow Rate (GPM)	EOS (Gallons)	Granular Sugar (Pounds)	Fructose Solution (Gallons)	Ascorbic Acid (Pounds)	Aquapure (Gallons)	UREA/DAP Solution (Gallons)	Sodium Bicarbonate (Pounds)	% Solution Injected (Gallons)	Flush Water Injected (Gallons)	Total Injected (Gallons)
CTIW-01S	6/7/2017	11:03 AM	6/7/2017	12:58 PM	20	to	25	5	5	3.0	58	292	289	2.3	2.3	0	12	350	0	350
	6/8/2017	9:22 AM	6/8/2017	11:05 AM				2	2	3.4	0	0	350	0	0	0	15	350	0	350
	6/9/2017	7:32 AM	6/9/2017	7:48 AM				3	3	2.3	0	0	0	0	0	37	0	37	63	100
	6/9/2017	7:50 AM	6/9/2017	12:40 PM				4	3	4.7	0	0	0	0	0	0	8	0	1,350	1,350
										TOTALS	**58**	**292**	**639**	**2.3**	**2.3**	**37**	**35**	**737**	**1,413**	**2,150**
CTIW-02S	6/7/2017	11:03 AM	6/7/2017	1:04 PM	20	to	25	15	10	2.9	58	292	289	2.3	2.3	0	12	350	0	350
	6/8/2017	9:22 AM	6/8/2017	11:16 AM				5	5	3.1	0	0	350	0.0	0.0	0	15	350	0	350
	6/9/2017	7:32 AM	6/9/2017	7:48 AM				11	11	2.3	0	0	0	0.0	0.0	37	0	37	63	100
	6/9/2017	7:50 AM	6/9/2017	12:40 PM				15	11	4.7	0	0	0	0.0	0.0	0	8	0	1,350	1,350
										TOTALS	**58**	**292**	**639**	**2.3**	**2.3**	**37**	**35**	**737**	**1,413**	**2,150**
CTIW-03S	6/7/2017	11:03 AM	6/7/2017	1:00 PM	20	to	25	20	15	3.0	58	292	289	2.3	2.3	0	12	350	0	350
	6/8/2017	9:22 AM	6/8/2017	11:09 AM				12	10	3.3	0	0	350	0.0	0.0	0	15	350	0	350
	6/9/2017	7:32 AM	6/9/2017	7:48 AM				13	13	2.3	0	0	0	0.0	0.0	37	0	37	63	100
	6/9/2017	7:50 AM	6/9/2017	12:40 PM				12	10	4.7	0	0	0	0.0	0.0	0	9	0	1,350	1,350
										TOTALS	**58**	**292**	**639**	**2.3**	**2.3**	**37**	**35**	**737**	**1,413**	**2,150**
CTIW-01D	6/6/2017	1:39 PM	6/6/2017	3:44 PM	35	to	50	8	6	2.4	50	250	248	2.0	2.0	0	10	300	0	300
	6/7/2017	1:23 PM	6/7/2017	3:12 PM				10	6	3.2	58	292	289	5.0	2.3	0	12	350	0	350
	6/7/2017	3:42 PM	6/7/2017	5:01 PM				4	4	5.1	0	0	397	7.3	3.0	0	15	400	0	400
	6/8/2017	11:16 AM	6/8/2017	11:50 AM				5	5	7.4	0	0	248	0.0	2.2	0	15	250	0	250
	6/8/2017	1:16 PM	6/8/2017	1:51 PM				5	5	7.1	0	0	250	0.0	0.0	0	15	250	0	250
	6/8/2017	2:38 PM	6/8/2017	3:44 PM				5	5	6.1	0	0	327	0.0	0.0	73	8	400	0	400
	6/8/2017	4:59 PM	6/8/2017	5:28 PM				6	5	8.6	0	0	250	0.0	0.0	0	0	250	0	250
	6/9/2017	7:50 AM	6/9/2017	9:06 AM				5	4	5.2	0	0	0	0.0	0.0	0	8	0	400	400
	6/9/2017	10:11 AM	6/9/2017	12:57 PM				6	4	6.6	0	0	0	0.0	0.0	0	0	0	1,100	1,100
										TOTALS	**108**	**542**	**2,009**	**14.3**	**9.5**	**73**	**83**	**2,200**	**1,500**	**3,700**

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INJECTION FIELD LOGS

PROJECT NAME/NUMBER: TETRA-TECH NERT SITE HENDERSON/304-17-1070

									% Solution									
Well ID	**Start Date**	**Start Time**	**End Date**	**End Time**	**Injection Interval**	**Initial Pressure (PSI)**	**Sustained Pressure (PSI)**	**Average Flow Rate (GPM)**	**EOS (Gallons)**	**Granular Sugar (Pounds)**	**Fructose Solution (Gallons)**	**Ascorbic Acid (Pounds)**	**Aquapure (Gallons)**	**UREA/DAP Solution (Gallons)**	**Sodium Bicarbonate (Pounds)**	**% Solution Injected (Gallons)**	**Flush Water Injected (Gallons)**	**Total Injected (Gallons)**
CTIW-02D	6/6/2017	1:39 PM	6/6/2017	3:46 PM	35 to 50	7	5	2.4	50	250	248	2.0	2.0	0	10	300	0	300
	6/7/2017	1:25 PM	6/7/2017	3:01 PM		8	5	3.6	58	292	289	5.0	2.3	0	12	350	0	350
	6/7/2017	3:42 PM	6/7/2017	5:01 PM		3	3	5.1	0	0	397	7.4	3.0	0	15	400	0	400
	6/8/2017	11:16 AM	6/8/2017	11:54 AM		3	3	6.6	0	0	248	0.0	2.0	0	15	250	0	250
	6/8/2017	1:16 PM	6/8/2017	1:46 PM		3	4	8.3	0	0	250	0.0	0.0	0	13	250	0	250
	6/8/2017	2:38 PM	6/8/2017	3:38 PM		3	3	6.7	0	0	327	0.0	0.0	73	8	400	0	400
	6/8/2017	4:59 PM	6/8/2017	5:33 PM		5	5	7.4	0	0	250	0.0	0.0	0	0	250	0	250
	6/9/2017	7:50 AM	6/9/2017	1:43 PM		7	4	5.6	0	0	0	0.0	0.0	0	8	0	1,950	1,950
								TOTALS	**108**	**542**	**2,009**	**14.4**	**9.3**	**73**	**81**	**2,200**	**1,950**	**4,150**
CTIW-03D	6/6/2017	1:38 PM	6/6/2017	3:35 PM	35 to 50	7	5	2.6	50	250	248	2.0	2.0	0	10	300	0	300
	6/7/2017	1:25 PM	6/7/2017	3:14 PM		8	6	3.2	58	292	289	5.0	2.3	0	12	350	0	350
	6/7/2017	3:42 PM	6/7/2017	5:01 PM		5	5	5.1	0	0	397	7.4	3.0	0	15	400	0	400
	6/8/2017	11:16 AM	6/8/2017	11:46 AM		7	4	8.3	0	0	248	0.0	2.0	0	15	250	0	250
	6/8/2017	1:16 PM	6/8/2017	1:48 PM		6	5	7.8	0	0	250	0.0	0.0	0	14	250	0	250
	6/8/2017	2:38 PM	6/8/2017	3:40 PM		5	5	6.5	0	0	327	0.0	0.0	73	8	400	0	400
	6/8/2017	4:59 PM	6/8/2017	5:31 PM		5	5	7.8	0	0	250	0.0	0.0	0	0	250	0	250
	6/9/2017	7:50 AM	6/9/2017	1:43 PM		5	5	5.6	0	0	0	0.0	0.0	0	8	0	1,950	1,950
								TOTALS	**108**	**542**	**2,009**	**14.4**	**9.3**	**73**	**82**	**2,200**	**1,950**	**4,150**
								PROJECT TOTALS	**500**	**2,500**	**7,945**	**50**	**35**	**320**	**350**	**8,810**	**9,641**	**18,451**

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REMEDIATION FIELD SERVICES REPORT

Nevada Environmental Response Trust Site
In-Situ Chromium Treatability Study Event 3
510 South 4th Street
Henderson, Nevada 89015

Date:
September 7, 2017

Project Number:
304-17-1082

Prepared For:
Tetra Tech, Inc.
17885 Von Karman Avenue, Suite 500
Irvine, California 92614

Prepared by:
Cascade Technical Services
1225 East McFadden Avenue
Santa Ana, California 92705
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DRILLING | TECHNICAL SERVICES

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September 7, 2017
Project No. 304-17-1082

Mr. Carl Lenker
Tetra Tech, Inc.
17885 Von Karman Avenue, Suite 500
Irvine, California 92614

Subject: Remediation Field Services Report
Nevada Environmental Response Trust Site
In-Situ Chromium Treatability Study Event 3
510 South 4th Street
Henderson, Nevada 89015

Dear Mr. Lenker,

In accordance with your request and authorization, Cascade Technical Services (Cascade) has performed remediation field services for the subject site. The field services were performed in general accordance with Cascade's proposal dated July 27, 2017.

Cascade appreciates the opportunity to provide our services to you. If you have any questions or comments regarding this report, please contact the undersigned at your convenience.

Respectfully submitted,
Cascade Technical Services

Michael Gerber
Operations Manager

Distribution: (1) Addressee (via e-mail)
JP/MG

TABLE OF CONTENTS

Appendices

1 INTRODUCTION

Tetra Tech, Inc. (client), subcontracted Cascade Technical Services (Cascade) to perform remediation field services at the subject site located at 510 South 4th Street, Henderson, Nevada. Field services were conducted in general accordance with Cascade's proposal dated July 27, 2017.

2 REMEDIATION APPROACH

A calcium polysulfide (CPS) solution and an emulsified vegetable oil (EVO) solution was mixed onsite on a custom-built injection platform. The CPS solution was pumped into 16, 2-inch onsite injection wells and the EVO solution comprised of $\mathrm{EOS_{PRO}}$, UREA/DAP, molasses, ascorbic acid, sodium bicarbonate, and water was injected into 6, 2-inch onsite wells.

3 PROJECT ACTIVITIES

The following sections describe the field activities conducted at the site. The activities were conducted between August 7 and 11, 2017.

3.1 PRE-MOBILIZATION ACTIVITIES

A site-specific health and safety plan was prepared to address worker and general public safety.

3.2 ONSITE ACTIVITIES

On August 7, 2017, Cascade mobilized a custom-built injection platform to the site. Prior to the commencement of field activities, a tailgate safety meeting was performed. The safety meeting was followed by a site walk to review the injection well locations. The injection platform was placed inside a containment berm located within an open field. Spill kits and portable vacuums were placed within the work area for immediate deployment. Injection material transportation and handling were coordinated by the client.

Approximately 600 gallons of a calcium polysulfide solution comprised of 60 gallons of CPS and 540 gallons of hydrant water was injected into 16 onsite wells (see injection logs for details). Approximately 6,450 gallons of an EVO solution comprised of $\mathrm{EOS_{PRO}}$, UREA/DAP, molasses, ascorbic acid, sodium bicarbonate, and water was injected into 6 onsite wells (see injection logs for details).

Throughout the injection activities, the injection lines were flushed with water at various quantities (see injection logs for specific quantities by well). Total volume injected into the 22 onsite injection wells was approximately 20,935 gallons.

Remediation activities were successfully completed on August 11, 2017.

3.3 SITE RESTORATION

Upon completion of injection activities, the inside of the well boxes and the surrounding area were cleared of debris and the well boxes were secured.

Investigation-derived waste was not generated during remediation activities at the site. Other waste (i.e. personal protective equipment, packaging materials, etc.) was collected in large trash bags and disposed as municipal solid waste.

4 LIMITATIONS

The implementation of the scope of work was performed in accordance with the client's design specification as described above (Section 2) and supporting injection logs (Appendix A). Cascade bears no responsibility for remediation results or impact to existing conditions.

APPENDIX A

Injection Summary and Logs

PROJECT SUMMARY

PROJECT NAME/NUMBER: TETRA-TECH NERT SITE HENDERSON/304-17-1082

Day	Date	On-site Time	Off-site Time	Wells Completed	Amendments							Amendment Solution Injected (Gallons)	Flush Water Injected (Gallons)	Total Injected (Gallons)
					Calcium Polysulfide (Gallons)	EOS (Gallons)	Urea/DAP (Gallons)	Molasses (Gallons)	Ascorbic Acid (Pounds)	Sodium Bicarbonate (Pounds)	Water (Gallons)			
Monday	8/7/2017	1:00 PM	5:30 PM	8	30	0	0	0	0	0	270	300	1,950	2,250
Tuesday	8/8/2017	7:00 AM	4:30 PM	8	30	0	0	0	0	0	270	300	1,960	2,260
Wednesday	8/9/2017	7:00 AM	5:15 PM	0	0	0	500	500	22	125	3,639	4,650	75	4,725
Thursday	8/10/2017	7:00 AM	4:15 PM	3	0	150	50	100	28	175	1,485	1,800	4,500	6,300
Friday	8/11/2017	7:00 AM	3:30 PM	3	0	0	0	0	0	0	0	0	5,400	5,400
			PROJECT TOTALS	22	60	150	550	600	50	300	5,664	7,050	13,885	20,935

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INJECTION FIELD LOGS

PROJECT NAME/NUMBER: TETRA-TECH NERT SITE HENDERSON/304-17-1082

								Amendment Solution										
Well ID	Start Date	Start Time	End Date	End Time	Initial Pressure (PSI)	Sustained Pressure (PSI)	Average Flow Rate (GPM)	Calcium Polysulfide (Gallons)	EOS (Gallons)	Urea/DAP (Gallons)	Molasses (Gallons)	Ascorbic Acid (Pounds)	Sodium Bicarbonate (Pounds)	Water (Gallons)	Amendment Solution Injected (Gallons)	Flush Water Injected (Gallons)	Total Injected (Gallons)	Day Lighting
UFIW-01s	8/7/2017	2:55 PM	8/7/2017	4:00 PM	10	10	4.6	5	0	0	0	0	0	45	50	250	300	
							TOTALS	**5**	**0**	**0**	**0**	**0**	**0**	**45**	**50**	**250**	**300**	
UFIW-02S	8/7/2017	2:55 PM	8/7/2017	4:00 PM	5	13	4.6	5	0	0	0	0	0	45	50	250	300	
							TOTALS	**5**	**0**	**0**	**0**	**0**	**0**	**45**	**50**	**250**	**300**	
UFIW-03S	8/7/2017	2:55 PM	8/7/2017	4:00 PM	7	7	4.6	5	0	0	0	0	0	45	50	250	300	
							TOTALS	**5**	**0**	**0**	**0**	**0**	**0**	**45**	**50**	**250**	**300**	
UFIW-04S	8/7/2017	2:55 PM	8/7/2017	2:55 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	
							TOTALS	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
UFIW-01I	8/7/2017	4:10 PM	8/7/2017	5:10 PM	1	1	5.6	3.75	0	0	0	0	0	34	38	300	338	
							TOTALS	**3.75**	**0**	**0**	**0**	**0**	**0**	**34**	**38**	**300**	**338**	
UFIW-02I	8/7/2017	4:10 PM	8/7/2017	5:10 PM	5	5	5.6	3.75	0	0	0	0	0	34	38	300	338	
							TOTALS	**3.75**	**0**	**0**	**0**	**0**	**0**	**34**	**38**	**300**	**338**	
UFIW-03I	8/7/2017	4:10 PM	8/7/2017	5:10 PM	7	7	5.6	3.75	0	0	0	0	0	34	38	300	338	
							TOTALS	**3.75**	**0**	**0**	**0**	**0**	**0**	**34**	**38**	**300**	**338**	
UFIW-04I	8/7/2017	4:10 PM	8/7/2017	5:10 PM	5	5	5.6	3.75	0	0	0	0	0	34	38	300	338	
							TOTALS	**3.75**	**0**	**0**	**0**	**0**	**0**	**34**	**38**	**300**	**338**	
UFIW-05S	8/8/2017	9:00 AM	8/8/2017	10:15 AM	17	15	4.5	3.75	0	0	0	0	0	34	38	300	338	
							TOTALS	**3.75**	**0**	**0**	**0**	**0**	**0**	**34**	**38**	**300**	**338**	
UFIW-06S	8/8/2017	9:00 AM	8/8/2017	10:15 AM	22	18	4.5	3.75	0	0	0	0	0	34	38	300	338	
							TOTALS	**3.75**	**0**	**0**	**0**	**0**	**0**	**34**	**38**	**300**	**338**	
UFIW-07S	8/8/2017	9:00 AM	8/8/2017	10:15 AM	21	21	4.5	3.75	0	0	0	0	0	34	38	300	338	
							TOTALS	**3.75**	**0**	**0**	**0**	**0**	**0**	**34**	**38**	**300**	**338**	
UFIW-08S	8/8/2017	9:00 AM	8/8/2017	10:15 AM	16	14	4.5	3.75	0	0	0	0	0	34	38	300	338	
							TOTALS	**3.75**	**0**	**0**	**0**	**0**	**0**	**34**	**38**	**300**	**338**	
UFIW-05I	8/8/2017	10:25 AM	8/8/2017	10:49 AM	17	15	4.1	3.75	0	0	0	0	0	34	38	60	98	X
							TOTALS	**3.75**	**0**	**0**	**0**	**0**	**0**	**34**	**38**	**60**	**98**	
UFIW-06I	8/8/2017	10:25 AM	8/8/2017	11:40 AM	15	13	4.5	3.75	0	0	0	0	0	34	38	300	338	
							TOTALS	**3.75**	**0**	**0**	**0**	**0**	**0**	**34**	**38**	**300**	**338**	
UFIW-07I	8/8/2017	10:25 AM	8/8/2017	10:56 AM	16	15	4.4	3.75	0	0	0	0	0	34	38	100	138	X
							TOTALS	**3.75**	**0**	**0**	**0**	**0**	**0**	**34**	**38**	**100**	**138**	
UFIW-08I	8/8/2017	10:25 AM	8/8/2017	11:40 AM	12	10	4.5	3.75	0	0	0	0	0	34	38	300	338	
							TOTALS	**3.75**	**0**	**0**	**0**	**0**	**0**	**34**	**38**	**300**	**338**	

CASCADE
DRILLING | TECHNICAL SERVICES

INJECTION FIELD LOGS

PROJECT NAME/NUMBER: TETRA-TECH NERT SITE HENDERSON/304-17-1082

								Amendment Solution										
Well ID	Start Date	Start Time	End Date	End Time	Initial Pressure (PSI)	Sustained Pressure (PSI)	Average Flow Rate (GPM)	Calcium Polysulfide (Gallons)	EOS (Gallons)	Urea/DAP (Gallons)	Molasses (Gallons)	Ascorbic Acid (Pounds)	Sodium Bicarbonate (Pounds)	Water (Gallons)	Amendment Solution Injected (Gallons)	Flush Water Injected (Gallons)	Total Injected (Gallons)	Day Lighting
CFIW-01D	8/9/2017	8:22 AM	8/9/2017	4:53 PM	7	16	3.1	0	0	167	167	7	42	1,213	1,550	25	1,575	
	8/10/2017	7:40 AM	8/10/2017	9:09 AM	8	10	3.4	0	0	0	33	2	8	266	300	0	300	
	8/10/2017	9:09 AM	8/10/2017	10:09 AM	9	9	2.5	0	25	0	0	2	3	124	150	0	150	
	8/10/2017	11:26 AM	8/10/2017	3:45 PM	7	7	2.9	0	0	0	0	2	0	0	0	750	750	
	8/11/2017	7:30 AM	8/11/2017	2:19 PM	13	12	4.4	0	0	0	0	0	0	0	0	1,800	1,800	
							TOTALS	**0**	**25**	**167**	**200**	**13**	**53**	**1,603**	**2,000**	**2,575**	**4,575**	
CFIW-02D	8/9/2017	8:22 AM	8/9/2017	4:53 PM	8	15	3.1	0	0	167	167	7	42	1,213	1,550	25	1,575	
	8/10/2017	7:40 AM	8/10/2017	9:09 AM	13	12	3.4	0	0	0	33	2	8	266	300	0	300	
	8/10/2017	9:09 AM	8/10/2017	10:09 AM	11	11	2.5	0	25	0	0	2	3	124	150	0	150	
	8/10/2017	11:26 AM	8/10/2017	3:45 PM	10	9	2.9	0	0	0	0	2	0	0	0	750	750	
	8/11/2017	7:30 AM	8/11/2017	2:19 PM	12	11	4.4	0	0	0	0	0	0	0	0	1,800	1,800	
							TOTALS	**0**	**25**	**167**	**200**	**13**	**53**	**1,603**	**2,000**	**2,575**	**4,575**	
CFIW-03D	8/9/2017	8:22 AM	8/9/2017	4:53 PM	5	13	3.1	0	0	167	167	7	42	1,213	1,550	25	1,575	
	8/10/2017	7:40 AM	8/10/2017	9:09 AM	11	10	3.4	0	0	0	33	2	8	266	300	0	300	
	8/10/2017	9:09 AM	8/10/2017	10:09 AM	12	11	2.5	0	25	0	0	2	3	124	150	0	150	
	8/10/2017	11:26 AM	8/10/2017	3:45 PM	11	10	2.9	0	0	0	0	2	0	0	0	750	750	
	8/11/2017	7:30 AM	8/11/2017	2:19 PM	8	10	4.4	0	0	0	0	0	0	0	0	1,800	1,800	
							TOTALS	**0**	**25**	**167**	**200**	**13**	**53**	**1,603**	**2,000**	**2,575**	**4,575**	
CFIW-01S	8/10/2017	10:31 AM	8/10/2017	11:13 AM	6	5	3.6	0	25	17	0	2	33	105	150	0	150	
	8/10/2017	11:25 AM	8/10/2017	3:45 PM	6	6	2.9	0	0	0	0	3	14	0	0	750	750	
							TOTALS	**0**	**25**	**17**	**0**	**4**	**47**	**105**	**150**	**750**	**900**	
CFIW-02S	8/10/2017	10:31 AM	8/10/2017	11:13 AM	8	6	3.6	0	25	17	0	2	33	105	150	0	150	
	8/10/2017	11:25 AM	8/10/2017	3:45 PM	6	5	2.9	0	0	0	0	2	14	0	0	750	750	
							TOTALS	**0**	**25**	**17**	**0**	**4**	**47**	**105**	**150**	**750**	**900**	
CFIW-03S	8/10/2017	10:31 AM	8/10/2017	11:13 AM	10	7	3.6	0	25	17	0	2	33	105	150	0	150	
	8/10/2017	11:25 AM	8/10/2017	3:45 PM	8	7	2.9	0	0	0	0	2	14	0	0	750	750	
							TOTALS	**0**	**25**	**17**	**0**	**4**	**47**	**105**	**150**	**750**	**900**	
							PROJECT TOTALS	**60**	**150**	**550**	**600**	**50**	**300**	**5,664**	**7,050**	**13,885**	**20,935**	

CASCADE
DRILLING | TECHNICAL SERVICES

Appendix E
Groundwater Monitoring Logs

Biological Reduction Study

TETRA TECH

WELL WATER LEVEL MEASUREMENT LOG

Page 1 of ___

NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study	Task No: M12	Date: 4/3/17
Task Manager Arul Ayyaswami	Field Sampler(s): D. Keady	Recorded by: D. Keady
Equipment Model/Type:	Serial Number:	Last Calibration Date:

Well Identification	Describe Measuring Point	Time (hrs)	Depth to Static Water Level (ft BMP)	Well Sounding Depth (ft BMP)	Condition of Well and Well Seal
CTIW-01S		0852	22.26	BIO TRAP IN WELL	
CTIW-01D		0855	22.21	BIO TRAP IN WELL	
CTIW-02S		0900	22.49	24.35	
CTIW-02D		0904	22.52	49.40	
CTIW-03S		0914	22.53	24.22	
CTIW-03D		0916	22.80	49.10	
CTMW-01S		0924	22.21	23.75	
CTMW-01D		0926	22.37	49.41	
CTMW-02S		0929	22.47	23.67	
CTMW-02D		0931	22.72	49.14	
CTMW-03S		0935	22.36	BIO TRAP IN WELL	
CTMW-03D		0937	22.43	BIO TRAP IN WELL	
CTMW-04S		0942	22.37	24.00	
CTMW-04D		0946	22.62	48.99	

BGS = Below Ground Surface BMP = Below Measuring Point MP = Measuring Point TOC = Top of Casing (Well Riser)

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

Page 1 of 1

NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTIW-01S
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 4-5-17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 23.59	Screened/Open Interval Top: — (ft BGS) (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) (ft BMP)
Pump and Tubing Type: QED SamplePro ; poly tubing		Pump Intake Depth: — (ft BGS) (ft BMP)	MP Description: TOC
Equipment Decon. Method:		Depth to Water Before Pump Installation (ft BMP): 22.26 Time:	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity m(µS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen Hach/YSI DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1443	X		27.10		7.46		9.18		2.01/2.32		166		0.7			22.30	
1448	X		26.59		7.31		9.37		1.55/2.03		170		0.0			22.30	
1453	X		25.64		7.31		9.43		1.32/2.06		170		0.0			22.30	
1458	X		25.39		7.30		9.45		1.22/2.07		170		0.0			22.30	
1503	X		25.38	✓	7.30	✓	9.49	✓	1.19/	✓	170	✓	0.0	✓		22.30	
1510		X	STABILIZATION														

DK 4-5-17

Sample ID:

Duplicate ID:

QA/QC Samples/ID:

COC Time: 1510

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Cr Treatability Study Suite				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous iron: 0.02 mg/L

Sulfide : 0.00 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

Page 1 of 1

NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study
Task Manager: Arul Ayyaswami
Task No: M12
Well ID: CTIW-01D
Field Samplers: D. Keady
Recorded by: D. Keady
Date: 4-6-17
Well Depth (ft BGS): —
MP Distance AGS (ft): —
Well Depth (ft BMP): 38.56
Screened/Open Interval Top: — (ft BGS) 33.56 (ft BMP)
Well Diameter (in): 2
PID/FID Readings Beneath Inner Cap (ppm cge akb): —
Screened/Open Interval Bottom: — (ft BGS) 38.56 (ft BMP)
Pump and Tubing Type: QED SamplePro; poly tubing
Pump Intake Depth: — (ft BGS) 36.06 (ft BMP)
MP Description: TOC
Equipment Decon. Method: 3 bucket rinse
Depth to Water Before Pump Installation (ft BMP): 22.21
Time: 0800
GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity m (dS/cm) READ	Spec Conductivity m (dS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0824	X		23.69		7.39		11.8		0.76/2.33		100		115		100	22.49	0
0829	X		24.63		7.45		11.8		0.27/2.02		104		49.9		100	22.49	500
0834	X		25.01		7.45		11.7		0.09/1.57		108		23.7		100	22.49	1000
0839	X		25.22		7.44		11.7		0.00/1.29		112		10.0		100	22.49	1500
0844	X		25.34		7.45	✓	11.8		0.00/1.32		113		6.2		100	22.49	
0849	X		25.55	✓	7.45		11.7	✓	0.00/1.26	✓	115	✓	1.2	✓	100	22.49	
0900		X	STABILIZATION												100	22.49	

DK 4-6-17

Sample ID: CTIW-01D-20170406
Duplicate ID: —
QA/QC Samples/ID: —
COC Time: 0900

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT In-Situ Cr Treatability Study Suite				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)
Field Decontamination: Y N
Field Filtered: Y N
COC Number:

Comments:
Ferrous iron: 0.00 mg/L
Sulfide: 0.01 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

Page 1 of 1

LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: NERT In-Situ Cr Treatability Study
Task Manager: Arul Ayyaswami
Task No: M12
Well ID: CTIW-02S
Field Samplers: D. Keady
Recorded by: D. Keady
Date: 4-3-17
Well Depth (ft BGS): —
MP Distance AGS (ft): —
Well Depth (ft BMP): 23.67
Screened/Open Interval Top: — (ft BGS) 17.47 (ft BMP)
Well Diameter (in): 2
PID/FID Readings Beneath Inner Cap (ppm cge akb): —
Screened/Open Interval Bottom: — (ft BGS) ~~22.47~~ 24.35 (ft BMP)
Pump and Tubing Type: QED Sample Pro ; poly tubing
Pump Intake Depth: — (ft BGS) 23.35 (ft BMP)
MP Description: TOC
Equipment Decon. Method: 3 bucket rinse
Depth to Water Before Pump Installation (ft BMP): 22.47
Time:
GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1323	X		26.72		6.51		9.17		0.60		164		170		100	22.54	0
1328	X		24.92		6.62		9.31		0.41		161		19.2		100	23.58	500
1333	X		24.64		6.68		9.26		0.32		159		2.1		100	23.58	1000
1338	X		24.44		6.72		9.22		0.31		157		0.0		100	23.58	1500
STOP FOR STORM 1343	X		24.37		6.74		9.20		0.35		156		0.0		100	23.58	2000
1440	X		24.01		6.75		9.18		0.38		159		0.0		100	23.55	2000
1445	X		23.98		6.73		9.16		0.36		156		0.0		100	23.58	2500
1450	X		23.96	✓	6.73	✓	9.10	✓	0.34	✓	153	✓	0.2	✓	100	23.58	3000
1510		X	STABILIZATION														

DK 4-3-17

Sample ID: CTIW-02S-20170403
Duplicate ID: —
QA/QC Samples/ID: —
COC Time: 1510

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT In-Situ Cr Suite				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N
Field Filtered: Y N
COC Number:

Comments:
Ferrous iron: 0.07 mg/L
Sulfide: 0.00 mg/L

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID:** CTIW-02D
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 4-4-17
Well Depth (ft BGS):	MP Distance AGS (ft): —	Well Depth (ft BMP): 49.40	Screened/Open Interval Top: 34.40 (ft ~~BGS~~ BMP) — (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: 49.40 (ft ~~BGS~~ BMP) — (ft BMP)
Pump and Tubing Type: QED SamplePro; poly tubing		Pump Intake Depth: 41.90 (ft ~~BGS~~ BMP) — (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse		Depth to Water Before Pump Installation (ft BMP): 22.52 Time: 0825	GW Disposal: GWTP Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity m(μS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Hach/YSI READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0845	X		21.10		6.57		12.4		1.76/2.12		302		222		100	22.65	0
0850	X		22.01		6.96		12.3		1.47/1.86		272		163		100	22.65	500
0855	X		22.44		7.09		12.3		1.55/1.72		256		119		100	22.68	1000
0900	X		22.74		7.14		12.3		1.68/1.85		245		90.3		100	22.68	1500
0905	X		22.81		7.16		12.2		1.75/1.65		238		78.5		100	22.70	2000
0910	X		22.95		7.19		12.2		1.81/1.62		228		63.5		100	22.70	2500
0915	X		23.12		7.19		12.2		1.83/1.65		221		56.6		100	22.71	7000
0920	X		23.14		7.20		12.2		1.88/1.66		215		48.0		100	22.71	3500
0925	X		23.24		7.20		12.2		1.93/1.67		211		42.2		100	22.71	4000
0930	X		23.34	✓	7.22	✓	12.2	✓	1.89/	✓	205	✓	38.1	✓	100	22.71	4500
0935		X	STABILIZATION														

DK 4-4-17

Sample ID: CTIW-02D-20170404 Duplicate ID: — QA/QC Samples/ID: — COC Time: 0935

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT In-Situ Cr Suite				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:
Ferrous Iron: 0.03 mg/L
Sulfide: 0.00 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: NERT In-Situ Cr Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID:** CTIW-03S
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 4-4-17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 24.22	Screened/Open Interval Top: 19.22 (ft ~~BGS~~) BMP (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: 24.22 (ft ~~BGS~~) BMP (ft BMP)
Pump and Tubing Type: QED Sample Pro; tubing (poly)		Pump Intake Depth: 23.22 (ft ~~BGS~~) BMP — (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse		Depth to Water Before Pump Installation (ft BMP): 22.53 Time: 1220	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (mS/cm) READ	Spec Conductivity (mS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1237	X		23.53		7.37		11.0		2.98/2.72		192		172		100	22.57	0
1242	X		23.74		7.29		11.0		2.34/2.52		192		58.8		100	22.57	500
1247	X		23.83		7.20		11.0		2.22/1.94		196		21.1		100	22.57	1000
1252	X		23.95		7.16		10.9		2.11/2.03		197		10.7		100	22.57	1500
1257	X		24.03		7.16		10.9		2.16/2.05		197		6.9		100	22.57	2000
1302	X		24.11		7.14		10.9		2.10/2.08		197		4.6		100	22.57	2500
1307	X		24.17	✓	7.14		10.9		2.20/2.04		197		3.2		100	22.57	3000
1312	X		24.20		7.14	✓	10.9	✓	2.21/	✓	197	✓	2.7	✓ (<5)	100	22.57	3500
1315		X	STABILIZATION														

DK 4-4-17

Sample ID: CTIW-03S-20170404 Duplicate ID: — QA/QC Samples/ID: COC Time: 1318

Sample Container Number	Sample Container Material Code	Sample Container Volume	Preservative	Intended Analysis and/or Method
NERT In-Situ Cr Suite				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N Field Filtered: Y N COC Number:

Comments:
Ferrous iron: 0.02 mg/L
Sulfide : 0.01 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: NERT In-Situ Cr Treatability Study		Task Manager: Arul Ayyaswami		Task No: M12	Well ID: CTIW-03D
Field Samplers: D. Keady				Recorded by: D. Keady	Date: 4-4-17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 49.10		Screened/Open Interval Top: 34.10	(ft ~~BGS~~ BMP) — (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —			Screened/Open Interval Bottom: 49.10	(ft ~~BGS~~ BMP) — (ft BMP)
Pump and Tubing Type: QED Sample Pro; poly tubing		Pump Intake Depth: —	(ft BGS)	41.60 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse		Depth to Water Before Pump Installation (ft BMP): 22.80		Time: 1445	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1505	X		25.50		7.66		13.5		3.23/3.92		163		28.9		100	23.10	0
1510	X		24.92		7.64		13.5		3.00/3.09		164		35.4		100	23.12	500
1515	X		24.64		7.65		13.3		2.66/3.06		164		36.0		100	23.13	1000
1520	X		24.68		7.67		13.3		2.45/3.02		164		35.8		100	23.14	1500
1525	X		24.60	✓	7.69	✓	13.2	✓	2.38/3.00	✓	164	✓	33.3	✓	100	23.14	2000
1530	~~X~~	X	STABILIZATION														

DK 4-4-17

Sample ID: CTIW-03D-20170404 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1530

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT In-Situ Cr Treatability Suite				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments: Ferrous Iron: 0.07 mg/L
Sulfide: 0.02 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ CR Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-01S
Field Samplers: Jacob Souza		Recorded by: Jacob Souza	Date: 4/4/17
Well Depth (ft BGS): /	MP Distance AGS (ft): /	Well Depth (ft BMP): 23.78	
Screened/Open Interval Top: /	(ft BGS)	19.00 (ft BMP)	
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): /	Screened/Open Interval Bottom: /	(ft BGS) 24.00 (ft BMP)
Pump and Tubing Type: QED SamplePro / poly tubing	Pump Intake Depth: / (ft BGS) 23.01 (ft BMP)		MP Description: T.O.C.
Equipment Decon. Method: Liquinox & water (x3)	Depth to Water Before Pump Installation (ft BMP): 22.24	Time: 0800	GW Disposal: GW-11 pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0832			23.88		7.15		8970		3.40		206		80.2		100	22.30	0
0837			24.96		7.29		8980		2.54		195		30.2		100	22.29	500
0842			25.20		7.29		9000		2.28		190		16.1		100	22.29	1000
0847			25.54		7.37		9010		1.99		185		9.1		100	22.29	1500
0852			25.59		7.36		9040		1.77		182		4.6		100	22.29	2000
0857			25.70		7.39		9170		1.76		176		1.0		100	22.29	2500
0902			25.76		7.41		9080		1.84		176		0.0		100	22.29	3000
0907			25.78		7.42		9080		1.71		174		0.0		100	22.29	3500
0912			26.04		7.43		9070		1.70		175		0.0		100	22.29	4000
0917			25.99		7.44		9070		1.76		174		0.0		100	22.29	4500
0922			26.08		7.44		9060		1.72		173		0.0		100	22.29	5000
0927			26.10		7.44		9080		1.71		170		0.0		100	22.29	5500

Sample ID: CTMW-01S-20170404 Duplicate ID: NA QA/QC Samples/ID: NA COC Time: 0932

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron = 0.02 mg/L
Sulfide = 0.00 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ CR Treatability Study
Task Manager: Arul Ayyaswami
Task No: M12
Well ID: CTMW-01D
Field Samplers: Jacob Souza
Recorded by: Jacob Souza
Date: 4/3/17
Well Depth (ft BGS): /
MP Distance AGS (ft): /
Well Depth (ft BMP): 49.41
Screened/Open Interval Top: / (ft BGS) 34.00 (ft BMP)
Well Diameter (in): 2
PID/FID Readings Beneath Inner Cap (ppm cge akb): /
Screened/Open Interval Bottom: / (ft BGS) 49.00 (ft BMP)
Pump and Tubing Type: QED Sample Pro / poly tubing
Pump Intake Depth: / (ft BGS) 41.50 (ft BMP)
MP Description: T.O.C.
Equipment Decon. Method: Alconox & Water (x3)
Depth to Water Before Pump Installation (ft BMP): 22.37
Time: 0926
GW Disposal: GW-11 pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1318			34.08		6.93		13600		2.12		215		321		180	22.80	0
1321			30.32		7.09		14300		1.57		211		196		180	22.96	540
1324			29.69		7.08		14400		2.03		209		165		180	22.90	1080
1327			29.85		7.10		14300		1.75		194		146		180	22.91	1620
1330			29.79		7.14		14300		1.67		186		122		180	22.94	2160
1333			29.45		7.13		14300		1.78		180		107		180	22.96	2700
1336			28.55		7.14		14400		1.80		172		81.3		180	22.97	3240
1339			28.44		7.13		14400		1.91		164		56.3		180	22.72	3780
@ 1345 - Stopped for thunderstorms											~~155~~						
1445			29.33		7.16		15100		2.14		155		533		120	22.61	3780
1448			24.58		7.11		15100		2.03		141		835		120	22.65	4140
1451			25.01		7.11		15000		1.84		~~15~~ 137		722		120	22.68	4500
1454			25.09		7.04		15000		1.62		129		654		120	22.68	4860
1457			25.24		7.03		15000		1.67		115		406		120	22.75	5220
1500			25.36		7.05		15000		1.48		109		294		120	22.74	5580

Sample ID: CTMW-01D-20170403
Duplicate ID: NA
QA/QC Samples/ID: NA
COC Time: 1535

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)
Field Decontamination: Y N
Field Filtered: Y N
COC Number:
Comments:

Ferrous Iron = 0.07 mg/L
Sulfide = 0.03 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ CR Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-01D
Field Samplers: Jacob Souza		Recorded by: Jacob Souza	Date: 4/3/17
Well Depth (ft BGS): /	MP Distance AGS (ft): /	Well Depth (ft BMP): 49.41	Screened/Open Interval Top: / (ft BGS) 34.00 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): /		Screened/Open Interval Bottom: / (ft BGS) 49.00 (ft BMP)
Pump and Tubing Type: QED Sample Pro/poly tubing		Pump Intake Depth: / (ft BGS) 41.50 (ft BMP)	MP Description: T.O.C.
Equipment Decon. Method: Liquinox & water (x3)		Depth to Water Before Pump Installation (ft BMP): 22.37 Time: 0926	GW Disposal: GW-11 pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1503			25.45		7.10		15000		1.51		98		208		120	22.73	5940
1507			25.47		7.03		15100		1.59		97		163		120	22.74	6420
1511			25.51		7.05		15100		1.58		99		128		120	22.74	6900
1515			25.52		7.03		15100		1.53		100		111		120	22.74	7380
1519			25.51		7.03		15200		1.56		97		96.7		120	22.74	7860
1523			25.53		7.03		15200		1.57		~~91.8~~ 100		91.8		120	22.74	8340
1527			25.54		7.02		15200		1.59		99		90.1		120	22.74	8820
1531			25.53		7.03		15200		1.55		100		84.7		120	22.74	9300

Sample ID: CTMW-01D-20170403 Duplicate ID: NA QA/QC Samples/ID: NA COC Time: 1535

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron = 0.07 mg/L

Sulfide = 0.03 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ CR Treatability Study
Task Manager: Arul Ayyaswami
Task No: M12
Well ID: CTMW-02S
Field Samplers: Jacob Souza
Recorded by: Jacob Souza
Date: 4/5/17
Well Depth (ft BGS): /
MP Distance AGS (ft): /
Well Depth (ft BMP): 23.70
Screened/Open Interval Top: / (ft BGS) 19.00 (ft BMP)
Well Diameter (in): 2"
PID/FID Readings Beneath Inner Cap (ppm cge akb): /
Screened/Open Interval Bottom: / (ft BGS) 24.00 (ft BMP)
Pump and Tubing Type: QED Sample Pump Pro/poly tubing
Pump Intake Depth: / (ft BGS) 23.10 (ft BMP)
MP Description: T.O.C.
Equipment Decon. Method: Liqunox & Water (x3)
Depth to Water Before Pump Installation (ft BMP): 22.50
Time: 0745
GW Disposal: GW-11 pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0908			25.86		7.31		9230		2.96		187		1.4		105	22.50	0
0913			26.33		7.36		9220		2.46		181		1.0		105	22.50	525
0918			26.45		7.37		9210		1.95		175		0.0		105	22.50	1050
0923			26.51		7.40		9210		1.86		171		0.0		105	22.50	1575
0928			26.63		7.42		9210		1.67		170		0.0		105	22.50	2100
0933			26.87		7.46		9220		1.56		167		0.0		105	22.50	2625
0938			26.97		7.43		9440		1.65		160		0.0		105	22.50	3150
0943			27.05		7.44		9270		1.67		160		0.0		105	22.50	3675
0948			27.17		7.45		9240		1.63		160		0.0		105	22.50	4200
0953			27.19		7.45		9230		1.56		161		0.0		105	22.50	4725

Sample ID: CTMW-02S-20170405
Duplicate ID: NA
QA/QC Samples/ID: NA
COC Time: 0958

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)
Field Decontamination: Y N
Field Filtered: Y N
COC Number:
Comments:
Ferrous Iron = 0.09 mg/L
Sulfide = 0.00 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: In-Situ CR Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-02D
Field Samplers: Jacob Souza		Recorded by: Jacob Souza	Date: 4/4/17
Well Depth (ft BGS): /	MP Distance AGS (ft): /	Well Depth (ft BMP): 49.18	Screened/Open Interval Top: / (ft BGS) 34.00 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): /		Screened/Open Interval Bottom: / (ft BGS) 49.00 (ft BMP)
Pump and Tubing Type: QED SAmpLe Pro / poly tubing		Pump Intake Depth: / (ft BGS) 41.50 (ft BMP)	MP Description: T.O.C.
Equipment Decon. Method: liquinox & water (x3)		Depth to Water Before Pump Installation (ft BMP): 22.67 Time: 1220	GW Disposal: GW-11 pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1254			28.07		7.49		12600		2.56		132		556		120	23.09	0
1259			27.75		7.48		12900		1.54		133		372		120	23.15	600
1304			27.76		7.50		13000		1.25		131		237		120	23.15	1200
1309			27.71		7.52		13000		1.22		131		263		120	23.15	1800
1314			27.70		7.50		12900		1.27		130		246		120	23.15	2400
1319			27.79		7.51		12900		1.12		130		166		120	23.15	3000
1324			27.82		7.52		13000		1.13		130		137		120	23.15	3600
1329			27.78		7.53		12900		1.24		128		111		120	23.15	4200
1334			27.74		7.53		12900		0.98		127		83.0		120	23.15	4800
1339			27.77		7.50		12900		1.21		127		70.1		120	23.15	5400
1344			27.78		7.58		12900		1.12		123		45.1		120	23.15	6000
1349			~~28~~ 27.79		7.59		12900		1.15		122		39.7		120	23.15	6600
1354			27.82		7.62		13000		1.16		119		31.5		120	23.15	7200
1357			27.83		7.62		12900		1.17		120		31.1		120	23.14	7800
1401			27.81		7.63		12900		1.18		120		28.9		120	23.13	8400

Sample ID: CTMW-02D-20170404 Duplicate ID: CTMW-02D-20170404-FD QA/QC Samples/ID: NA COC Time: 0205

Sample Container Number	Sample Container Material Code	Sample Container Volume	Preservative	Intended Analysis and/or Method

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron = 0.11 mg/L
Sulfide = 0.06 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ CR Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-03S
Field Samplers: Jacob Souza		Recorded by: Jacob Souza	Date: 4/5/17
Well Depth (ft BGS): /	MP Distance AGS (ft): /	Well Depth (ft BMP): 24.37	Screened/Open Interval Top: / (ft BGS) 19.00 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): /		Screened/Open Interval Bottom: / (ft BGS) 24.00 (ft BMP)
Pump and Tubing Type: QED Sample Pro / poly tubing	Pump Intake Depth: / (ft BGS) 23.20 (ft BMP)		MP Description: T.O.C.
Equipment Decon. Method: Liquinox & Water (x3)	Depth to Water Before Pump Installation (ft BMP): 22.40	Time: 1114	GW Disposal: GW-11 pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1125			27.77		7.35		9260		2.89		158		0.2		105	22.40	0
1130			27.62		7.30		9320		2.28		157		0.0		105	22.40	525
1135			27.92		7.35		9290		2.20		160		0.0		105	22.40	1050
1140			27.89		7.31		9280		2.11		158		0.0		105	22.40	1575
1145			27.73		7.35		9310		2.00		160		0.0		105	22.40	2100
1150			27.84		7.33		9290		2.22		159		0.0		105	22.40	2625
1155			27.61		7.33		9330		1.89		160		0.0		105	22.40	3150
1200			27.80		7.34		9330		1.89		162		0.0		105	22.40	3675
1205			27.82		7.34		9350		1.88		161		0.0		105	22.40	4200

Sample ID: CTMW-03S-20170405 Duplicate ID: NA QA/QC Samples/ID: NA COC Time: 1210

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron = 0.00 mg/L

Sulfide = 0.00 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study
Task Manager: Arul Ayyaswami
Task No: M12
Well ID: CTMW-03D
Field Samplers: Jacob Souza
Recorded by: Jacob Souza
Date: 4/6/17
Well Depth (ft BGS): /
MP Distance AGS (ft): /
Well Depth (ft BMP): 39.50
Screened/Open Interval Top: / (ft BGS) 34.00 (ft BMP)
Well Diameter (in): 2
PID/FID Readings Beneath Inner Cap (ppm cge akb): /
Screened/Open Interval Bottom: / (ft BGS) 39.00 (ft BMP)
Pump and Tubing Type: QED Sample Pro / poly tubing
Pump Intake Depth: / (ft BGS) 36.50 (ft BMP)
MP Description: TOC
Equipment Decon. Method: liquinox & water (x3)
Depth to Water Before Pump Installation (ft BMP): 22.47
Time: 0750
GW Disposal: GW-11 pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0825			21.14		6.30		10500		3.47		291		13.0		120	22.49	0
0830			21.97		6.89		10500		3.35		266		11.9		120	22.49	600
0835			22.51		7.24		10500		3.30		244		9.5		120	22.49	1200
0840			22.70		7.33		10900		2.89		236		6.0		120	22.49	1800
0845			22.85		7.40		10900		3.38		226		3.6		120	22.48	2400
0850			22.93		7.42		10900		3.40		220		2.8		120	22.47	3000
0855			22.93		7.43		10900		3.43		216		2.6		120	22.46	3600
0900			22.94		7.43		10900		3.39		214		2.1		120	22.45	4200

Sample ID: CTMW-03D-20170406
Duplicate ID: NA
QA/QC Samples/ID: NA
COC Time: 0906

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N
Field Filtered: Y N
COC Number:

Comments:
Ferrous Iron = 0.00 mg/L
Sulfide = 0.00 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-045
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 4-5-17
Well Depth (ft BGS): —	MP Distance AGS (ft): — Well Depth (ft BMP): 24.00	Screened/Open Interval Top: —	(ft BGS) 19.00 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: —	(ft BGS) 24.00 (ft BMP)
Pump and Tubing Type: QED SamplePro; poly tubing	Pump Intake Depth: —	(ft BGS) 23.00 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse	Depth to Water Before Pump Installation (ft BMP): 22.37	Time: 0850	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (mS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0910	X		22.71		7.36		9.17		1.27/2.27		132		9.0		100	22.40	0
0915	X		23.11		7.29		9.18		0.73/2.15		135		5.0		100	22.40	500
0920	X		23.25		7.28		9.17		0.58/1.41		137		1.5		100	22.40	1000
0925	X		23.26	✓	7.27		9.16		0.52/1.38		139		0.0		100	22.40	1500
0930	X		23.28		7.27	✓	9.16	✓	0.53/1.36	✓	139	✓	0.0	✓	100	22.40	2000
0935		X	STABILIZATION														

DK 4-5-17

Sample ID: CTMW-045-20170405 Duplicate ID: — QA/QC Samples/ID: — COC Time: 0935

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT In-Situ Cr Treatability Study Suite				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron: 0.02 mg/L
Sulfide: 0.00 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study	Task Manager: Arul Ayyaswami	Task No: 194-8760014	**Well ID:** CTMW-04D
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 4-5-17
Well Depth (ft BGS): —	MP Distance AGS (ft): — Well Depth (ft BMP): 48.99	Screened/Open Interval Top: —	(ft BGS) 33.99 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: —	(ft BGS) 48.99 (ft BMP)
Pump and Tubing Type: QED SamplePro; poly tubing	Pump Intake Depth: —	(ft BGS) 41.49 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket method	Depth to Water Before Pump Installation (ft BMP): 22.62	Time:	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (mS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1102	X		25.61		7.50		13.0		1.79/2.12		158		154		100	22.65	0
1107	X		25.12		7.39		13.3		0.83/1.11		156		153		100	22.69	500
1112	X		25.09		7.37		13.3		0.57/1.09		154		120		100	22.71	1000
1117	X		25.21		7.30		13.3		0.46/1.10		154		74.8		100	22.71	1500
1122	X		25.17		7.27		13.3		0.37/1.12		153		48.7		100	22.71	2000
1127	X		25.23		7.26		13.3		0.24/1.09		152		34.1		100	22.71	2500
1132	X		25.28		7.23		13.3		0.21/1.08		151		25.2		100	22.71	3000
1137	X		25.32		7.22		13.3		0.20/1.09		149		18.1		100	22.71	3500
1142	X		25.35		7.21		13.3		0.19/1.07		148		15.0		100	22.71	4000
1147	X		25.37		7.20		13.3		0.17/1.07		146		11.2		100	22.71	4500
1152	X		25.39		7.19		13.3		0.18/1.07		146		9.9		100	22.71	5000
1157	X		25.40		7.19		13.3		0.17/1.07		145		7.7		100	22.71	5500
1202	X		25.41		7.18		13.4		0.18/1.10		144		5.9		100	22.71	6000
1207	X		25.44	✓	7.17	✓	13.4	✓	0.19/1.10	✓	143	✓	4.7	✓ (<5)	100	22.71	6500
1215		X	STABILIZATION														

Sample ID: CTMW-04D-20170405 **Duplicate ID:** — **QA/QC Samples/ID:** — **COC Time:** 1215

Sample Container

Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT	InSitu	Cr	Treatability	Study Suite

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron: 0.00 mg/L
Sulfide: 0.01 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

WELL WATER LEVEL MEASUREMENT LOG

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NERT, Henderson, NV Project

Task Name: In-Situ Cr T.S.	Task No: M12	Date: 5-2-17
Task Manager A. Ayyaswami	Field Sampler(s): D. Keady	Recorded by: D. Keady
Equipment Model/Type: Solinst 101 Water Level Meter	Serial Number: R19515	Last Calibration Date: —

Well Identification	Measuring Point (MP)	Time (hrs)	Depth to Static Water Level (ft BMP)	Well Sounding Depth (ft BMP)	Condition of Well and Well Seal
CTIW-01S	TOC	0806	22.15	23.65	Good
CTIW-01D	TOC	0808	22.41	38.62	Good
CTIW-02S	TOC	0933	22.20	24.38	Difficult to remove cap
CTIW-02D	TOC	0936	23.21	47.78	Difficult to remove cap; well seal loose
CTIW-03S	TOC	0810	22.35	24.22	Good
CTIW-03D	TOC	0928	NM*A	49.26	Under pressure; Difficult to remove cap
CTMW-01S	TOC	0938	22.25	23.78	Good
CTMW-01D	TOC	0942	22.43	49.42	Good
CTMW-02S	TOC	0947	22.79	23.66	Good
CTMW-02D	TOC	0949	22.96	49.19	Good
CTMW-03S	TOC	0952	22.41	24.35	Good
CTMW-03D	TOC	0954	22.56	39.49	Good
CTMW-04S	TOC	0956	22.61	24.01	Good
CTMW-04D	TOC	0958	22.75	49.07	Good

* Unable to obtain DTW; water level meter does not beep to indicate presence of water in well; thick, slimy residue on probe observed which may be interfering w/ probe; decontaminated probe and tried several times at different levels of sensitivity, unsuccessful

All injection wells observed to have extremely strong putrid odor, similar to rotting cranberries, and very thick yellow-orange slime residue observed on water level meter after removing from each well. Water used for decontamination observed to have what appears to be ~~the~~ tiny oil droplets, possibly due to injectate.

A Obtained interface probe and gauged well on 5·3·17: DTP = 23.65 ft BMP
DTW = 23.79 ft BMP
DK 5·3·17

DK 5·2·17

BGS = Below Ground Surface BMP = Below Measuring Point MP = Measuring Point TOC = Top of Casing (Well Riser)

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study
Task Manager: Arul Ayyaswami
Task No: M12
Well ID: CTMW-01S
Field Samplers: D. Keady
Recorded by: D. Keady
Date: 5-3-17
Well Depth (ft BGS): —
MP Distance AGS (ft): —
Well Depth (ft BMP): 23.78
Screened/Open Interval Top: — (ft BGS) 19 (ft BMP)
Well Diameter (in): 2
PID/FID Readings Beneath Inner Cap (ppm cge akb): —
Screened/Open Interval Bottom: — (ft BGS) 24 (ft BMP)
Pump and Tubing Type: ~~QE~~ Mega Monsoon; poly tubing
Pump Intake Depth: — (ft BGS) 23.01 (ft BMP)
MP Description: TOC
Equipment Decon. Method: 3 bucket rinse
Depth to Water Before Pump Installation (ft BMP): 22.43 Time: 0740
GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity m(µS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0755			27.43		5.49		12.0		3.59/2.78		-33		283		100	22.76	0
0800			27.35		5.75		12.1		1.58/2.56		-68		179		100	22.78	500
0805			28.15		5.71		12.0		0.98/2.22		-88		40.2		100	22.80	1000
0810			28.06		5.77		12.8		0.73/1.98		-129		22.3		100	22.81	1500
0815			28.63		5.91		13.4		0.77/1.96		-147		30.0		100	22.82	2000
0820			28.56		5.93		13.5		0.67/1.95		-153		26.5		100	22.83	2500
0825			28.64		5.90		13.7		0.69/1.93		-157		29.8		100	22.83	3000
0830			28.67		5.94		14.0		0.53/1.88		-155		22.7		100	22.83	3500
0835			28.69		5.92		14.0		0.48/1.86		-160		18.8		100	22.83	4000
0840			28.70		5.95		14.2		0.46/1.87		-163		16.5		100	22.83	4500
0845			28.72		5.95		14.2		0.44/1.86		-165		16.0		100	22.83	5000
0850			28.73	✓	5.96	✓	14.2	✓	0.43/1.87	✓	-166	✓	15.5	✓	100	22.83	5500
0855		X	STABILIZATION														

DK 5-3-17

Sample ID: CTMW-01S-20170503
Duplicate ID: —
QA/QC Samples/ID: —
COC Time: 0855

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Cr-TS Sampling Suite				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)
Field Decontamination: Y N
Field Filtered: Y N
COC Number:
Comments:
Ferrous Iron : 0.00 mg/L
Sulfide : 0.00 mg/L
groundwater color : cloudy, white

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study	Task Manager: Arul Ayyaswami		Task No: M12		Well ID: CTMW-01D
Field Samplers: D. Keady			Recorded by: D. Keady		Date: 5-3-17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 49.42	Screened/Open Interval Top: —	(ft BGS) 34	(ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: —	(ft BGS) 49	(ft BMP)
Pump and Tubing Type: MegaMonsoon; poly tubing		Pump Intake Depth: —	(ft BGS) 41.50	(ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse		Depth to Water Before Pump Installation (ft BMP): 22.41		Time: 0950	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity m~~µ~~S/cm		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
1000	X		27.46		6.66		17.5		1.03/2.87		82		>1000		100	22.78	0
1005	X		27.09		6.41		17.6		0.77/2.08		61		720		100	22.90	500
1010	X		26.96		6.46		17.7		0.69/2.00		56		522		100	22.93	1000
1015	X		26.93		6.50		17.7		0.62/1.71		59		478		100	22.94	1500
1020	X		26.80		6.51		17.5		0.55/1.69		67		266		100	22.95	2000
1025	X		26.88		6.54		17.4		0.51/1.67		70		159		100	22.95	2500
1030	X		27.00		6.54		17.3		0.46/1.50		72		90.8		100	22.95	3000
1035	X		26.89		6.53		17.3		0.44/1.49		76		95.9		100	22.95	3500
1040	X		26.99		6.55		17.3		0.42/1.47		71		88.6		100	22.95	4000
1045	X		26.98		6.52		17.3		0.40/1.46		75		84.3		100	22.95	4500
1050	X		27.00		6.49		17.3		0.38/1.43		79		81.2		100	22.95	5000
1055		X	STABILIZATION														

5-3-17

Sample ID: CTMW-01D-20170503 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1055

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT In-Situ Cr T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron: 0.05 mg/L

Sulfide: 0.01 mg/L

groundwater color: cloudy, yellow-green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point

C - Centigrade
COC - Chain of Custody

GS - Ground Surface
ID - Identification

mg/L - milligram/Liter
mV - milli Volts

min - Minute
ml - milliliter

MP - Measuring Point
NTU - Nephelometric Units

QA - Quality Assurance
QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

Page 1 of 1

NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID:** CTMW-02S
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 5-4-17
Well Depth (ft BGS): —	MP Distance AGS (ft): — Well Depth (ft BMP): ~~24.98~~ 23.66	Screened/Open Interval Top: —	(ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: —	(ft BGS) 24 (ft BMP)
Pump and Tubing Type: QED Sample Pro; poly tubing / Bailer	Pump Intake Depth: ~~23.10~~ 23.50	(ft ~~BGS~~) BMP — (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.79	Time: 0815	GW Disposal: GW-11

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (m~~μ~~S/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (~~ml~~) gal
0820	X		ATTEMPTED LOW FLOW; UNABLE TO GET FLOW; <1' OF WATER IN WELL.														
0835			WILL NEED TO BAIL INSTEAD.														
0900	X		BAILED ~0.45 gallons OF WATER (3 well volumes)														0.45 gal
1300		X	33.65		5.05		13.3		7.53		190		62.9		BAIL		

DK 5-4-17

Sample ID: CTMW-02S-20170504 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1300

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT In-Situ CrTS Sampling Suite				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron : 0.01 mg/L
Sulfide : 0.00 mg/L
groundwater color : clear/no color cloudy

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatabl.ty Study
Task Manager: Arul Ayyaswami
Task No: M12
Well ID: CTMW-02D
Field Samplers: D. Keady
Recorded by: D. Keady
Date: 5-3-17
Well Depth (ft BGS): —
MP Distance AGS (ft): —
Well Depth (ft BMP): 49.19
Screened/Open Interval Top: — (ft BGS) 34 (ft BMP)
Well Diameter (in): 2
PID/FID Readings Beneath Inner Cap (ppm cge akb): —
Screened/Open Interval Bottom: — (ft BGS) 49 (ft BMP)
Pump and Tubing Type: MegaMonsoon; poly tubing
Pump Intake Depth: — (ft BGS) 41.50 (ft BMP)
MP Description: TOC
Equipment Decon. Method: 3 bucket rinse
Depth to Water Before Pump Installation (ft BMP): 22.96
Time: 1250
GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity mS/cm READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1302	X		31.53		5.83		14.7		0.86/2.50		213		308		100	23.42	0
1307	X		30.22		5.98		15.2		0.71/2.13		197		133		100	23.58	500
1312	X		29.68		6.02		15.3		0.62/1.46		186		65.2		100	23.59	1000
1317	X		29.10		6.02		15.3		0.56/1.44		179		34.3		100	23.61	1500
1322	X		28.43		6.06		15.5		0.51/1.81		172		21.2		100	23.62	2000
1327	X		28.81		6.06		15.4		0.46/1.32		165		16.3		100	23.63	2500
1332	X		29.04		6.05		15.2		0.43/1.21		157		12.6		100	23.63	3000
1337	X		29.45		6.03		15.0		0.39/1.29		147		10.8		100	23.63	3500
1342	X		29.55		6.03		15.0		0.36/1.28		136		8.8		100	23.63	4000
1347	X		29.27		6.02		15.0		0.35/1.28		134		7.5		100	23.63	4500
1352	X		29.29		6.02		14.9		0.33/1.25		129		6.1		100	23.63	5000
1357	X		29.31	✓	6.01	✓	14.8	✓	0.31/1.21	✓	125	✓	5.2	✓	100	23.63	5500
1400		X	STABILIZATION														

Sample ID: CTMW-02D-20170503
Duplicate ID: CTMW-02D-20170503-FD
QA/QC Samples/ID: —
COC Time: 1400

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT In-Situ Cr TIS Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)
Field Decontamination: Y N
Field Filtered: Y N
COC Number:
Comments:
Ferrous Iron: 0.14 mg/L
Sulfide: 0.03 mg/L
groundwater color: yellow-green
Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

Page 1 of 1

NERT, Henderson, NV Project

Task Name: En-Situ Cr Treatability Study	Task Manager: Arul Ayyawami	Task No: M12	Well ID: CTMW-035
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 5-5-17
Well Depth (ft BGS):	MP Distance AGS (ft): —	Well Depth (ft BMP): 24.35	Screened/Open Interval Top: — (ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 24 (ft BMP)
Pump and Tubing Type: QED Sample Pro bladder; poly tubing	Pump Intake Depth: — (ft BGS) 23 (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 bucket + MFE w/ Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.41	Time: 0745	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity mS/cm READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0754	X		24.85		5.49		9.21		3.41/2.99		244		1.2		100	22.42	
0759	X		24.79		5.95		9.27		2.05/2.00		86		0.9		100	22.42	
0804	X		24.77		6.10		9.30		1.26/1.55		36		0.6		100	22.43	
0809	X		24.78		6.20		9.32		1.05/1.63		12		0.6		100	22.43	
0814	X		24.80		6.23		9.33		0.82/1.48		5		0.6		100	22.43	
0819	X		24.82		6.27		9.34		0.85/1.43		-1		0.5		100	22.43	
0824	X		24.86	✓	6.30	✓	9.35	✓	0.78/1.40	✓	-3	✓	0.5	✓	100	22.43	
0830		X	STABILIZATION														

DK 5-5-17

Sample ID: CTMW-035-20170505 **Duplicate ID:** — **QA/QC Samples/ID:** — **COC Time:** 0830

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT InSitu Cr TS-Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron : 0.00 mg/L
Sulfide : 0.00 mg/L

groundwater color : yellowgreen

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Stdy
Task Manager: Arul Ayyaswami
Task No: M12
Well ID: CTMW-03D
Field Samplers: D. Keady
Recorded by: D. Keady
Date: 5-5-17
Well Depth (ft BGS): —
MP Distance AGS (ft): —
Well Depth (ft BMP): 39.49
Screened/Open Interval Top: — (ft BGS) 34 (ft BMP)
Well Diameter (in): 2
PID/FID Readings Beneath Inner Cap (ppm cge akb): —
Screened/Open Interval Bottom: — (ft BGS) 39 (ft BMP)
Pump and Tubing Type: QED Sample Pro bladder; poly tubing
Pump Intake Depth: — (ft BGS) ~~38~~ 36.50 (ft BMP)
MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox
Depth to Water Before Pump Installation (ft BMP): 22.54 Time: 0900
GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity mS/cm READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Probe/Sfc READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0907	X		26.29		6.23		12.0		1.17/2.22		183		4.0		100	22.66	0
0912	X		26.03		6.37		12.0		0.97/2.00		182		2.3		100	22.66	500
0917	X		26.18		6.43		11.9		0.93/2.05		183		1.0		100	22.68	1000
0922	X		26.24		6.47		11.9		0.95/2.02		183		0.7		100	22.68	1500
0927	X		26.37	✓	6.50	✓	11.9	✓	1.02/2.10	✓	183	✓	0.5	✓	100	22.68	2000
0940		X	STABILIZATION														

DK 5.5.17

Sample ID: CTMW-03D-20170505
Duplicate ID: —
QA/QC Samples/ID: —
COC Time: 0940

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT In-Situ Cr T.S Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)
Field Decontamination: Y N
Field Filtered: Y N
COC Number:

Comments:
Ferrous Iron: 0.00 mg/L
Sulfide: 0.00 mg/L
groundwater color: yellow green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-04S
Field Samplers: D. Keady		Recorded by: D Keady	Date: 5-4-17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 24.01	
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Top: — (ft BGS) 19 (ft BMP)	
		Screened/Open Interval Bottom: — (ft BGS) 24 (ft BMP)	
Pump and Tubing Type: QED Sample Pro; poly tubing	Pump Intake Depth: — (ft BGS) 23 (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.61	Time: 0930	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	CHANGE*	pH (pH Units) READ	CHANGE*	Spec Conductivity m(μS/cm) READ	CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	CHANGE*	Redox Potential ORP (mV) READ	CHANGE*	Turbidity (NTU) READ	CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0940	X		26.95		5.51		11.8		1.81/3.14		168		27.8		100	22.69	
0945	X		26.94		5.75		11.8		1.23/2.50		145		9.1		100	22.70	
0950	X		26.84		5.83		11.8		1.00/1.94		131		6.9		100	22.71	
0955	X		26.78		5.85		11.8		0.87/1.86		124		6.5		100	22.73	
1000	X		26.66		5.83		11.8		0.80/1.48		121		6.5		100	22.73	
1005	X		26.51		5.84		11.8		0.74/1.45		121		6.2		100	22.73	
1010	X		26.56	✓	5.83	✓	11.9	✓	0.69/1.43	✓	120	✓	6.0	✓	100	23.73	
1015		X	STABILIZATION														

5-4-17

Sample ID: CTMW-04S-20170504 Duplicate ID: —

QA/QC Samples/ID: —

COC Time: 1015

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT In-Situ Cr T.S. Sample Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N

Field Filtered: Y N

COC Number:

Comments:

Ferrous Iron: 0.02 mg/L

Sulfide: 0.00 mg/L

groundwater color: yellow-green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study
Task Manager: Arul Ayyaswami
Task No: M12
Well ID: CTMW-04D
Field Samplers: D. Keady
Recorded by: D. Keady
Date: 5-4-17
Well Depth (ft BGS): —
MP Distance AGS (ft): —
Well Depth (ft BMP): 49.07
Screened/Open Interval Top: — (ft BGS) 34 (ft BMP)
Well Diameter (in): 2
PID/FID Readings Beneath Inner Cap (ppm cge akb): —
Screened/Open Interval Bottom: — (ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Sample Pro; poly tubing
Pump Intake Depth: — (ft BGS) 41.50 (ft BMP)
MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox
Depth to Water Before Pump Installation (ft BMP): 22.75 Time: 1125
GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity M(μS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1133	X		28.01		5.77		14.9		2.65/3.06		194		314		100	22.95	0
1138	X		28.39		6.01		15.0		3.19/2.72		194		153		100	22.96	500
1143	X		28.31		6.13		15.1		3.87/3.21		193		83.0		100	22.96	1000
1148	X		28.51		6.19		15.1		4.30/3.21		194		56.0		100	22.96	1500
1153	X		28.62		6.20		15.0		5.06/3.64		196		36.2		100	22.96	2000
1158	X		28.39		6.21		15.1		5.55/3.83		197		27.3		100	22.96	2500
1203	X		28.16		6.20		15.0		5.78/3.71		198		21.8		100	22.96	3000
1208	X		28.68		6.21		15.1		6.03/3.67		199		17.7		100	22.96	3500
1213	X		28.63		6.20		15.1		6.10/3.74		200		15.0		100	22.96	4000
1218	X		28.40		6.19		15.1		6.24/3.81		201		13.0		100	22.96	4500
1223	X		28.34	✓	6.20	✓	15.1	✓	6.22/3.74	✓	201	✓	12.2	✓	100	22.96	5000
1228	X		28.27		6.20		15.1		6.20/3.70		201		11.9		100	22.96	5500
1230		X	STABILIZATION														

DK 5-4-17

Sample ID: CTMW-04D-20170504
Duplicate ID: —
QA/QC Samples/ID: LEVEL 4 QC
COC Time: 1230

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT IN-SITU T.S. Sampling Suite				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N
Field Filtered: Y N
COC Number:

Comments:
Ferrous Iron: 0.00 mg/L
Sulfide: 0.00 mg/L
groundwater Color: yellow-green

Signature(s): D Keady

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

WELL WATER LEVEL MEASUREMENT LOG

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NERT, Henderson, NV Project

Task Name: In-Situ G. T.S.
Task No: M12
Date: 5-16-17
Task Manager: Anil Ayyarwami
Field Sampler(s): J. Bunkers, D. Keady
Recorded by: J. Bunkers, D. Keady
Equipment Model/Type: Interface Probe
Serial Number: ———
Last Calibration Date: ———

Well Identification	Measuring Point (MP)	Time (hrs)	Depth to Static Water Level (ft BMP)	~~Well Sounding Depth~~ Depth to Product (ft BMP)	Condition of Well and Well Seal
CTIW-01S	TOC	0747	22.29	—	
CTIW-01D	TOC	0748	22.48	—	
CTIW-02S	TOC	0816	22.32	—	
CTIW-02D	TOC	0812	23.70	2[illegible]2.71	
CTIW-03S	TOC	0809	22.44	—	
CTIW-03D	TOC	0803	23.76	23.59	
CTMW-01S	TOC	0824	22.13	~~22.13~~ DK 5-16-17	5-16-17
CTMW-01D	TOC	0820	22.54	—	
CTMW-02S	TOC	0759	22.90	—	
CTMW-02D	TOC	0800	23.07	—	
CTMW-03S	TOC	0746	22.45	—	
CTMW-04S	TOC	0754	22.71	—	
CTMW-04D	TOC	0755	22.88	—	
CTMW-03D	TOC	0751	22.57	—	

5-16-17

BGS = Below Ground Surface BMP = Below Measuring Point MP = Measuring Point TOC = Top of Casing (Well Riser)

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-015
Field Samplers: D. Keady, J. Bunkers		Recorded by: D. Keady, J. Bunker	Date: 5-16-17
Well Depth (ft BGS): —	MP Distance AGS (ft): — / Well Depth (ft BMP): 23.78	Screened/Open Interval Top: — (ft BGS)	19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: — (ft BGS)	24 (ft BMP)
Pump and Tubing Type: QED SamplePro (bladder); poly tubing	Pump Intake Depth: —	(ft BGS) 22.78 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.13 ~~22.29~~	Time: ~~0747~~ 0824	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity m~~µ~~S/cm READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0839	X		23.40		6.80		10.7		8.97/2.43		-54		70.8		100	22.43	0
0844	X		23.49		6.80		10.6		8.06/2.22		-82		70.3		100	22.48	500
0849	X		23.64		6.79		10.6		7.58/2.28		-121		71.4		100	22.53	1000
0854	X		23.88		6.77		10.6		7.10/1.78		-173		70.5		100	22.56	1500
0859	X		24.00		6.75		10.6		6.57/1.41		-206		70.5		100	22.59	2000
0904	X		24.09		6.74		10.6		6.49/1.42		-228		69.8		100	22.62	2500
0909	X		24.23		6.73		10.6		6.17/1.36		-249		69.0		100	22.65	3000
0914	X		24.31		6.72		10.7		5.92/1.32		-265		67.0		100	22.68	3500
0919	X		24.40		6.70		10.7		5.62/1.28		-280		62.7		100	22.71	4000
0924	X		24.38		6.69		10.7		5.43/1.23		-290		60.5		100	22.73	4500
0929	X		24.39	✓	6.68	✓	10.7	✓	5.38/1.21	✓	-298	✓	59.0	✓	100	22.76	5000
0930		X	STABILIZATION														

DK 5-16-17

Sample ID: CTMW-015-20170516 **Duplicate ID:** — **QA/QC Samples/ID:** — **COC Time:** 0930

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT In-Situ Cr T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron : 0.22 mg/L

Sulfide : 0.11 mg/L

groundwater color : cloudy but no color

(lots of bubbles observed in sample cell during HACH sulfide reaction).

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study	Task Manager: Anil Ayyaswami	Task No: M12	Well ID: CTMW-01D
Field Samplers: D. Keady, J. Bunkers		Recorded by: D. Keady, J. Bunkers	Date: 5-16-17
Well Depth (ft BGS): —	MP Distance AGS (ft): — / Well Depth (ft BMP): 49.41	Screened/Open Interval Top: —	(ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: —	(ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED SamplePro (bladder); poly tubing	Pump Intake Depth: —	(ft BGS) 41.50 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.54	Time: 0820	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity M(µS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1055	X		24.97		7.33		13.2		6.19/1.41		-33		325		100	22.70	
1100	X		25.55		7.42		13.6		5.21/1.22		-31		256		100	22.76	
1105	X		25.73		7.44		13.7		4.83/1.34		-30		202		100	22.80	
1110	X		25.89		7.46		13.8		4.52/1.30		-28		152		100	22.82	
1115	X		26.21		7.47		13.8		4.20/1.22		-26		90.3		100	22.84	
1120	X		26.39		7.47		13.9		4.04/1.20		-25		70.8		100	22.85	
1125	X		26.63		7.47		13.9		3.92/1.19		-24		42.8		100	22.85	
1130	X		27.02	✓	7.47	✓	13.9	✓	3.79/1.16	✓	-23	✓	11.0	✓	100	22.85	
1135	X		27.09		7.46		13.9		3.69/1.14		-23		4.8		100	22.85	
1145		X	STABILIZATION														

DK 5-16-17

Sample ID: CTMW-01D-20170516 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1145

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT In-Situ Cr T.S Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N Field Filtered: Y N COC Number:

Comments:

Ferrous Iron: 0.15 mg/L

Sulfide: 0.00 mg/L

groundwater color: yellow-green

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

e 1 of 1

NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID:** CTMW-02S
Field Samplers: D. Keady; J. Bunker		Recorded by: D. Keady, J. Bunker	Date: 5-16-17
Well Depth (ft BGS): —	MP Distance AGS (ft): — / Well Depth (ft BMP): 23.70	Screened/Open Interval Top: —	(ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: —	(ft BGS) 24 (ft BMP)
Pump and Tubing Type: Monsoon (electric); poly tubing	Pump Intake Depth: ~~23~~ — (ft BGS) 23.69 (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.90 Time:		GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity mS/cm READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1347	X		33.10		6.78		10.8		5.77/1.99		-12		0.0		100	NM	0
1352	X		32.69		6.76		10.8		4.98/1.75		-35		0.0		100	NM	500
1357	X		32.01		6.76		10.9		4.65/1.72		-44		0.0		100	NM	1000
1402	X		31.50		6.75		11.0		4.55/1.70		-48		0.0		100	NM	1500
1407	X		31.31	✓	6.75	✓	11.1	✓	4.49/1.68	✓	-43	✓	0.0	✓	100	NM	2000
1410		X	STABILIZATION														

DK 5-16-17

Sample ID: CTMW-02S-20170516 **Duplicate ID:** — **QA/QC Samples/ID:** — **COC Time:** 1410

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT		In-Situ	Cr	Treatability Study Set

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron: 0.16 mg/L
Sulfide: 0.11 mg/L
(many bubbles formed in sample cell during HACH sulfide rxn.)

groundwater color: clear & no color

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID:** CTMW-02D
Field Samplers: D. Keady, J. Bunkers		Recorded by: D. Keady, J. Bunkers	Date: 5-17-17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 49.18	Screened/Open Interval Top: — (ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED SamplePro (bladder); poly tubing	Pump Intake Depth: — (ft BGS) 41.50 (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox	Depth to Water Before Pump Installation (ft BMP): 23.07	Time: 0715	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	CHANGE*	pH (pH Units) READ	CHANGE*	Spec Conductivity m (µS/cm) READ	CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	CHANGE*	Redox Potential ORP (mV) READ	CHANGE*	Turbidity (NTU) READ	CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0828	X		20.92		7.09		13.4		10.46/5.43		-8		>1000		100	22.84	0
0833	X		21.96		7.13		13.4		9.45/5.41		3		>1000		100	22.86	500
0838	X		22.32		7.16		13.4		8.99/4.76		7		656		100	22.88	1000
0843	X		22.49		7.16		13.3		8.68/4.21		12		439		100	22.90	1500
0848	X		22.63		7.15		13.3		8.40/3.83		16		335		100	22.92	2000
0853	X		22.78		7.15		13.3		8.09/3.72		20		251		100	22.93	2500
0858	X		22.88		7.16		13.2		7.78/3.63		23		206		100	22.94	3000
0903	X		22.98		7.15		13.2		7.55/3.91		25		187		100	22.94	3500
0908	X		23.04		7.15		13.1		7.34/4.46		28		152		100	22.94	4000
0913	X		23.12		7.13		13.0		7.09/3.60		30		134		100	22.94	4500
0918	X		23.15		7.14		13.0		6.88/3.55		31		140		100	22.94	5000
0923	X		2323	✓	7.13	✓	12.9	✓	6.71/3.40	✓	33	✓	130	✓	100	22.94	5500
0930		X	STABILIZATION														

DK 5-17-17

Sample ID: CTMW-02D-20170517 Duplicate ID: — QA/QC Samples/ID: — COC Time: 0930

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT In-Situ Cr T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments: Ferrous Iron: 0.00 mg/L
Sulfide: 0.03 mg/L
groundwater color: yellow-green, cloudy

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-situ chromium study
Task Manager: Arul Ayyaswami
Task No: M12
Well ID: CTMW-035
Field Samplers: Jesse Bunkers, Daniel Keady
Recorded by: Jesse Bunkers
Date: 5/17/17
Well Depth (ft BGS): 24.37
MP Distance AGS (ft):
Well Depth (ft BMP): —
Screened/Open Interval Top: 19 (ft BGS) — (ft BMP)
Well Diameter (in): 2
PID/FID Readings Beneath Inner Cap (ppm cge akb): —
Screened/Open Interval Bottom: 24 (ft BGS) — (ft BMP)
Pump and Tubing Type: QED Bladder / 1/4" HDPE
Pump Intake Depth: 21.5 (ft BGS) 23 (ft BMP)
MP Description: TOC
Equipment Decon. Method: 2x Alconox, DI Rinse
Depth to Water Before Pump Installation (ft BMP): 22.40
Time: 0833
GW Disposal: GW-11

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0857	✓		20.79		6.68		10.1		8.16		244		2.0		80	22.41	500
0902	✓		20.81		6.80		10.1		7.53		211		1.6		80	22.41	750
0907	✓		20.70		6.86		10.1		7.16		194		1.4		80	22.41	1000
0912	✓		20.77		6.80		10.1		6.63		182		1.2		80	22.41	1300
0917	✓		20.80		6.89		10.1		6.22		173		1.1		80	22.41	1800
0922	✓		20.75		7.57		10.1		5.86		165		1.2		80	22.41	2100
0927	✓		20.84		7.48		10.1		5.36		156		1.0		80	22.41	2400
0932	✓		20.87		7.65		10.1		5.04		152		1.0		80	22.41	2800
0937	✓		20.89		7.36		10.1		4.84		148		1.0		80	22.41	3100
0942	✓		20.91		7.42		10.1		4.80		147		1.0		80	22.41	3500
0947	✓		20.91		7.40		10.1		4.75		145		1.0		80	22.41	3900

DK 5/17/17

Sample ID: CTMW-035-20170517
Duplicate ID: —
QA/QC Samples/ID: —
COC Time: 0950

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT In-situ Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N
Field Filtered: Y N
COC Number:

Comments: Ferrous Iron: 0.00
Sulfide: 0.08
groundwater color: yellow

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: In-Situ Chromium Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID:** CTMW-03D
Field Samplers: Jesse Bunkers, Daniel Keady		Recorded by: Jesse Bunkers	Date: 5/17/17
Well Depth (ft BGS): 49.10	MP Distance AGS (ft): —	Well Depth (ft BMP): 49.10	Screened/Open Interval Top: 34 (ft BGS) — (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: 49 (ft BGS) — (ft BMP)
Pump and Tubing Type: QED Sample Pro Bladder / 1/4" HDPE	Pump Intake Depth: 41.5 (ft BGS) 41.5 (ft BMP)		MP Description: TOC
Equipment Decon. Method: 2x Alconox, DI Rinse	Depth to Water Before Pump Installation (ft BMP): 22.60 Time: 1112		GW Disposal: GW-11

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1156	✓		25.32		8.63		10.3		3.22		181		2.1		120	22.45	300
1201	✓		23.51		8.67		10.4		3.07		177		1.5		120	22.62	700
1206	✓		22.94		8.69		10.4		3.61		173		1.0		120	22.62	1200
1209	✓		22.83		8.70		10.4		4.25		170		0.9		120	22.62	2000
1214	✓		22.67		8.71		10.5		4.28		168		0.6		120	22.62	2900
1219	✓		22.65		8.71		10.5		4.31		167		0.8		120	22.62	3600

Rb 5-17-17

Sample ID: CTMW-03D-20170517

Duplicate ID: —

QA/QC Samples/ID: CTMW-03D-20170517 MS/MSD

COC Time: 1220

Sample Container Number	Sample Container Material Code	Sample Container Volume	Preservative	Intended Analysis and/or Method
NERT		In-Situ	Sampling	Set

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron: 0.00 mg/L

Sulfide: 0.01 mg/L

Groundwater color: yellow

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point

C - Centigrade
COC - Chain of Custody

GS - Ground Surface
ID - Identification

mg/L - milligram/Liter
mV - milli Volts

min - Minute
ml - milliliter

MP - Measuring Point
NTU - Nephelometric Units

QA - Quality Assurance
QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-04S
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 5-17-17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 24.00	Screened/Open Interval Top: — (ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 24 (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder); poly tubing	Pump Intake Depth: — (ft BGS) 23.00 (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.71	Time: 1140	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity m(µS/cm) READ	Spec Conductivity m(µS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) Hach/YSI READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1156	X		25.49		6.59		10.6		6.74/1.96		22		51.3		100	22.72	0
1201	X		25.72		6.60		10.6		5.91/1.25		10		48.1		100	22.74	500
1206	X		25.77		6.62		10.6		5.59/1.21		-5		46.3		100	22.76	1000
1211	X		25.85		6.67		10.6		5.40/1.19		-11		47.2		100	22.78	1500
1216	X		25.85	✓	6.68	✓	10.6	✓	5.32/1.16	✓	-12	✓	47.4	✓	100	22.80	2000
1230		X	STABILIZATION														

DK 5-17-17

Sample ID: CTMW-04S-20170517 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1230

Sample Container

Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT In-Situ Cr T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N

Field Filtered: Y N

COC Number:

Comments:
Ferrous Iron: 0.17 mg/L groundwater color: no color, slightly cloudy
Sulfide: 0.17 mg/L
(many bubbles formed in sample cell during HACH sulfide run.)

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study	Task Manager: Anil Ayyagari	Task No: M12	Well ID: CTMW-04D
Field Samplers: D. Keady, J. Bunker		Recorded by: R. Keady, J. Bunker	Date: 5-17-17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 48.99	Screened/Open Interval Top: — (ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: (ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder); poly tubing		Pump Intake Depth: — (ft BGS) 41.50 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox		Depth to Water Before Pump Installation (ft BMP): 22.88 Time: 1330	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity m ~~µ~~S/cm READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) [illegible]/YSI READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1336	X		26.92		8.73		11.8		1.38/1.13		158		92.0		100	23.10	0
1341	X		25.94		8.69		12.2		0.65/1.68		172		93.6		100	23.10	500
1346	X		25.64		8.69		12.3		0.46/1.27		177		79.6		100	23.10	1000
1351	X		25.37		8.70		12.4		0.35/1.00		178		67.3		100	23.10	1500
1356	X		24.86		8.70		12.3		0.30/0.99		181		48.6		100	23.10	2000
1401	X		24.33		8.71		12.3		0.22/0.87		182		37.1		100	23.10	2500
1406	X		23.95		8.71		12.4		0.18/0.88		183		23.5		100	23.10	3000
1411	X		23.63		8.72		12.4		0.15/0.91		184		17.9		100	23.10	3500
1416	X		23.42	✓	8.71	✓	12.4	✓	0.13/0.89	✓	185	✓	13.7	✓	100	23.10	4000
1430		X STABILIZATION															

DRJ 5/17/17

Sample ID: CTMW-04D-20170517~~-FD~~ Duplicate ID: CTMW-04D-20170517-FD QA/QC Samples/ID: — COC Time: 1430

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT Sampling Set for In-Situ Cr T.S.				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments: ~~Fe~~ Ferrous Iron: 0.07 mg/L groundwater color: yellow green
Sulfide: 0.01 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

WELL WATER LEVEL MEASUREMENT LOG

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NERT, Henderson, NV Project

Task Name: In-Situ Cr	Task No: Performance/Injection Monitoring	Date: 5/31/17
Task Manager Mike Crews	Field Sampler(s): Jeff Richeson	Recorded by: Jeff Richeson
Equipment Model/Type: Solinst interface meter Model 122	*Serial Number:* 287934	*Last Calibration Date:*

500 DTW	Well Identification	Measuring Point (MP)	Time (hrs)	Depth to Static Water Level (ft BMP)	~~Well Sounding~~ Depth (ft BMP) Depth to Product	Condition of Well and Well Seal	Afte Bail DTW
	CTIW-01S	TOC	0846	22.16	~~22.16~~ PN	Good	
	CTIW-01D	TOC	0849	22.36 ←	~~22.36~~	Good	
	CTIW-02S	TOC	0854	22.37 ←	~~22.37~~	Good	
23.20	CTIW-02D	TOC	0856	23.92	~~22.60~~ ok	Good * Product	23.21
	CTIW-03S	TOC	0858	22.51 ←	~~22.51~~	Good	
23.33	CTIW-03D	TOC	0900	23.64	23.43	Good * Product	23.78
	CTMW-02S	TOC	0903	22.85	~~22.85~~ PN	Good	
	CTMW-02D	TOC	0904	23.08		"	
	CTMW-01S	TOC	0907	22.28		Good	
	CTMW-01D	TOC	0908	22.46		"	
	CTMW-03S	TOC	0910	22.47		Good	
	CTMW-03D	TOC	0911	22.58		"	
	CTMW-04S	TOC	0912	22.69		Good	
	CTMW-04D	TOC	0913	22.86		"	

BGS = Below Ground Surface BMP = Below Measuring Point MP = Measuring Point TOC = Top of Casing (Well Riser)

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Cr	Task Manager: mike Crews / Arul A.	Task No: Performance / Injection M12	Well ID: CTMW-015
Field Samplers: J. Richeson		Recorded by: J. Richeson	Date: 5/31/17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 23.78	Screened/Open Interval Top: (ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: (ft BGS) 24 (ft BMP)
Pump and Tubing Type: QED Sample pro (1 Bladder) poly tubing	Pump Intake Depth: 23.50' (ft BGS)	(ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket rinse w/ liquinox	Depth to Water Before Pump Installation (ft BMP): 22.28	Time: 0900	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity mS ~~(uS/cm)~~		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
1100	X		31.17		6.22		10.7		4.98		-141		23.6		200 ml/	22.28	0
1105	X		29.01		6.14		11.0		4.27		-144		19.8		200 ml/min	22.92	1 Liter
1110	X		28.79		6.18		11.2		1.53		-147		19.6		200 ml/min	22.94	2 L
1115	X		28.74		6.13		11.2		1.15		-146		18.0		200	22.95	3 L
1120	X		28.39		6.10		11.2		1.21		-150		14.7		200	22.95	4 L
1125	X		28.57		6.10		11.2		1.15		-153		12.4		200	22.94	5 L
1130	X		28.65		6.12		11.1		1.17		-155		9.7		200	22.96	6 L
1135	X		28.59		6.10		11.2		1.11		-152		9.4		200	22.98	7 L
1140	X		28.64		6.09		11.2		1.05		-157		9.2		200	22.96	8 L

Stabilization Achieved Begin Sampling at 1140

Sample ID: CTMW-015-20170531 Duplicate ID: N/A QA/QC Samples/ID: N/A COC Time:

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT	In-Situ	Cr	T.S.	Sampling Set

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: [✓ Y] N COC Number:

Comments: Ferrous Iron = 0.04 mg/L water clear color
Sulfide = 0.05 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability study	Task Manager: Arul A.	Task No: M12	Well ID: CTMW-01D
Field Samplers: J Richeson		Recorded by: Jeff Richeson	Date: 5/31/17
Well Depth (ft BGS): —	MP Distance AGS (ft): — / Well Depth (ft BMP): 49.41	Screened/Open Interval Top: —	(ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: —	(ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Bladder Pump	Pump Intake Depth:	(ft BGS) (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse w/ Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.46	Time: 0908	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1335	X		31.15		7.46		13.5		1.55		-7		115		200	22.47	0
1340	X		28.71		7.36		14.3		1.09		-33		71.2		200	22.89	1L
1345	X		28.20		7.02		14.3		1.12		-17		27.8		200	23.10	2L
1350	X		28.11		6.95		14.3		0.67		-14		10.0		200	23.16	3L
1355	X		27.50		6.94		14.4		0.72		-14		6.2		200	23.10	4L
1400	X		27.45		7.01		14.1		0.75		-16		3.8		200	23.09	5L
1405	X		27.41		6.98		14.3		0.80		-14		0.2		200	23.08	6L
1410	X		27.37		7.00		14.5		0.83		-14		0.6		200	23.06	7L

Stabilization Acheived at 1410

Sample ID: CTMW-01D-20170531 Duplicate ID: N/A

QA/QC Samples/ID: N/A COC Time:

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method

NERT In-Situ Cr T.S Sampling Set

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N

Field Filtered: Y N

COC Number:

Comments: Ferrous Iron = 0.05 mg/L
Sulfide = 0.00 mg/L
water Yellow color

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Cr	Task Manager: Arul A	Task No: M12	Well ID: CTMW-02S
Field Samplers: Jeff Richeson		Recorded by: JR	Date: 5/31/17
Well Depth (ft BGS): 23.77	MP Distance AGS (ft): — ; Well Depth (ft BMP): 23.77	Screened/Open Interval Top:	(ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):	Screened/Open Interval Bottom:	(ft BGS) 24 (ft BMP)
Pump and Tubing Type: QED / Bailer / Monsoon pump	Pump Intake Depth: — (ft BGS)	23.70 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket rinse w/ liquinox	Depth to Water Before Pump Installation (ft BMP):	Time:	GW Disposal: Gwell/Pad

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (uS/cm) READ	Spec Cond. CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
5/31 1455	X		31.50		6.66		11.6		1.60		229		1.9		200	22.77	0
1500			31.39		6.62		11.2		2.14		181		13.4		200	23.43	1 L
unable to pump well due to insufficient water level																	
1510	X	Hand Bail															
went Dry & Hand Bailer is sticking to the side wall @ bottom of the well																	
/1 0750	X		29.55		6.70		11.2		1.82		150		6.6		N/A	22.83	1.5 L
well Dry @ 0755																23.65	
Allow well to Recharge																	
sample collected @ 1535 on 6/1/17																	

Sample ID: CTMW-02S-20170601 Duplicate ID: N/A QA/QC Samples/ID: N/A COC Time:

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT In-Situ Cr Treatability Study Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N Field Filtered: Y N COC Number:

Comments:

Ferrous Iron = 0.10 mg/l
sulfide = 0.06 mg/l

Groundwater Color is Clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ CR Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-02D
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 6/11/17
Well Depth (ft BGS): 49.18	MP Distance AGS (ft): — Well Depth (ft BMP): 49.18	Screened/Open Interval Top: — (ft BGS)	34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: — (ft BGS)	49 (ft BMP)
Pump and Tubing Type: mega monsoon w/ poly Tubing	Pump Intake Depth: (ft BGS) (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse w/ Liquinox	Depth to Water Before Pump Installation (ft BMP): 23.18	Time: 0720	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0820	X		29.05		6.90		12.7		1.85		180		55.0		200	23.20	
0825	X		27.75		6.80		12.8		0.94		178		41.7		200	25.00	1L
0830	X		27.26		6.73		12.8		1.11		172		40.6		200	25.91	2L
0835	X		27.03		6.73		13.0		0.62		175		13.3		200	26.00	3L
0840	X		27.22		6.71		13.0		0.67		181		6.4		200	26.02	4L
0845	X		27.37		6.76		13.1		0.74		173		7.0		200	25.11	5L
0850	X		27.24		6.75		13.2		0.54		174		7.5		200	25.07	6L
0855	X		27.20		6.71		13.1		0.50		172		7.2		200	25.04	7L
0900	X		27.24		6.72		13.1		0.52		170		7.0		200	25.03	8L
0905	X		27.21		6.74		13.1		0.51		168		6.8		200	25.00	9L
0910	X		27.20		6.74		13.1		0.52		164		6.6		200	24.98	10L
0910		X	stabilization achieved @ 0910 Begin Sampling														

Sample ID: CTMW-02D-20170601 Duplicate ID: CTMW-02D-20170601-FD QA/QC Samples/ID:

COC Time:

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT. In-Situ CR				
Treatability Study Sample Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N

Field Filtered: Y N

COC Number:

Comments: Ferrous Iron = 0.05 mg/l Groundwater
Sulfide = 0.04 mg/l is yellowish Green Color.

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ CR Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-035
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 6/1/17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 24.37	Screened/Open Interval Top: — (ft BGS) 19 (ft BMP)
Well Diameter (in):	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: — (ft BGS) 24 (ft BMP)
Pump and Tubing Type: Mega Monsoon w/ Poly Tubing	Pump Intake Depth: (ft BGS) 24.00 (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse w/ liquinox	Depth to Water Before Pump Installation (ft BMP): 22.47	Time: 1020	GW Disposal: GW Bnd

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1025	X		31.15		7.30		10.7		3.70		140		32.7		100	22.46	0
1030	X		29.03		6.99		10.6		1.64		177		2.4		100	22.48	500
1035	X		28.11		6.93		10.5		1.32		189		0.0		100	22.48	1L
1040	X		27.90		6.93		10.5		1.22		186		0.0		100	22.48	1.5L
1045	X		27.65		6.90		10.5		1.18		174		0.0		100	22.49	2L
1050	X		27.51		6.88		10.5		1.16		174		0.0		100	22.49	2.5L
1055	X		27.60		6.87		10.5		1.14		173		0.0		100	22.50	3L
1100	X		27.63		6.89		10.6		1.14		172		0.0		100	22.49	3.5L
Parameters stabilized @ 1100																	
1100		X															

Sample ID: CTMW-035-20170601 Duplicate ID: N/A QA/QC Samples/ID: N/A COC Time:

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT In-Situ CR Treatability Study sample set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:
Ferrous Iron = 0.00 mg/l Groundwater
Sulfide = 0.00 mg/l color yellow

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ CR Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-03D
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 6/1/17
Well Depth (ft BGS): —	MP Distance AGS (ft): — Well Depth (ft BMP): 39.50	Screened/Open Interval Top: — (ft BGS)	34.00 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: (ft BGS)	39.00 (ft BMP)
Pump and Tubing Type: Mega Monsoon w/ poly Tubing	Pump Intake Depth: (ft BGS)	37.00 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse w/ Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.58	Time: 1340	GW Disposal: GW 11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (uS/cm) READ	Spec Cond. CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1350	X		30.09		7.52		10.5		1.99		272		24.8		150	22.58	0
1355	X		28.32		7.27		10.5		0.56		238		0.0		150	23.69	750
1400	X		27.65		7.22		10.6		0.50		233		0.0		150	23.54	1.5 L
1405	X		27.35		7.20		10.7		0.53		229		0.0		150	23.50	2.25 L
1410	X		27.46		7.17		10.6		0.56		224		0.0		150	23.49	3 L
1415	X		27.85		7.16		10.6		0.57		220		0.0		150	23.48	3.75 L
1420	X		27.75		7.16		10.6		0.59		217		0.0		150	23.48	4.5 L
1425	X		27.81		7.17		10.6		0.60		215		0.0		150	23.47	5.25 L
1430	X		27.85		7.18		10.7		0.58		213		0.0		150	23.46	6 L
Parameters Stabilized @ 1430																	
1430		X															

Sample ID: CTMW-03D-20170601 Duplicate ID: N/A QA/QC Samples/ID: MS/MSD COC Time:

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT In-Situ CR Treatability study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: Y [✓ N] COC Number:

Comments:
Ferrous Iron = 0.0 mg/l
Sulfide = 0.0 mg/l
water color is Yellow

Signature(s): Jeff Richeson

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-045
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 6/2/17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 24.01	Screened/Open Interval Top: — (ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 24 (ft BMP)
Pump and Tubing Type: mega Monsoon w/ poly Tubing	Pump Intake Depth: — (ft BGS) 23.50 (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 Bucket rinse w/ liquinox	Depth to Water Before Pump Installation (ft BMP): 22.70	Time: 0730	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0740	X		28.33		6.46		11.2		3.94		292		134		100	22.75	0
0745	X		27.78		6.47		11.0		1.67		249		73.6		100	22.99	500
0750	X		27.54		6.48		10.9		1.40		228		60.2		100	23.01	1L
0755	X		27.29		6.46		11.0		1.20		211		32.3		100	23.03	1.5L
0800	X		27.23		6.50		11.0		1.35		203		34.5		100	23.03	2L
0805	X		27.30		6.47		11.0		1.40		194		36.2		100	23.02	2.5L
0810	X		27.36		6.47		11.1		1.43		193		38.5		100	23.01	3L
0815	X		27.40		6.47		11.1		1.45		192		39.0		100	23.01	3.5L
			Parameters Stabilized Collect Sample CTMW-045														
0815		X	CTMW-045-20170602														

Sample ID: CTMW-045-20170602 Duplicate ID: — QA/QC Samples/ID: N/A COC Time:

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT In-Situ Cr Treatability Study Sample Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: Y [✓ N] COC Number:

Comments: Ferrous Iron = 0.03 mg/l Groundwater Sulfide = 0.02 mg/l Color = clear A little cloudy

Signature(s): JR

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-04D
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 6/2/17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 48.99	Screened/Open Interval Top: — (ft BGS) 33.99 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 48.99 (ft BMP)
Pump and Tubing Type: Mega Monsoon w/ Poly Tubing	Pump Intake Depth: — (ft BGS) 41 (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 Bucket rinse w/ liquid	Depth to Water Before Pump Installation (ft BMP): 22.98	Time: 0930	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0940	X		27.29		7.81		12.3		1.50		184		110		100	22.80	0
0945	X		29.95		7.23		12.3		0.98		185		94.2		100	23.01	500
0950	X		27.83		7.13		12.3		0.79		185		81.7		100	23.03	1L
0955	X		27.26		7.11		12.2		0.30		182		7.0		100	23.05	1.5 L
1000	X		27.15		7.13		12.3		0.29		182		6.8		100	23.06	2 L
1005	X		27.05		7.12		12.3		0.32		182		6.5		100	23.06	2.5 L
1010	X		27.07		7.12		12.4		0.34		181		6.4		100	23.06	3L
			Stabilization acheived collect sample CTMW-04D														
1010		X	CTMW-04D-20170602														

Sample ID: CTMW-04D-20170602 Duplicate ID: N/A QA/QC Samples/ID: Level 4 QC COC Time:

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT In-Situ Cr Treatability Study Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: Y [✓ N] COC Number:

Comments: Ferrous Iron = 0.0 mg/l Groundwater Sulfide = 0.0 mg/l Color is Yellow

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

WELL WATER LEVEL MEASUREMENT LOG

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NERT, Henderson, NV Project

Task Name: In-Situ Chromium	Task No: M12	Date: 6/19/17
Task Manager Arul Ayyaswami	Field Sampler(s): Jeff Richeson	Recorded by: Jeff Richeson
Equipment Model/Type: Solinst 100' IP meter	Serial Number:	Last Calibration Date:

DTW after product Removal	Well Identification	Measuring Point (MP)	Time (hrs)	Depth to Static Water Level (ft BMP)	Well Sounding DT Depth Product (ft BMP)	Condition of Well and Well Seal
	CTIW-01S	TOC	0534	22.03		Good (black Chunky liquid, not oil)
	CTIW-01D		0533	22.21		"
	CTIW-02S		0532	22.13		Good
	CTIW-02D		0531	22.70		"
	CTIW-03S		0530	22.24		Good Black Chunky liquid not oil
23.20	CTIW-03D		0529	23.25	23.05	" 0.20' of oil
	CTMW-01S		0527	22~~23~~.24		Good
	CTMW-01D		0528	22.48		"
	CTMW-02S		0525	22.75		Good
	CTMW-02D		0526	23.12		"
	CTMW-03S		0523	22.40		Good
	CTMW-03D		0524	22.58		"
	CTMW-04S		0521	22.66		Good
	CTMW-04D		0522	22.85		"
	CTMW-05S		0519	23.18		Good
	CTMW-05D		0520	23.36		"
	CTMW-06S		0516	23.41		Good
	CTMW-06D	✓	0517	23.74		"

BGS = Below Ground Surface BMP = Below Measuring Point MP = Measuring Point TOC = Top of Casing (Well Riser)

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-01S**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 6/19/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 23.78	Screened/Open Interval Top: (ft BGS) 19 (ft BMP)
Well Diameter (in):	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 24 (ft BMP)
Pump and Tubing Type: Mega Monsoon Pump with Poly Tubing		Pump Intake Depth: (ft BGS) 23.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 22.24 Time: 0527	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0640	X		30.69		6.35		13.7		0.95		-91		1000		200	22.23	0
0645	X		30.80		6.20		13.9		0.75		-122		459		200	22.30	1L
0650	X		30.82		6.20		13.8		0.58		-125		459		200	22.30	2L
0655	X		30.90		6.21		13.8		0.56		-124		462		200	22.31	3L
0700	X		30.93		6.19		13.9		0.55		-126		458		200	22.32	4L
0705	X		30.95		6.20		13.9		0.56		-127		455		200	22.31	5L
			Parameters stabilized at 0705														
0705		X	Collect sample CTMW-01S-20170619														

Sample ID: CTMW-01S-20170619 **Duplicate ID:** N/A **QA/QC Samples/ID:** N/A **COC Time:** 0705

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N | Field Filtered: Y [✓ N] | COC Number:

Comments:

Ferrous Iron = 0.30 mg/l

Sulfide = 0.08 mg/l

Groundwater color is Dark Grey w/ strong odor of fermenting fr

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-01D**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 6/19/17
Well Depth (ft BGS):	MP Distance AGS (ft): / Well Depth (ft BMP): 49.41	Screened/Open Interval Top:	(ft BGS) 34 (ft BMP)
Well Diameter (in):	PID/FID Readings Beneath Inner Cap (ppm cge akb):	Screened/Open Interval Bottom:	(ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing	Pump Intake Depth:	(ft BGS) 41.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.48	Time: 0528	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0810	X		30.03		7.47		12.6		4.70		-90		60.1		200	22.46	0
0815	X		29.01		7.24		13.1		3.60		-94		23.6		200	22.49	1L
0820	X		28.70		7.03		13.5		1.08		-102		10.7		200	22.50	2L
0825	X		27.98		6.93		13.4		1.75		-119		7.1		200	22.50	3L
0830	X		27.59		6.87		13.7		0.75		-132		4.5		200	22.50	4L
0835	X		28.12		6.91		13.8		0.74		-127		4.1		200	22.50	5L
0840	X		28.29		6.87		13.9		0.45		-136		4.1		200	22.51	6L
0845	X		28.40		6.88		14.0		0.47		-135		4.0		200	22.50	7L
0850	X		28.49		6.95		13.9		0.47		-133		4.1		200	22.50	8L
0855	X		28.55		6.97		14.0		0.49		-130		4.2		200	22.50	9L
			Parameters Stabilized at 0855														
0855		X	Collect Sample CTMW-01D-20170619 (MS/MSD														

Sample ID: CTMW-01D-20170619 **Duplicate ID:** N/A **QA/QC Samples/ID:** MS/MSD CTMW-01D-2017 0619 **COC Time:** 0855

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: Y [✓ N] COC Number:

Comments:

Ferrous Iron = 0.00 mg/l

Sulfide = 0.00 mg/l

Groundwater color is yellow

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-02S**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 6/20/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 23.77	Screened/Open Interval Top: (ft BGS) 19 (ft BMP)
Well Diameter (in):	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 24 (ft BMP)
Pump and Tubing Type: Hand Bailer		Pump Intake Depth: (ft BGS) (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 22.75 Time: 0420	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0435	X		31.26		7.01		10.6		1.17		-64		533		Hand Bailer	22.75	
0440	X		29.27		6.83		10.5		0.60		-150		350			23.40	1L
0445	X		27.70		6.76		10.5		0.56		-145		239		✓	23.73	2L
											Purged Dry						
			Allow Recharge before Sampling														
0500		X	collect CTMW-02S-20170620														

Sample ID: CTMW-02S-20170620 Duplicate ID: N/A QA/QC Samples/ID: N/A COC Time: 0500

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: Y [✓ N] COC Number:

Comments:

Ferrous Iron = 0.30 mg/l

Sulfide = 0.10 mg/l

Groundwater color is slightly Grey

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-02D**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 6/19/17
Well Depth (ft BGS):	MP Distance AGS (ft): / Well Depth (ft BMP): 49.18	Screened/Open Interval Top:	(ft BGS) 34 (ft BMP)
Well Diameter (in):	PID/FID Readings Beneath Inner Cap (ppm cge akb):	Screened/Open Interval Bottom:	(ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder) with poly tubing	Pump Intake Depth:	(ft BGS) 41 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 23.12	Time: 0526	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1000	X		30.58		7.17		12.2		1.57		-9		89.1		150	23.10	0
1005	X		28.40		7.12		12.1		1.42		-99		66.8		150	23.14	750
1010	X		27.51		6.98		12.0		0.41		-128		24.7		150	23.14	1.5L
1015	X		26.97		6.99		12.2		0.40		-134		13.4		150	23.15	2.25L
1020	X		27.00		6.99		12.2		0.66		-138		10.7		150	23.15	3.0L
1025	X		27.70		6.97		12.3		0.66		-145		8.4		150	23.15	3.75L
1030	X		26.94		6.97		12.3		0.60		-145		8.4		150	23.15	4.5L
1035	X		27.04		6.97		12.3		0.40		-153		7.9		150	23.16	5.25L
1040	X		26.83		6.97		12.4		0.37		-155		7.5		150	23.16	6.0L
1045	X		26.73		6.97		12.4		0.36		-157		7.6		150	23.17	6.75L
1050	X		26.73		7.00		12.5		0.50		-153		7.3		150	23.18	7.5L
1055	X		26.71		6.97		12.5		0.47		-157		7.4		150	23.17	8.25L
1100	X		26.62		6.97		12.5		0.44		-160		7.1		150	23.18	9.0L
1105	X		26.55		6.97		12.5		0.41		-161		7.2		150	23.18	9.75L
1105		X	parameters stabilized. Collect Sample CTMW-02D-20170619 + CTMW-02D-201706														

Sample ID: CTMW-02D-20170619 Duplicate ID: CTMW-02D-20170619-FD QA/QC Samples/ID: FD COC Time: 1105 -F

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: Y [✓ N] COC Number:

Comments:

Ferrous Iron = 0.00 mg/l

Sulfide = 0.00 mg/l

Groundwater color is yellow.

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-03S
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 6/20/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 24.35	Screened/Open Interval Top: (ft BGS) 19 (ft BMP)
Well Diameter (in):	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 24 (ft BMP)
Pump and Tubing Type: Mega Monsoon pump with poly tubing		Pump Intake Depth: (ft BGS) 23.75 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 22.40 Time: 0515	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0530	X		26.41		6.72		11.1		1.75		5		272		200	22.40	0
0535	X		26.18		6.62		11.2		1.49		9		107		200	22.54	1L
0540	X		26.26		6.62		11.3		1.03		22		111		200	22.55	2L
0545	X		26.11		6.51		11.4		0.52		30		119		200	22.55	3L
0550	X		26.11		6.53		11.4		0.54		32		115		200	22.55	4L
0555	X		26.25		6.50		11.4		0.50		53		98.0		200	22.56	5L
0600	X		26.17		6.52		11.4		0.48		52		97.0		200	22.56	6L
0605	X		26.08		6.50		11.4		0.22		38		95.1		200	22.55	7L
0610	X		26.20		6.51		11.4		0.21		40		91.2		200	22.56	8L
0615	X		26.19		6.51		11.3		0.25		34		88.8		200	22.57	9L
0620	X		26.24		6.52		11.3		0.24		33		87.1		200	22.56	10L
0625	X		26.26		6.55		11.3		0.25		32		85.6		200	22.56	11L
0630	X		26.22		6.53		11.3		0.26		33		84.0		200	22.56	12L
			Parameters stabilized at 0630 (3 consecutive readings)														
0630		X	Sample CTMW-035-20170620														

Sample ID: CTMW-035-20170620 Duplicate ID: QA/QC Samples/ID: COC Time: 0630

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: Y [✓ N] COC Number:

Comments:

Ferrous Iron = 0.00 mg/l

Sulfide = 0.00 mg/l

Groundwater color is Clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-03D
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 6/20/17
Well Depth (ft BGS):	MP Distance AGS (ft): / Well Depth (ft BMP): 39.49	Screened/Open Interval Top:	(ft BGS) 34 (ft BMP)
Well Diameter (in):	PID/FID Readings Beneath Inner Cap (ppm cge akb):	Screened/Open Interval Bottom:	(ft BGS) 39 (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder) with poly tubing	Pump Intake Depth:	(ft BGS) 37 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.58	Time: 0710	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0715	X		27.25		8.33		10.1		1.99		-165		32.0		200	22.58	0
0720	X		26.72		7.79		10.1		1.50		-168		8.2		200	22.70	1L
0725	X		26.62		7.70		10.1		1.27		-175		5.4		200	22.72	2L
0730	X		26.70		7.69		10.2		1.70		-177		5.0		200	22.73	3L
0735	X		26.75		7.68		10.2		1.45		-178		4.7		200	22.73	4L
0740	X		26.66		7.67		10.2		1.41		-180		4.6		200	22.75	5L
0745	X		26.51		7.65		10.2		1.17		-182		4.5		200	22.75	6L
0750	X		26.61		7.66		10.3		1.22		-187		4.6		200	22.75	7L
0755	X		26.51		7.63		10.3		1.17		-191		4.5		200	22.75	8L
0800			26.57		7.65		10.3		1.15		-193		4.6		200	22.75	9L
			Parameters achieved stabilization at 0800 (3 consecutive)														
0809		X	Collect sample CTMW-03D-20170620														

Sample ID: CTMW-03D-20170620 Duplicate ID: N/A QA/QC Samples/ID: N/A COC Time: 0800

Sample Container Number	Sample Container Material Code	Sample Container Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: Y [✓ N] COC Number:

Comments:

Ferrous Iron = 0.00 mg/l

Sulfide = 0.00 mg/l

Groundwater color is yellow

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-04S**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 6/20/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 24.01	Screened/Open Interval Top: (ft BGS) 19 (ft BMP)
Well Diameter (in):	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 24 (ft BMP)
Pump and Tubing Type: Mega Monsoon pump with poly tubing		Pump Intake Depth: (ft BGS) 23.75 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 22.66 Time: 0900	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0935	X		31.04		6.90		10.1		1.70		191		150		200	22.66	0
0940	X		30.66		6.95		10.2		1.42		132		125		200	22.71	1L
0945	X		30.59		6.97		10.3		1.30		115		108		200	22.71	2L
0950	X		30.81		6.77		10.4		0.31		-78		76		200	22.73	3L
0955	X		30.78		6.82		10.4		0.33		-75		74		200	22.75	4L
1000	X		30.83		6.87		10.4		0.35		-73		76		200	22.78	5L
1005	X		30.85		6.88		10.4		0.36		-70		79		200	22.81	6L

Sample ID: CTMW-04S-20170620 Duplicate ID: N/A QA/QC Samples/ID: level 4 QC COC Time:

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron = 0.25 mg/l

Sulfide = 0.09 mg/l

Groundwater color is Clear (slightly Grey)

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-04D**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 6/21/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 48.99	Screened/Open Interval Top: (ft BGS) 34 (ft BMP)
Well Diameter (in):	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Sample Pro with poly tubing		Pump Intake Depth: (ft BGS) 41 ~~22.75~~ (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 22.55 Time: 0435	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0500	X		28.96		9.18		11.1		1.31		2		185		200	22.86	0
0505	X		26.79		7.89		11.2		0.70		-34		66.8		200	22.94	1L
0510	X		25.94		7.76		11.5		0.40		-57		22.0		200	22.96	2L
0515	X		25.76		7.69		11.6		0.32		-65		11.4		200	22.98	3L
0520	X		25.36		7.66		11.7		0.34		-63		9.4		200	22.99	4L
0525	X		25.34		7.61		11.8		0.40		-70		7.0		200	23.00	5L
0530	X		25.29		7.57		11.8		0.48		-73		6.7		200	23.02	6L
0535	X		25.10		7.55		11.8		0.51		-70		6.4		200	23.03	7L
0540	X		25.04		7.53		11.8		0.48		-68		6.3		200	23.04	8L
0545	X		24.98		7.52		11.9		0.50		-66		6.1		200	23.05	9L
			parameters achieved stabilization at 0545 (3 consecutive readings)														
0545		X	collect sample CTMW-04D-20170621														

Sample ID: CTMW-04D-20170621 **Duplicate ID:** N/A **QA/QC Samples/ID:** N/A **COC Time:** 0545

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N | Field Filtered: Y [✓ N] | COC Number:

Comments:

Ferrous Iron = 0.00 mg/l

Sulfide = 0.00 mg/l

Groundwater color is yellow

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-05S**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 6/21/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 24.5	Screened/Open Interval Top: (ft BGS) 19 (ft BMP)
Well Diameter (in):	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 24 (ft BMP)
Pump and Tubing Type: Mega Monsoon pump with poly tubing		Pump Intake Depth: (ft BGS) 23.75 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 23.19 Time: ~~23~~ 0615	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0620	X		25.97		7.15		10.4		2.50		88		130		200	23.20	0
0625	X		25.97		7.02		10.4		1.01		92		44.9		200	23.36	1L
0630	X		26.16		6.95		10.4		0.86		95		31.6		200	23.40	2L
0635	X		26.27		7.04		10.5		1.03		100		23.1		200	23.41	3L
0640	X		26.38		6.90		10.5		0.99		104		19.3		200	23.45	4L
0645	X		26.36		6.99		10.5		1.03		107		20.5		200	23.46	5L
0650	X		26.60		6.97		10.5		1.06		111		19.6		200	23.44	6L
0655	X		26.80		6.99		10.5		1.09		113		18.7		200	23.45	7L
			parameters achieved stabilization (3 consecutive readings) @ 0655														
0655		X	Collect sample CTMW-055-20170621														

Sample ID: CTMW-055-20170621 **Duplicate ID:** N/A **QA/QC Samples/ID:** N/A **COC Time:** 0655

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron = 0.00 mg/l

Sulfide = 0.02 mg/l

Groundwater color is Yellow

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-05D**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 6/21/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 54	Screened/Open Interval Top: (ft BGS) 34 (ft BMP)
Well Diameter (in):	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 54 (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder) with poly tubing		Pump Intake Depth: (ft BGS) 44 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 23.36 Time: 0730	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0820	X		31.11		8.09		10.0		1.80		176		64.8		200	23.37	0
0825	X		28.15		7.81		10.1		1.20		167		23.7		200	23.52	1L
0830	X		27.53		7.66		10.2		1.00		157		11.2		200	23.55	2L
0835	X		27.44		7.63		10.3		1.55		151		9.1		200	23.57	3L
0840	X		27.55		7.61		10.4		1.59		148		8.9		200	23.56	4L
0845	X		27.32		7.63		10.5		1.65		145		8.6		200	23.57	5L
0850	X		27.30		7.59		10.4		1.59		142		8.8		200	23.57	6L
			parameters stabilized at 0850 (3 consecutive readings)														
0859		X	collect sample CTMW-05D-20170621 & CTMW-05D-20170621-FD														

Sample ID: CTMW-05D-20170621 **Duplicate ID:** CTMW-05D-20170621-FD **QA/QC Samples/ID:** N/A **COC Time:** 0850

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N | Field Filtered: Y [✓ N] | COC Number:

Comments:

Ferrous Iron = 0.00 mg/l

Sulfide = 0.00 mg/l

Groundwater color is yellow

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-06S**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 6/21/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 24.4	Screened/Open Interval Top: (ft BGS) 19 (ft BMP)
Well Diameter (in):	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 24 (ft BMP)
Pump and Tubing Type: Mega Monsoon pump with poly tubing		Pump Intake Depth: (ft BGS) 24 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 23.41 Time: 0945	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
1010	X		34.50		6.79		9.47		1.94		-12		315		150	23.42	0
1015	X		34.26		6.76		9.60		1.25		-85		143		150	23.65	0.75 L
1020	X		34.99		6.71		9.79		0.80		-106		268		150	23.67	1.5 L
1025	X		35.26		6.74		9.89		0.76		-113		263		150	23.70	2.25 L
1030	X		35.29		6.76		10.00		0.69		-120		256		150	23.70	3.0 L
1035	X		35.23		6.74		10.1		0.66		-125		250		150	23.70	3.75 L

Sample ID: CTMW-06S-20170621 **Duplicate ID:** N/A **QA/QC Samples/ID:** N/A **COC Time:** 1035

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N | Field Filtered: Y [✓ N] | COC Number:

Comments:

Ferrous Iron = 0.40 mg/l

Sulfide = 0.02 mg/l

Groundwater color is slightly grey (fermenting fruit odor)

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-06D**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 6/22/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 54.25	Screened/Open Interval Top: (ft BGS) 34 (ft BMP)
Well Diameter (in):	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 54 (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder) with poly tubing		Pump Intake Depth: (ft BGS) 44 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 23.75 Time: 0500	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0505	X		28.05		7.80		10.5		1.63		25		~~23.76~~	175	200	23.91	0
0510	X		26.26		7.36		10.8		0.71		43		20.6		200	23.95	1L
0515	X		25.75		7.27		10.9		0.40		56		90.8		200	23.97	2L
0520	X		24.99		7.28		11.2		0.35		67		34.8		200	23.94	3L
0525	X		24.96		7.26		11.2		0.25		70		21.1		200	23.93	4L
0530	X		25.01		7.26		11.3		0.23		74		16.4		200	23.95	5L
0535	X		24.94		7.26		11.3		0.17		77		12.2		200	23.97	6L
0540	X		25.00		7.24		11.4		0.16		79		11.5		200	23.95	7L
0545	X		24.94		7.24		11.4		0.15		82		10.5		200	23.98	8L
0550	X		24.91		7.23		11.4		0.15		85		9.7		200	23.99	9L
			Parameters achieved stabilization at CTMW-06D (3 readings)														
0550	~~X~~	X	Collect sample (CTMW-06D-2017062)														

Sample ID: CTMW-06D-20170622 **Duplicate ID:** N/A **QA/QC Samples/ID:** N/A **COC Time:** 0550

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N | Field Filtered: Y [✓ N] | COC Number:

Comments:

Ferrous Iron = 0.90 mg/l

Sulfide = 0.00 mg/l

Groundwater color is yellow

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

WELL WATER LEVEL MEASUREMENT LOG

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NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task No: M12	Date: 7/17/17
Task Manager Arul Ayyaswami	Field Sampler(s): Jeff Richeson	Recorded by: Jeff Richeson
Equipment Model/Type:	*Serial Number:*	*Last Calibration Date:*

Well Identification	Describe Measuring Point	Time (hrs)	Depth to Static Water Level (ft BMP)	Well Sounding Depth (ft BMP)	Condition of Well and Well Seal
CTIW-01S	TOC	0640	22.25		chunky + dark
CTIW-01D	TOC	0643	22.39		clear
CTIW-02S	TOC	0645	22.46		chunky + dark
CTIW-02D	TOC	0647	22.88	22.87	0.01' of oil
CTIW-03S	TOC	0649	22.69		chunky + dark
CTIW-03D	TOC	0652	23.18	23.16	0.02' of oil
CTMW-01S	TOC	0654	22.45		Good
CTMW-01D	TOC	0656	22.63		
CTMW-02S	TOC	0658	22.96		
CTMW-02D	TOC	0700	23.22		
CTMW-03S	TOC	0702	22.59		
CTMW-03D	TOC	0704	22.75		
CTMW-04S	TOC	0706	22.80		
CTMW-04D	TOC	0708	23.01		
CTMW-05S	TOC	0710	23.28		
CTMW-05D	TOC	0712	23.48	[illegible]	~~0.01' of oil~~
CTMW-06S	TOC	0714	23.[illegible]53		
CTMW-06D	TOC	0716	23.[illegible]84	[illegible]	~~0.02' of oil~~

BGS = Below Ground Surface BMP = Below Measuring Point MP = Measuring Point TOC = Top of Casing (Well Riser)

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-01S
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 7/20/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 23.78	Screened/Open Interval Top: (ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 24 (ft BMP)
Pump and Tubing Type: Mega Monsoon Pump with Poly Tubing		Pump Intake Depth: (ft BGS) 23.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 22.45 Time: 0654	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0750	X		29.08		5.93		14.3		0.58		-49		137		100	22.45	0
0755	X		29.08		5.76		14.8		0.75		-41		69.5		100	22.56	500
0809	X		28.95		5.85		14.3		0.75		-41		71.7		100	22.59	1000
0805	X		28.88		5.87		14.3		0.75		-41		71.9		100	22.60	1.5L
0810	X		28.73		5.93		14.3		0.76		-41		73.5		100	22.59	2L
0815	X		28.95		5.94		14.4		0.77		-40		74.7		100	22.60	2.5L
			Parameters stabilized														
0815		X	collect sample CTMW-015-20170720														

Sample ID: CTMW-015-20170720　Duplicate ID: N/A　QA/QC Samples/ID: N/A　COC Time: 0815

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N　Field Filtered: Y [✓ N]　COC Number:

Comments:

Ferrous Iron = 0.19 mg/l

Sulfide= 0.25 mg/l

Groundwater Color is slightly Gray, w/ strong odor of fermenting fru

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH:　± 3% for Specific Conductivity and Temperature:　± 10 mv for Redox Potential:　± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study
Task Manager: Arul Ayyaswami
Task No: M12
Well ID: CTMW-01D
Field Samplers: Jeff Richeson
Recorded by: Jeff Richeson
Date: 7/20/17
Well Depth (ft BGS):
MP Distance AGS (ft):
Well Depth (ft BMP): 49.41
Screened/Open Interval Top: (ft BGS) 34 (ft BMP)
Well Diameter (in): 2
PID/FID Readings Beneath Inner Cap (ppm cge akb):
Screened/Open Interval Bottom: (ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing
Pump Intake Depth: (ft BGS) 41.5 (ft BMP)
MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox
Depth to Water Before Pump Installation (ft BMP): 22.63 Time: 0656
GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0535	X		26.82		6.84		14.4		0.63		-78		75.5		200	22.63	0
0540			26.80		6.75		14.5		0.68		-90		39.5		200	22.66	1L
0545			26.79		6.66		14.7		0.70		-89		15.9		200	22.67	2L
0550			26.75		6.60		14.7		0.62		-93		12.9		200	22.68	3L
0555			26.67		6.52		14.8		0.50		-95		8.5		200	22.69	4L
0600			26.78		6.48		15.1		0.27		-110		8.0		200	22.70	5L
0605			26.80		6.48		15.1		0.30		-113		8.2		200	22.68	6L
0610			26.81		6.47		15.1		0.33		-117		8.1		200	22.69	7L
0615			26.86		6.47		15.1		0.36		-120		7.9		200	22.68	8L

parameters stabilized

0615 X Collect sample CTMW-01D-20170720
CTMW-01D-20170720-FD

Sample ID: CTMW-01D-20170720
Duplicate ID: CTMW-01D-20170720-FD
QA/QC Samples/ID:
COC Time: 0615

Sample Container			Preservative	Intended Analysis and/or Method
Number	Material Code	Volume		
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N
Field Filtered: Y [✓ N]
COC Number:

Comments:
Ferrous Iron= 0.03 mg/l
Sulfide = 0.03 mg/l
Groundwater Color is Yellow

Signature(s): J R R

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-02S
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 7/19/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 23.77	Screened/Open Interval Top: (ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 24 (ft BMP)
Pump and Tubing Type: Hand Bailer	Pump Intake Depth: (ft BGS) (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.96	Time: 0646	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0540	X		30.00		6.60		11.5		0.77		-31		98.1		Hand Bail	22.96	0.5 ga
			well Bailed dry @ ~0540. ~0.5 gallons purged.													23.75	
			Allow recharge for sample														
0915		X	Collect sample CTMW-02S-20170719														

Sample ID: CTMW-02S-20170719 **Duplicate ID:** N/A **QA/QC Samples/ID:** N/A **COC Time:** 0915

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N | Field Filtered: Y [✓ N] | COC Number:

Comments:

Ferrous Iron= 0.17 mg/l

Sulfide = 0.13 mg/l

Groundwater Color is Gray w/ fermenting fruit odor

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-02D**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 7/19/17
Well Depth (ft BGS):	MP Distance AGS (ft): / Well Depth (ft BMP): 49.18	Screened/Open Interval Top:	(ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):	Screened/Open Interval Bottom:	(ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Sampre Pro (bladder) with poly tubing	Pump Intake Depth:	(ft BGS) 41 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): ~~22.84~~ 23.22	Time: 0647	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1050	X		25.07		6.81		13.9		0.68		26		150		200	23.22	0
1055	X		25.49		6.71		13.6		0.65		33		75.5		200	23.29	1 L
1100	X		25.61		6.64		13.3		0.65		49		57.5		200	23.30	2 L
1105	X		25.71		6.63		13.3		0.65		32		30.0		200	23.30	3 L
1110	X		25.92		6.62		13.3		0.64		34		29.7		200	23.29	4 L
1115	X		25.76		6.64		13.3		0.66		36		28.1		200	23.30	5 L
1120	X		25.64		6.66		13.4		0.68		39		26.7		200	23.31	6 L
			Parameters Stabilized														
1120		X	Collect sample CTMW-02D-20170719														

Sample ID: CTMW-02D-20170719 Duplicate ID: N/A QA/QC Samples/ID: N/A COC Time:

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: Y [✓ N] COC Number:

Comments:

Ferrous Iron= 0.02 mg/l

Sulfide = 0.03 mg/l

Groundwater Color is Yellow

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-03S**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 7/18/17
Well Depth (ft BGS):	MP Distance AGS (ft): Well Depth (ft BMP): 24.35	Screened/Open Interval Top:	(ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):	Screened/Open Interval Bottom:	(ft BGS) 24 (ft BMP)
Pump and Tubing Type: Mega Monsoon pump with poly tubing	Pump Intake Depth:	(ft BGS) 23.75 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.59	Time: 0702	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1110	X		30.63		6.61		10.9		0.79		101		29.4		100	22.59	0
1115	X		29.29		6.74		10.9		0.65		113		15.0		100	22.62	500
1120	X		29.01		6.73		10.9		0.79		127		18.5		100	22.61	1L
1125	X		28.61		6.71		10.9		0.90		125		17.8		100	22.62	1.5L
1130	X		28.50		6.69		11.0		0.85		123		17.5		100	22.61	2L
1135	X		28.35		6.67		11.0		0.88		125		17.1		100	22.63	2.5L
1140	X		28.20		6.65		11.0		0.87		124		16.3		100	22.63	3L
			Parameters Stabilized														
1140		X	Collect sample CTMW-03S-20170718														

Sample ID: CTMW-03S-20170718 **Duplicate ID:** N/A **QA/QC Samples/ID:** N/A **COC Time:** 1140

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N | Field Filtered: Y [✓ N] | COC Number:

Comments:

Ferrous Iron= 0.00 mg/l

Sulfide = 0.00 mg/l

Groundwater Color is Yellow

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-03D**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 7/19/17
Well Depth (ft BGS):	MP Distance AGS (ft): Well Depth (ft BMP): 39.49	Screened/Open Interval Top:	(ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):	Screened/Open Interval Bottom:	(ft BGS) 39 (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder) with poly tubing	Pump Intake Depth: (ft BGS) 37 (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.75	Time: 0652	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0555	X	-	26.93		7.47		10.6		0.55		23		28,1		200	22.75	0
0600	X		26.17		7.30		10.7		0.60		63		6,7		200	22.79	1L
0605	X		25.89		7.30		10.8		0.72		80		3.5		200	22.81	2L
0610	X		25,70		7.39		10.8		0.85		91		2,9		200	22,82	3L
0615	X		25.82		7,27		10.8		0.73		98		2,9		200	22.82	4L
0620	X		25.72		7.30		10.9		0.75		103		3.1		200	22.83	5L
0625	X		25,65		7.26		10.9		0.76		108		3.0		200	22.82	6L
0630	X		25,74		7,24		10.9		0.78		110		3.0		200	22.83	7L
			parameters stabilized														
0630		X	Collect sample CTMW-03D-20170719														

Sample ID: CTMW-03D-20170719 Duplicate ID: N/A QA/QC Samples/ID: N/A COC Time: 0630

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N | Field Filtered: Y [✓ N] | COC Number:

Comments:

Ferrous Iron= 0.00 mg/l

Sulfide = 0.00 mg/l

Groundwater Color is Yellow

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-04S**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 7/18/17
Well Depth (ft BGS):	MP Distance AGS (ft): Well Depth (ft BMP): 24.01	Screened/Open Interval Top:	(ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):	Screened/Open Interval Bottom:	(ft BGS) 24 (ft BMP)
Pump and Tubing Type: Mega Monsoon Pump with poly tubing	Pump Intake Depth:	(ft BGS) 23.75 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.80	Time: 0706	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0940	X		27.85		6.62		11.2		1.90		54		38.1		100	22.80	0
0945.	X		29.26		6.75		11.3		1.62		18		60.2		100	22.88	500
0950	X		29.07		6.77		11.3		1.55		15		65.9		100	22.97	1L
0955	X		29.14		6.70		11.3		1.47		5		59.9		100	23.02	1.5L
1000	X		29.25		6.72		11.3		1.45		3		57.4		100	23.03	2L
1005	X		29.37		6.72		11.3		1.42		1		58.8		100	23.03	2.5L
1010	X		29.54		6.73		11.3		1.40		-1		60.2		100	23.02	3L
					parameters stable												
1010		X		collect sample CTMW-04S-20170718													

Sample ID: CTMW-04S-20170718 Duplicate ID: N/A QA/QC Samples/ID: N/A COC Time: 1010

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N | Field Filtered: Y [✓ N] | COC Number:

Comments:

Ferrous Iron= 0.10 mg/l

Sulfide = 0.07 mg/l

Groundwater Color is Clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-04D
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 7/18/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 48.99	Screened/Open Interval Top: (ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 49 (ft BMP)
Pump ~~and Tubing~~ Type: QED Sample Pro (bladder) with poly tubing	Pump Intake Depth:	(ft BGS) 41 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 23.01	Time: 0708	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (uS/cm) READ	Spec Cond. CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0805	X		27.06		7.59		12.6		0.79		47		780		200	23.01	0
0810	X		26.22		7.26		12.6		0.48		-29		282		200	23.12	1L
0815	X		26.08		7.23		12.6		0.52		-31		98.1		200	23.14	2L
0829	X		25.94		7.22		12.7		0.48		-27		73.4		200	23.17	3L
0825	X		26.04		7.20		12.8		0.52		-35		76.8		200	23.18	4L
0830	X		25.92		7.20		12.8		0.60		-32		34.0		200	23.19	5L
0835	X		25.82		7.19		12.9		0.64		-31		24.0		200	23.19	6L
0840	X		25.98		7.25		12.9		0.66		-34		22.1		200	23.18	7L
0845	X		26.05		7.28		12.8		0.69		-37		20.7		200	23.19	8L
0850	X		26.11		7.28		12.8		0.71		-36		18.8		200	23.20	9L

Parameters Stabilized
Collect Sample CTMW-04D-20170718

Sample ID: CTMW-04D-20170718 Duplicate ID: N/A QA/QC Samples/ID: N/A COC Time: 0850

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N | Field Filtered: [✓ Y] N | COC Number:

Comments:
Ferrous Iron= 0.02 mg/l
Sulfide = 0.01 mg/l
Groundwater Color is Yellow

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-05S
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 7/17/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 24.5	Screened/Open Interval Top: (ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 24 (ft BMP)
Pump and Tubing Type: Mega Monsoon Pump with poly tubing		Pump Intake Depth: (ft BGS) 23.75 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 23.28 Time: 0710	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1305	X		32.26		6.61		11.5		0.47		113		37.8		100	23.28	0
1310	X		31.43		6.57		11.7		0.75		110		12.1		100	23.35	500
1315	X		31.68		6.54		11.8		0.81		118		11.2		100	23.37	1L
1320	X		31.34		6.49		11.9		0.90		118		9.6		100	23.38	1.5L
1325	X		31.40		6.45		11.9		0.75		118		9.5		100	23.39	2L
1330	X		31.57		6.51		11.8		0.78		114		9.7		100	23.40	2.5L
1335	X		31.55		6.54		11.8		0.80		112		10.2		100	23.40	3L
1340	X		31.61		6.57		11.9		0.82		115		11.0		100	23.37	3.5L
			parameters stabilized														
1340			collect sample CTMW-05S-20170717														

Sample ID: CTMW-05S-20170717 Duplicate ID: N/A QA/QC Samples/ID: N/A COC Time: 1340

Sample Container Number	Sample Container Material Code	Sample Container Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: Y [✓ N] COC Number:

Comments:

Ferrous Iron= 0.04 mg/l

Sulfide = 0.03 mg/l

Groundwater Color is clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-05D**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 7/18/17
Well Depth (ft BGS):	MP Distance AGS (ft): / Well Depth (ft BMP): 54.00	Screened/Open Interval Top:	(ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):	Screened/Open Interval Bottom:	(ft BGS) 54 (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder) with poly tubing	Pump Intake Depth:	(ft BGS) 44 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 23.48 ~~[illegible]~~	Time: 0712 ~~[illegible]~~	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0555	X		28.49		8.00		11.1		0.68		137		375		200	23.48	0
0600	X		27.40		7.23		11.2		0.98		136		71.1		200	23.54	1L
0605	X		26.52		7.26		11.3		0.67		136		12.4		200	23.58	2L
0610	X		26.54		7.26		11.3		0.79		137		5.7		200	23.59	3L
0615	X		26.37		7.24		11.3		0.75		139		4.4		200	23.60	4L
0620	X		26.20		7.27		11.3		0.77		139		3.7		200	23.58	5L
0625	X		26.36		7.24		11.4		0.80		140		3.4		200	23.59	6L
			parameters stabilized														
0625			collect sample (CTMW-05D-20170718 (MS/MSD)														

Sample ID: CTMW-05D-20170718

Duplicate ID:

QA/QC Samples/ID: MS/MSD CTMW-05D-20170718

COC Time:

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N

Field Filtered: Y [✓ N]

COC Number:

Comments:

Ferrous Iron= 0.00 mg/l

Sulfide = 0.00 mg/l

Groundwater Color is Yellow

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-06S**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 7/17/17
Well Depth (ft BGS):	MP Distance AGS (ft): / Well Depth (ft BMP): 24.4	Screened/Open Interval Top:	(ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):	Screened/Open Interval Bottom:	(ft BGS) 24 (ft BMP)
Pump and Tubing Type: Mega Monsoon Pump with poly tubing	Pump Intake Depth:	(ft BGS) 24 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 23.53	Time: 0714	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0930	X		33.72		6.92		11.1		0.80		-154		143		100	23.53	0
0935	X		33.84		6.74		11.3		0.71		-141		149		100	22.57	500
0940	X		34.02		6.65		11.4		0.68		-112		154		100	22.60	1L
0945	X		34.12		6.59		11.5		0.65		-115		157		100	22.65	1.5L
0950	X		34.20		6.58		11.6		0.63		-117		152		100	22.68	2L
0955	X		34.26		6.60		11.7		0.61		-120		155		100	22.70	2.5L

Parameters stabilized @ 0955

Sample ID: CTMW-06S-20170717 **Duplicate ID:** N/A **QA/QC Samples/ID:** N/A **COC Time:** 0955

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; GG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N | Field Filtered: Y [✓ N] | COC Number:

Comments:

Ferrous Iron= 0.05 mg/l

Sulfide = 0.09 mg/l

Groundwater Color is Dark Gray w/ Fermenting fruit odor

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-06D
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 7/17/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 54.25	Screened/Open Interval Top: (ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 54 (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder) with poly tubing		Pump Intake Depth: (ft BGS) 44 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 23.84 Time: 0716	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
1050	X		31.56		7.71		12.4		0.51		-98		240		200	23.84	0
1055	X		30.00		7.17		12.5		0.40		-23		126		200	23.91	1L
1100	X		29.87		7.05		12.7		0.33		25		52.2		200	23.94	2L
1105	X		30.11		6.92		12.7		0.43		58		28.5		200	23.96	3L
1110	X		30.16		6.96		12.8		0.46		64		19.1		200	23.99	4L
1115	X		30.19		6.96		12.8		0.50		72		13.3		200	24.02	5L
1120	X		30.34		6.96		12.9		0.53		78		11.5		200	24.03	6L
1125	X		30.38		6.96		12.9		0.65		81		9.3		200	24.02	7L
1130	X		30.46		6.96		12.9		0.63		85		7.7		200	24.03	8L
1135	X		30.50		6.96		12.9		0.65		87		6.9		200	24.04	9L
1140	X		30.51		6.96		12.9		0.63		87		7.1		200	24.05	10L
			parameters stabilized														
1140			Collect Sample CTMW-06D-20170717 + CTMW-06D-20170717-FD														

Sample ID: CTMW-06D-20170717 Duplicate ID: CTMW-06D-20170717-FD QA/QC Samples/ID: COC Time: 1140

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N | Field Filtered: Y [✓ N] | COC Number:

Comments:
Ferrous Iron= 0.00 mg/l
Sulfide = 0.00 mg/l
Groundwater Color is yellow

Signature(s): J R

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

WELL WATER LEVEL MEASUREMENT LOG

Page 1 of 1

NERT, Henderson, NV Project

Task Name: In-Situ Cr Treatability Study	Task No: M12	Date: 8/22/17
Task Manager A. Ayyaswami	Field Sampler(s): K. Lew	Recorded by: D. Keady
Equipment Model/Type: Heron H01L	Serial Number: 032746 (Pine)	Last Calibration Date: —

Well Identification	Measuring Point (MP)	Time (hrs)	Depth to Static Water Level (ft BMP)	Well Sounding Depth (ft BMP)	Condition of Well and Well Seal
CTIW-01S	TOC	0749	22.19	—	GOOD
CTIW-01D		0750	22.95	—	GOOD
CTIW-02S		0752	21.40	—	GOOD
CTIW-02D		0753	22.76	—	GOOD
CTIW-03S		0755	21.75	—	GOOD
CTIW-03D		1530	24.23	—	DIFFICULT TO UNSCREW CAP; OTHERWISE GOOD.
CTIW-01S		0746	22.50	—	GOOD
CTMW-01D		0747	22.72	—	GOOD
CTMW-02S		0742	DRY	23.70	GOOD
CTMW-02D		0743	23.36	—	GOOD
CTMW-03S		0741	22.64	—	GOOD
CTMW-03D		0742	22.80	—	GOOD
CTMW-04S		0740	22.89	—	GOOD
CTMW-04D		0741	23.07	—	GOOD
CTMW-05S		0739	23.36	—	GOOD
CTMW-05D		0740	23.53	—	GOOD
CTMW-06S		0735	23.59	—	GOOD
CTMW-06D		0736	23.96	—	GOOD

DK 8-22-17

BGS = Below Ground Surface BMP = Below Measuring Point MP = Measuring Point TOC = Top of Casing (Well Riser)

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-01S
Field Samplers: ~~Jeff Richeson~~ D. Keady, K. Lew		Recorded by: ~~Jeff Richeson~~ D Keady, K. Lew	Date: 8-24-17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 23.78	Screened/Open Interval Top: (ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: (ft BGS) 24 (ft BMP)
Pump and Tubing Type: ~~Mega Monsoon~~ Geo Squid Pump with Poly Tubing / bailer	Pump Intake Depth: — (ft BGS) 23.5 (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.50	Time: 0946 (8-22-17)	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity m (~~µ~~S/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1057	X		30.80		6.47		14.6		0.00/1.86		-114		624		200	NM	
1102	~~X~~		Stopped purging; ~~the~~ well ran dry; unable to achieve low enough flow rate to low flow, will purge 3 volumes.														
1115	X		Purged ~0.26 gal (3 purge volumes)														
1145		X	>90% recovery; began sampling w/ bailer														
1150		X	30.10		6.51		14.2		2.06		-71		295		—		

DK 8-24-17

Sample ID: CTMW-01S-20170824 **Duplicate ID:** — **QA/QC Samples/ID:** — **COC Time:** 1145

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron = 3.30 mg/L

Sulfide= 0.62 mg/L

Groundwater Color is blackish yellow

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-01D
Field Samplers: ~~Jeff Richeson~~ K. Lau, D. Keady		Recorded by: ~~Jeff Richeson~~ K. Lau D. Keady	Date: 08/24/17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 49.41	Screened/Open Interval Top: — (ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing		Pump Intake Depth: — (ft BGS) 41.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 22.72 Time: 0747 (P22.71)	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0926	X		27.28		6.37		15.7		0.94		-68		95.3		200	23.28	0
0931	X		27.18		6.37		16.2		0.84		-128		45.2		200	23.28	1000
0936	X		27.05		6.39		16.1		0.81		-150		45.0		200	23.28	2000
0941	X		26.99		6.39		16.2		0.78		-154		37.4		200	23.28	3000
0946	X		26.87		6.39		16.1		0.77		-157		31.7		200	23.28	4000
0951	X		26.79		6.38		16.1		0.75		-159		28.5		200	23.28	5000
0956	X		26.78		6.38		16.1		0.74		-160		27.9		200	23.28	6000
1001	X		26.79		6.38		16.1		0.73		-162		26.8		200	23.28	7000

DE 8-24-17

Sample ID: CTMW-01D-20170824 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1005

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron= 0.07 mg/L

Sulfide = 0.06 mg/L

Groundwater Color is Yellow-green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-02S
Field Samplers: ~~Jeff Richeson~~ D Keady, K.Lew		Recorded by: ~~Jeff Richeson~~ D Keady, K.Lew	Date: 8-24-17
Well Depth (ft BGS): — MP Distance AGS (ft): —	Well Depth (ft BMP): 23.77	Screened/Open Interval Top: — (ft BGS)	19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: — (ft BGS)	24 (ft BMP)
Pump and Tubing Type: ~~Hand Bailer~~ Dry	Pump Intake Depth: — (ft BGS)	— (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): DRY	Time: —	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
			WELL DRY; UNABLE TO SAMPLE.														

DK 8-24-17

Sample ID: — Duplicate ID: — QA/QC Samples/ID: — COC Time: —

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments: —

Ferrous Iron= —

Sulfide = —

Groundwater Color is —

DRY

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-02D**
Field Samplers: ~~Jeff Richeson~~ K. Lew; D. Keady		Recorded by: ~~Jeff Richeson~~ K. Lew, D. Keady	Date: 08/24/17
Well Depth (ft BGS): –	MP Distance AGS (ft): –	Well Depth (ft BMP): 49.18	Screened/Open Interval Top: – (ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: – (ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Sampre Pro (bladder) with poly tubing		Pump Intake Depth: – (ft BGS) 41 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 23.36 Time: 0742 (8-22-17)	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0738	X		26.80		6.77		14.7		1.65		-57		304		200	23.97	0
0743	X		26.54		6.59		15.0		1.14		-106		337		200	23.97	1000
0748	X		26.48		6.55		15.0		0.97		-123		195		200	23.99	2000
0753	X		26.44		6.54		15.0		0.91		-134		100		200	23.97	3000
0758	X		26.39		6.55		14.9		0.88		-140		65		200	23.97	4000
0803	X		26.38		6.55		14.8		0.85		-144		53.9		200	23.96	5000
0808	X		26.38		6.56		14.7		0.82		-147		47.1		200	23.97	6000
0813	X		26.35		6.58		14.7		0.79		-150		38.7		200	23.97	7000
0818	X		26.33		6.58		14.6		0.77		-155		33.7		200	23.97	8000
0823	X		26.31		6.59		14.6		0.76		-159		30.59		200	23.97	9000
0828	X		26.31	✓	6.60	✓	14.6	✓	0.75	✓	-163	✓	31.2	✓	200	23.97	10000

DK 8-24-17

Sample ID: CTMW-02D-20170824 Duplicate ID: – QA/QC Samples/ID: MS/MSD COC Time: 0835

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron= 0.09 mg/L

Sulfide = 0.04 mg/L

Groundwater Color is yellow-green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-03S
Field Samplers: ~~Jeff Richeson~~ D. Keady, K. Lew		Recorded by: ~~Jeff Richeson~~ D. Keady, K. Lew	Date: 8-23-17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 24.35	Screened/Open Interval Top: — (ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 24 (ft BMP)
Pump and Tubing Type: ~~Mega Monsoon~~ Geosump pump with poly tubing		Pump Intake Depth: — (ft BGS) 23.75 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 22.64 Time: 0741 (8-22-17)	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity m (~~µ~~S/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
1318	X		27.39		6.41		12.7		1.62		-6		97.4		200	NM	0
1323	X		27.39		6.39		12.6		1.58		6		99.2		200	NM	1000
1328	X		27.85		6.39		12.6		1.54		7		104		200	NM	2000
1333	X		28.01		6.39		12.5		1.53		21		105		200	NM	3000
1338	X		27.86		6.40		12.4		1.53		24		105		200	NM	4000
1343	X		27.94		6.40		12.4		1.53		17		105		200	NM	5000
1348	X		27.64		6.40		12.3		1.53		14		104		200	NM	6000

DK 8-23-17

Sample ID: CTMW-03S-20170823 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1350

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron= 0.16 mg/L

Sulfide = 0.16 mg/L

Groundwater Color is yellow-green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study
Task Manager: Arul Ayyaswami
Task No: M12
Well ID: CTMW-03D
Field Samplers: ~~Jeff Richeson~~ D. Keady, K. Lew
Recorded by: ~~Jeff Richeson~~ D. Keady, K. L
Date: 8-23-17
Well Depth (ft BGS): —
MP Distance AGS (ft): —
Well Depth (ft BMP): 39.49
Screened/Open Interval Top: — (ft BGS) 34 (ft BMP)
Well Diameter (in): 2
PID/FID Readings Beneath Inner Cap (ppm cge akb): —
Screened/Open Interval Bottom: — (ft BGS) 39 (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder) with poly tubing
Pump Intake Depth: — (ft BGS) 37 (ft BMP)
MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox
Depth to Water Before Pump Installation (ft BMP): 22.80
Time: 0742 (8-22-17)
GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity m ~~µ~~S/cm READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1119	X		28.57		7.42		11.1		1.00/1.19		-13		16.6		200	23.24	0
1124	X		27.00		7.33		11.2		0.00/0.86		-28		33.2		200	23.24	1000
1129	X		26.84		7.33		11.2		0.00/0.81		-28		56.0		200	23.24	2000
1134	X		26.57		7.33		11.2		0.00/0.76		-28		59.5		200	23.24	3000
1139	X		26.52	✓	7.33	✓	11.2	✓	0.00/0.74	✓	-28	✓	54.5	✓	200	23.24	4000
1145		X	STABILIZATION														

DK 8-23-17

Sample ID: CTMW-03D-20170823
Duplicate ID: —
QA/QC Samples/ID: —
COC Time: 1145

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N
Field Filtered: Y N
COC Number:

Comments:
Ferrous Iron= 0.13 mg/L
Sulfide = 0.09 mg/L
Groundwater Color is yellow-green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-04S
Field Samplers: ~~Jeff Richeson~~ D. Keady, K. Lew		Recorded by: ~~Jeff Richeson~~ D. Keady, K. Lew	Date: 8-23-17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 24.01	Screened/Open Interval Top: — (ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 24 (ft BMP)
Pump and Tubing Type: ~~Mega Monsoon Pump with poly tubing~~ GeoTech Geopump tubing		Pump Intake Depth: — (ft BGS) 23.75 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 22.89 Time: 0740 (8-22-17)	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity mS/cm		Dissolved Oxygen DO (mg/L) Horiba/YSI		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
1005	X		31.14		6.54		12.4		2.01/1.98		-114		679		200	NM	0
1010	X		30.57		6.59		11.8		1.36/1.72		-181		127		200	NM	1000
1015	X		31.00		6.59		11.9		0.00/1.70		-236		83.1		200	NM	2000
1020	X		31.17	✓	6.58	✓	11.8	✓	0.00/1.62	✓	-238	✓	77.6	✓	200	NM	3000
1025	X		31.23		6.58		11.8		0.00/1.49		-239		69.9		200	NM	4000
1030		X	STABILIZATION														

DK 8-23-17

Sample ID: CTMW-04S-20170823 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1030

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron= 2.05 mg/L

Sulfide = 0.17 mg/L

Groundwater Color is blackish yellow

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-04D
Field Samplers: ~~Jeff Richeson~~ D. Keady, K. Lew		Recorded by: ~~Jeff Richeson~~ D. Keady, K. Lew	Date: 8-23-17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 48.99	Screened/Open Interval Top: — (ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder) with poly tubing / GeoSump		Pump Intake Depth: — (ft BGS) 41 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 23.07 Time: 0741 (8-22-17)	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity mS/cm READ	Spec Cond. CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0742	X		27.06		7.44		12.7		19.04/10.25		-19		49.5		200	23.36	0
0747	~~X~~		STOPPED; DO seems too high; pulled pump and pushed tubing in more to prevent air from line getting in water.														
0751	X		27.32		7.32		12.9		3.89/3.37		7		159		200	23.32	1000
0756	~~X~~		STOPPED; DO still seems too high, will cut line and start over; switched to GeoSump electric pump														
0832	X		26.42		7.23		12.7		7.16/2.27		3		308		200	24.31	2000
0837	X		26.08		7.23		12.7		5.27/1.18		-8		258		200	24.35	3000
0842	X		25.95		7.22		12.6		3.92/0.95		-19		220		200	24.39	4000
0847	X		25.88		7.21		12.7		0.14/0.88		-39		191		200	24.41	5000
0852	X		25.81		7.21		12.7		0.00/0.85		-52		164		200	24.41	6000
0857	X		25.78		7.22		12.7		0.00/0.81		-59		147		200	24.41	7000
0902	X		25.76		7.21		12.8		0.00/0.78		-64		134		200	24.41	8000
0907	X		25.71		7.21		12.8		0.00/0.77		-67		124		200	24.41	9000
0912	X		25.19	✓	7.21	✓	12.9	✓	0.00/0.78	✓	-69	✓	117	✓	200	24.41	10 000
0920		X	STABILIZATION														

DK 8-23-17

Sample ID: CTMW-04D-20170823 Duplicate ID: CTMW-04D-20170823-FD QA/QC Samples/ID: — COC Time: 0920

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron= 0.26 mg/L

Sulfide = 0.21 mg/L

Groundwater Color is yellow green, cloudy

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-05S
Field Samplers: ~~Jeff Richeson~~ D. Keady, K. Lew		Recorded by: ~~Jeff Richeson~~ D Keady, K. Lew	Date: 8-22-17
Well Depth (ft BGS): —	MP Distance AGS (ft): — / Well Depth (ft BMP): 24.5	Screened/Open Interval Top: — (ft BGS)	19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: — (ft BGS)	24 (ft BMP)
Pump and Tubing Type: ~~Mega Monsoon~~ Geofump Pump with poly tubing	Pump Intake Depth: — (ft BGS) 23.75 (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 23.36 (0729 8-22-17) Time:		GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity m (~~µ~~S/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1336	X		27.68		6.85		11.8		1.41		135		4.9		200	23.40	0
1341	X		27.64		6.81		11.8		1.01		144		6.8		200	23.42	1000
1346	X		27.86		6.82		11.9		0.98		146		6.5		200	23.43	2000
1351	X		27.83		6.80		11.8		0.94		150		7.2		200	23.43	3000
1356	X		27.68	✓	6.79	✓	11.8	✓	0.89	✓	151	✓	7.4	✓	200	23.43	4000
1401	X		27.66		6.78		11.8		0.87		151		7.6		200	23.43	5000
1410		X	STABILIZATION														

DK 8-22-17

Sample ID: CTMW-05S-20170822

Duplicate ID: —

QA/QC Samples/ID: —

COC Time: 1410

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron= 0.02 mg/L

Sulfide = 0.00 mg/L

Groundwater Color is yellow-green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-05D**
Field Samplers: ~~Jeff Richeson~~ D Keady, K. Lew		Recorded by: ~~Jeff Richeson~~ D Keady, K. Lew	Date: 8-22-17
Well Depth (ft BGS): —	MP Distance AGS (ft): — / Well Depth (ft BMP): 54.00	Screened/Open Interval Top: —	(ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: —	(ft BGS) 54 (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder) with poly tubing	Pump Intake Depth: —	(ft BGS) 44 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 23.53	Time: 0740	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity mS/cm (~~µS/cm~~)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
1041	X		27.18		7.55		11.4		2.05		51		30.8		200	23.86	0
1046	X		26.26		7.51		11.5		1.03		58		71.7		200	23.86	1000
1051	X		26.00		7.50		11.5		0.89		63		57.6		200	23.88	2000
1056	X		25.92		7.50		11.5		0.85		DK8 22-17 ~~46.7~~ 66		46.7		200	23.88	3000
1101	X		25.70		7.49		11.5		0.81		72		35.2		200	23.88	4000
1106	X		25.76		7.48		11.6		0.80		74		33.1		200	23.88	5000
1111	X		25.71		7.47		11.6		0.77		77		22.3		200	23.88	6000
1116	X		25.75		7.46		11.6		0.77		81		18.3		200	23.88	7000
1121	X		25.75		7.47		11.6		0.75		83		16.0		200	23.88	8000
1126	X		25.80		7.47		11.6		0.74		85		11.9		200	23.88	9000
1131	X		25.73	✓	7.47	✓	11.6	✓	0.73	✓	86	✓	10.5		200	23.88	10000
1136	X		25.59		7.47		11.6		0.72		88		9.6	✓	200	23.88	11000
1140		X	STABILIZATION														
													DK 8/22/17				

Sample ID: CTMW-05D-20170822 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1140

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron= 0.[illegible]0 mg/L

Sulfide = 0.03 mg/L

Groundwater Color is yellow-green

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-06S
Field Samplers: ~~Jeff Richeson~~ D.Keady, K.Lew		Recorded by: ~~Jeff Richeson~~ D.Keady, K.Lew	Date: 8-22-17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 24.4	Screened/Open Interval Top: — (ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 24 (ft BMP)
Pump and Tubing Type: Mega Monsoon Pump with poly tubing / Bail		Pump Intake Depth: — (ft BGS) 24 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 23.59 Time: 0735	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1010	X		Unable to achieve low flow w/ pump; recharge too slow.														
1025	X		Purged 3 casing volumes (0.21 gal)														0.21gal
1442	*	X	3253		6.77		13.1		6.50		-92		173		—		1.5 gal

DK 8-22-17

Sample ID: CTMW-06S-20170822 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1400

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N Field Filtered: Y N COC Number:

Comments:
Ferrous Iron= 2.17 mg/L
Sulfide = 0.33 mg/L
Groundwater Color is black

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-06D
Field Samplers: ~~Jeff Richeson~~ D. Keady, K. Lew		Recorded by: ~~Jeff Richeson~~ D. Keady, K. Lew	Date: 8-22-17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 54.25	Screened/Open Interval Top: — (ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 54 (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder) with poly tubing		Pump Intake Depth: — (ft BGS) 44 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 23.96 Time: 0736	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity m (µS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0821	X		29.32		6.96		13.1		1.63		-20		353		200	24.31	~~[illegible]~~ 0
0826	X		29.38		6.91		13.2		0.29		-11		156		200	24.34	~~[illegible]~~ 1000
0831	X		26.33		6.90		13.2		0.00		-4		139		200	24.35	~~600~~ 2000
0836	X		26.32		6.89		13.2		2.36*		-6		120		200	24.35	~~800~~ 3000
0841	X		26.22		6.88		13.2		1.52		-13		95.3		200	24.35	~~1000~~ 4000
0846	X		26.18		6.88		13.2		1.27		-13		101		200	24.35	~~1200~~ 5000
0851	X		26.13		6.88		13.2		1.13		-10		98.5		200	24.35	~~1400~~ 6000
0856	X		26.16		6.88		13.2		1.06		-5		80.1		200	24.35	7000
0901	X		26.14		6.88		13.3		1.03		-1		57.6		200	24.35	8000
0906	X		26.11		6.88		13.3		0.95		4		49.9		200	24.35	9000
0911	X		26.10		6.87		13.3		0.93		8		46.1		200	24.35	10000
0916	X		26.14	✓	6.86	✓	13.3	✓	0.90	✓	11	✓	46.5	✓	200	24.35	11000
0920		X	STABILIZATION														

DK 8/22/17

Sample ID: CTMW-06D-20170822

Duplicate ID: —

QA/QC Samples/ID: —

COC Time: 0920

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N

Field Filtered: Y N

COC Number:

Comments: * Switched from Horiba DO to YSI DO probe.

Ferrous Iron= 0.00 mg/L

Sulfide = 0.10 mg/L

Groundwater Color is yellow-green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

WELL WATER LEVEL MEASUREMENT LOG

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NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task No: M12 –	Date: 9/19/17
Task Manager Arul Ayyaswami	Field Sampler(s): Jeff Richeson, D. Kendy	Recorded by: Jeff Richeson, D Kendy
Equipment Model/Type: Solinst IP 122	*Serial Number:* 027681 (Pine)	*Last Calibration Date:* —

Well Identification	Describe Measuring Point	Time (hrs)	Depth to Static Water Level (ft BMP)	Well Sounding Depth (ft BMP)	Condition of Well and Well Seal
CTIW-01S	TOC	0701	22.33	—	Cap stuck on well - Pipe wrc
CTIW-01D	TOC	0653	—	—	Interphase can't read
CTIW-02S	TOC	0655	—	—	~~[illegible]~~ injectate in well
CTIW-02D	TOC	0657	22.75	—	Good
CTIW-03S	TOC	0658	22.50	—	Good
CTIW-03D	TOC	0700	24.11	—	Good
CTMW-01S	TOC	0644	22.85	—	Good
CTMW-01D	TOC	0645	23.77	—	Good
CTMW-02S	TOC	0642	23.21	—	Good TD=23.70
CTMW-02D	TOC	0643	23.40	—	Good
CTMW-03S	TOC	0640	22.73	—	Good
CTMW-03D	TOC	0641	22.88	—	Good
CTMW-04S	TOC	0638	22.90	—	Good
CTMW-04D	TOC	0639	23.13	—	Good
CTMW-05S	TOC	0636	23.38	—	Good
CTMW-05D	TOC	0637	23.56	—	Good
CTMW-06S	TOC	0634	23.64	—	Good
CTMW-06D	TOC	0633	23.95	—	Good

JDK 9-19-17

BGS = Below Ground Surface BMP = Below Measuring Point MP = Measuring Point TOC = Top of Casing (Well Riser)

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-01S
Field Samplers: Jeff Richeson, D. Keady		Recorded by: Jeff Richeson, D. Keady	Date: 9/20/17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 23.78	Screened/Open Interval Top: — (ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 24 (ft BMP)
Pump and Tubing Type: ~~Mega Monsoon~~ Solinst Peristaltic Pump with Poly Tubing		Pump Intake Depth: — (ft BGS) 23.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 22.85 Time: 0744 [illegible]	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity m (µS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0804	X		27.87		6.50		12.6		2.03/0.33		-57		136		100	22.96	0
0809	X		28.85		6.43		12.3		1.32/0.18		-64		77.9		100	23.00	500
0814	X		29.56		6.43		12.2		1.00/0.15		-68		45.2		100	23.05	1000
0819	X		30.22		6.43		12.2		0.84/0.14		-71		36.4		100	23.15	1500
0824	X		30.56		6.41		12.3		0.76/0.13		-72		35.6		100	23.24	2000
0829	X		30.84	✓	6.40	✓	12.4	✓	0.70/0.15	✓	-72	✓	34.7	✓	100	NM	2500
0830		X	STABILIZATION														

DK 9/20/17

Sample ID: CTMW-01S-20170920 Duplicate ID: — QA/QC Samples/ID: — COC Time: 0830

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron = NS

Sulfide= 0.49 mg/L

Groundwater Color is blackish yellow-green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study
Task Manager: Arul Ayyaswami
Task No: M12
Well ID: CTMW-01D
Field Samplers: Jeff Richeson, D.Keady
Recorded by: Jeff Richeson, D.Keady
Date: 9/20/17
Well Depth (ft BGS): —
MP Distance AGS (ft): —
Well Depth (ft BMP): 49.41
Screened/Open Interval Top: — (ft BGS) 34 (ft BMP)
Well Diameter (in): 2
PID/FID Readings Beneath Inner Cap (ppm cge akb): —
Screened/Open Interval Bottom: — (ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing
Pump Intake Depth: — (ft BGS) 41.5 (ft BMP)
MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox
Depth to Water Before Pump Installation (ft BMP): 23.77
Time: 0645 (9/19/17)
GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity M ~~µ~~S/cm READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0639	X		25.68		6.51		14.7		1.71/0.26		-63		106		200	23.25	0
0644	X		25.75		6.46		15.0		0.23/0.23		-83		26.0		200	23.65	1000
0649	X		25.74		6.53		14.8		0.09/0.24		-91		21.0		200	23.68	2000
0654	X		25.69		6.57		14.7		0.00/0.23		-96		18.3		200	23.70	3000
0659	X		25.69		6.54		14.7		0.00/0.22		-96		17.0		200	23.72	4000
0704	X		25.68	✓	6.54	✓	14.7	✓	0.00/0.22	✓	-98	✓	15.5	✓	200	23.74	5000
0709	X		25.68	✓	6.53	✓	14.7	✓	0.00/0.21	✓	-99	✓	14.7	✓	200	23.74	6000
0714	X		25.67	✓	6.53	✓	14.6	✓	0.00/0.21	✓	-100	✓	13.6	✓	200	23.78	7000
0719	X		25.67	✓	6.54	✓	14.6	✓	0.00/0.21	✓	-102	✓	12.5	✓	200	23.80	8000
0724	X		25.68	✓	6.53	✓	14.6	✓	0.01/0.21	✓	-103	✓	11.5	✓	200	23.82	9000
0725		X	STABILIZED AT 0704, BUT PURGED FOR ADDITIONAL 20 MINUTES AS INSTRUCTED														

DK 9/20/17

Sample ID: CTMW-01D-20170~~8~~920
Duplicate ID: —
QA/QC Samples/ID: —
COC Time: 0725

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)
Field Decontamination: Y N
Field Filtered: Y N
COC Number:
Comments:
Ferrous Iron= NS
Sulfide = 0.06 mg/L
Groundwater Color is yellow-green
Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-02S
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 9/20/17
Well Depth (ft BGS): —	MP Distance AGS (ft): — Well Depth (ft BMP): 23.77	Screened/Open Interval Top: — (ft BGS)	19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: — (ft BGS)	24 (ft BMP)
Pump and Tubing Type: Hand Bailer	Pump Intake Depth: — (ft BGS)	— (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 23.21	Time: 0642 (9/19/17)	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1345		X	HAND BAILED DUE TO INSUFFICIENT WATER COLUMN / SLOW RECHARGE.														

9/20/17

Sample ID: CTMW-02S-20170920 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1745

Sample Container Number	Sample Container Material Code	Sample Container Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron= NS

Sulfide = NS

Groundwater Color is blackish yellow-green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-02D**
Field Samplers: Jeff Richeson, D. Kealy		Recorded by: Jeff Richeson, D. Kealy	Date: 9/20/17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 49.18	Screened/Open Interval Top: — (ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Sampre Pro (bladder) with poly tubing		Pump Intake Depth: — (ft BGS) 41 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 23.40 Time: 0643 (9/19/17)	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity m µS/cm READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0945	X		27.24	TA8	6.87		13.2		0.74/0.16		39		>1000		200	24.16	0
0950	X		25.94		6.92		13.6		0.05/0.17		46		698		200	24.34	1000
0955	X		25.75		6.91		13.6		0.00/0.16		52		368		200	24.48	2000
1000	X		25.69		6.90		13.6		0.00/0.16		58		199		200	24.50	3000
1005	X		25.66		6.89		13.6		0.00/0.15		61		158		200	24.52	4000
1010	X		25.63		6.87		13.5		0.00/0.15		64		118		200	24.55	5000
1015	X		25.58		6.88		13.5		0.00/0.14		46		83.8		200	24.58	6000
1020	X		25.55		6.87		13.4		0.00/0.13		66		62.1		200	24.59	7000
1025	X		25.55		6.86		13.4		0.00/0.13		66		50.2		200	24.60	8000
1030	X		25.54		6.85		13.3		0.00/0.12		64		50.0		200	24.60	9000
1035	X		25.54	✓	6.83	✓	13.3	✓	0.00/0.12	✓	62	✓	47.3	✓	200	24.60	10000
1040	X		25.54	✓	6.82	✓	13.3	✓	0.00/0.12	✓	58	✓	51.2	✓	200	24.60	11000
1045	X		25.54	✓	6.83	✓	13.3	✓	0.00/0.12	✓	52	✓	46.5	✓	200	24.60	12000
1050	X		25.55	✓	6.82	✓	13.3	✓	0.00/0.12	✓	54	✓	42.9	✓	200	24.60	13000
1055	X		24.55	✓	6.82	✓	13.3	✓	0.00/0.12	✓	53	✓	39.2	✓	200	24.60	14000

Sample ID: CTMW-02D-20170920 **Duplicate ID:** — **QA/QC Samples/ID:** Level 4 QC **COC Time:** 1100

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N

Field Filtered: Y N

COC Number:

Comments: Stabilization at 1035, but purged for add'l. 20 mins. as instructed; sampled @ 1100

Ferrous Iron= NS

Sulfide = 0.02 mg/L

Groundwater Color is yellow-green

Signature(s): DOK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-03S**
Field Samplers: Jeff Richeson, D.Keady		Recorded by: Jeff Richeson, D.Keady	Date: 9/21/17
Well Depth (ft BGS): —	MP Distance AGS (ft): — Well Depth (ft BMP): 24.35	Screened/Open Interval Top: —	(ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: —	(ft BGS) 24 (ft BMP)
Pump and Tubing Type: ~~Mega Monsoon~~ Solinst Peristaltic pump with poly tubing	Pump Intake Depth: — (ft BGS)	23.75 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.73	Time: 0640 (9/19/17)	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity M (~~µ~~S/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0809	X		25.46		6.94		10.5		2.35/0.37		57		10.5		180	22.77	0
0814	X		25.26		6.84		10.5		0.94/0.24		62		4.4		180	22.77	900
0819	X		25.27		6.83		10.5		0.57/0.18		64		2.7		180	22.77	1800
0824	X		25.27		6.86		10.5		0.43/0.17		65		2.5		180	22.77	2700
0829	X		25.30	✓	6.87	✓	10.6	✓	0.35/0.16	✓	67	✓	2.1	✓ (<5)	180	22.77	3600
0830		X	STABILIZATION														

DK 9/21/17

Sample ID: CTMW-03S-20170921 **Duplicate ID:** — **QA/QC Samples/ID:** — **COC Time:** 0830

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron= NS

Sulfide = 0.12 mg/L

Groundwater Color is yellow-green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-03D**
Field Samplers: Jeff Richeson, D. Keady		Recorded by: Jeff Richeson, D. Keady	Date: 9/21/17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 39.49	Screened/Open Interval Top: — (ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 39 (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder) with poly tubing		Pump Intake Depth: — (ft BGS) 37 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 22.88 Time: 0641	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity m (µS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0915	X		24.77		7.50		9.91		1.50/0.17		85		11.1		140	23.04	0
0920	X		24.45		7.58		9.90		0.42/0.14		77		7.3		140	23.04	700
0925	X		24.37		7.58		9.90		0.13/0.13		75		3.5		140	23.04	1400
0930	X		24.31		7.57		9.90		0.00/0.13		73		1.6		140	23.04	2100
0935	X		24.29	✓	7.58	✓	9.91	✓	0.00/0.12	✓	71	✓	1.0	✓ (≤5)	140	23.04	2800
0940		X	STABILIZATION														

DK 9/21/17

Sample ID: CTMW-03D-20170921 **Duplicate ID:** — **QA/QC Samples/ID:** — **COC Time:** 0940

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron= NS

Sulfide = 0.03 mg/L

Groundwater Color is yellowgreen

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-04S**
Field Samplers: Jeff Richeson, D. Keady		Recorded by: Jeff Richeson, D. Keady	Date: 9/21/17
Well Depth (ft BGS): — MP Distance AGS (ft): —	Well Depth (ft BMP): 24.01	Screened/Open Interval Top: —	(ft BGS) 19 (ft BMP)
Well Diameter (in): 2 PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: —	(ft BGS) 24 (ft BMP)
Pump and Tubing Type: ~~Mega Monsoon~~ Solinst peristaltic Pump with poly tubing	Pump Intake Depth: —	(ft BGS) 23.75 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.90	Time: 0638 (9/21/17)	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity m (µS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen Horiba/YSI DO (mg/L) READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0635	X		25.18		6.76		11.1		1.56/0.31		-98		253		100	23.14	0
0640	X		25.63		6.75		11.0		1.31/0.26		-145		116		100	23.15	500
0645	X		25.78		6.76		10.9		1.23/0.27		-148		54.2		100	23.15	1000
0650	X		25.92		6.77		10.9		1.10/0.23		-144		37.8		100	23.15	1500
0655	X		25.98		6.80		10.9		0.98/0.21		-139		28.7		100	23.15	2000
0700	X		26.04		6.81		10.9		0.87/0.19		-134		23.5		100	23.15	2500
0705	X		26.12		6.78		10.9		0.79/0.18		-127		19.5		100	23.15	3000
0710	X		26.17		6.75		10.9		0.76/0.16		-121		19.2		100	23.15	3500
0715	X		26.21		6.74		10.8		0.88/0.16		-119		18.5		100	23.15	4000
0720		X	STABILIZATION														

DK 9/21/17

Sample ID: CTMW-04S-20170921 **Duplicate ID:** — **QA/QC Samples/ID:** — **COC Time:** 0720

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron= NS

Sulfide = 0.11 mg/L

Groundwater Color is blackish yellow-green (light)

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-04D**
Field Samplers: Jeff Richeson, D.Keady		Recorded by: Jeff Richeson, D.Keady	Date: 9/20/17
Well Depth (ft BGS): —	MP Distance AGS (ft): — Well Depth (ft BMP): 48.99	Screened/Open Interval Top: —	(ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: —	(ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder) with poly tubing	Pump Intake Depth: —	(ft BGS) 41 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 23.13	Time: 0639 (9/18/17)	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (~~µ~~mS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1245	X		27.19		7.51		11.4		1.02/0.22		-64		188		200	23.35	0
1250	X		26.35		7.47		11.5		0.35/0.22		-84		109		200	23.37	1000
1255	X		26.03		7.47		11.5		0.22/0.20		-90		67.0		200	22.39	2000
1300	X		25.83		7.46		11.6		0.12/0.20		-92		47.2		200	22.40	3000
1305	X		25.84		7.45		11.6		0.04/0.17		-94		21.1		200	22.41	4000
1310	X		25.84		7.44		11.6		0.00/0.17		-93		17.3		200	22.41	5000
1315	X		25.83		7.43		11.5		0.00/0.17		-93		12.6		200	22.41	6000
1320	X		25.87		7.42		11.5		0.00/0.17		-94		7.6		200	22.41	7000
1325	X		25.95	✓	7.42	✓	11.6	✓	0.00/0.16	✓	-96	✓	4.7	✓ (<5)	200	22.41	8000
1330		X	STABILIZATION														

DK 9/20/17

Sample ID: CTMW-04D-20170920 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1330

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N Field Filtered: Y N COC Number:

Comments:

Ferrous Iron= NS

Sulfide = 0.18mg/L

Groundwater Color is yellow-green

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-05S**
Field Samplers: Jeff Richeson, D. Keady		Recorded by: Jeff Richeson, D. Keady	Date: 9-19-17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 24.5	Screened/Open Interval Top: — (ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 24 (ft BMP)
Pump and Tubing Type: ~~Mega Monsoon~~ Peristaltic Pump with poly tubing		Pump Intake Depth: — (ft BGS) 23.75 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 23.38 Time: 0636	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity M(μS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/96 READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1313	X		30.07		6.70		11.1		2.16/0.36		155		856		120	23.50	0
1318	X		29.23		6.67		11.0		1.55/0.27		158		211		120	23.51	600
1323	X		28.85		6.62		11.1		0.99/0.19		160		52.0		120	23.53	1200
1328	X		28.73		6.58		11.1		0.81/0.21		162		19.7		120	23.54	1800
1333	X		28.69		6.55		11.0		0.68/0.19		165		8.4		120	23.55	2400
1338	X		28.71		6.54		11.1		0.63/0.20		165		5.1		120	23.55	3000
1343	X		28.74		6.57		11.2		0.56/0.17		164		5.0		120	23.55	3600
1348	X		28.81		6.61		11.1		0.52/0.17		163		4.9		120	23.55	4200
1350		X	STABILIZATION														

DK 9-19-17

Sample ID: CTMW-05S-20170919 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1150

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron= NS

Sulfide = 0.01 mg/L

Groundwater Color is light yellow-green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-05D
Field Samplers: Jeff Richeson, D. Keady		Recorded by: Jeff Richeson	Date: 9-19-17
Well Depth (ft BGS): —	MP Distance AGS (ft):	Well Depth (ft BMP): 54.00	Screened/Open Interval Top: — (ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 54 (ft BMP)
Pump and Tubing Type: ~~QED Sample Pro (bladder)~~ Solinst Peristaltic pump with poly tubing		Pump Intake Depth: — (ft BGS) 44 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 23.56 Time: 0637	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity ~~(dS/cm)~~ M READ	Spec Cond. CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1109	X		30.13		7.25		10.4		1.74/0.39		97		13.8		140	23.69	0
1114	X		29.26		7.26		10.4		0.93/0.22		103		7.2		140	23.70	700
1119	X		28.83		7.25		10.4		0.76/0.19		108		6.5		140	23.70	1400
1124	X		28.56		7.28		10.5		0.65/0.19		110		7.5		140	23.70	2100
1129	X		28.34	✓	7.29		10.5		0.59/0.21		111		8.1		140	23.70	2800
1134	X		28.24		7.34	✓	10.5	✓	0.56/0.22	✓	111	✓	8.2	✓	140	23.70	3500
1135		X	STABILIZED														

DK 9-19-17

Sample ID: CTMW-05D-20170919 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1135

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron= NS

Sulfide = 0.02 mg/L

Groundwater Color is yellow-green

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-06S**
Field Samplers: Jeff Richeson, D. Kendy		Recorded by: Jeff Richeson, D. Kendy	Date: 9/19/17
Well Depth (ft BGS): —	MP Distance AGS (ft): — Well Depth (ft BMP): 24.4	Screened/Open Interval Top: —	(ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: —	(ft BGS) 24 (ft BMP)
Pump and Tubing Type: ~~Mega Monsoon~~ Solinst Peristaltic Pump with poly tubing	Pump Intake Depth: — (ft BGS) 24 (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 23.64 Time: 0634		GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (mS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0918	X		29.21		6.81		12.2		1.98/0.61		-114		152		80	23.64	0
0923	X		29.32		6.69		12.1		1.51/0.47		-102		131		80	23.78	400
0928	X		29.37		6.63		12.0		1.28/0.33		-98		108		80	23.78	800
0933	X		29.50		6.64		12.0		1.10/0.29		-100		146		80	23.78	1200
0938	X		29.76		6.65		12.0		1.08/0.21		-104		124		80	23.78	1600
0943	X		29.93	✓	6.65	✓	12.0	✓	1.07/0.20	✓	-106	✓	127	✓	80	23.78	2000
0948	X		30.22		6.64		12.0		1.10/0.18		-109		124		80	23.78	2400
0950		X	STABILIZATION														

DK 9/19/17

Sample ID: CTMW-06S-20170919 Duplicate ID: — QA/QC Samples/ID: — COC Time: 0950

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron= NS

Sulfide = 0.08

Groundwater Color is yellow/Gray

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-06D**
Field Samplers: Jeff Richeson, Daniel Keady		Recorded by: Jeff Richeson, D.Keady	Date: 9/19/17
Well Depth (ft BGS): —	MP Distance AGS (ft): — Well Depth (ft BMP): 54.25	Screened/Open Interval Top: —	(ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: —	(ft BGS) 54 (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder) with poly tubing		Pump Intake Depth: — (ft BGS) 44 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 23.95 Time: 0633	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity m(µS/cm)		Dissolved Oxygen DO (mg/L) Horiba YSI		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0732	X		25.37		6.61		12.5		1.03/0.57		191		50.1		200	24.35	0
0737	X		25.35		6.70		12.8		0.24/0.61		175		41.3		200	24.37	1000
0742	X		25.30		6.72		12.8		0.14/0.58		171		38.2		200	24.38	2000
0747	X		25.33		6.74		12.8		0.16/0.55		169		31.7		200	24.39	3000
0752	X		25.35		6.74		12.7		0.13/0.51		170		29.6		200	24.39	4000
0757	X		25.40	✓	6.75	✓	12.7	✓	0.11/0.49	✓	170	✓	27.8	✓	200	24.39	5000
0800		X	STABILIZED														

DK 09/19/17

Sample ID: CTMW-06D-20170919 **Duplicate ID:** CTMW-06D-20170919-FD **QA/QC Samples/ID:** — **COC Time:** 0800

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: [✓ Y] N COC Number:

Comments:

Ferrous Iron= NS

Sulfide = 0.10

Groundwater Color is yellow-green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

WELL WATER LEVEL MEASUREMENT LOG

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NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task No: M12	Date: 10/3/17
Task Manager Arul Ayyaswami	Field Sampler(s): Jeff Richeson, D. Kealy, E. Pierce	Recorded by: Jeff Richeson, D. Kealy, E. Pierce
Equipment Model/Type: Interphase Prober (Pine)	*Serial Number:* —	*Last Calibration Date:* —

Well Identification	Describe Measuring Point	Time (hrs)	Depth to Static Water Level (ft BMP)	Well Sounding Depth (ft BMP)	Condition of Well and Well Seal
CTIW-01S	TOC	0649	22.39/22.80	-	Product/Water, good
CTIW-01D	TOC	0649	22.68	-	good
CTIW-02S	TOC	0651	22.52	-	good
CTIW-02D	TOC	0651	22.83	-	good
CTIW-03S	TOC	0652	22.79	-	good
CTIW-03D	TOC	0652	23.41	-	good
CTMW-01S	TOC	0645	22.67	-	good
CTMW-01D	TOC	0645	22.74	-	good
CTMW-02S	TOC	0643	23.26	-	good
CTMW-02D	TOC	0643	23.36	-	good
CTMW-03S	TOC	0642	22.74	-	good
CTMW-03D	TOC	0642	22.85	-	good
CTMW-04S	TOC	0640	22.98	-	good
CTMW-04D	TOC	0640	23.12	-	good
CTMW-05S	TOC	0639	23.42	-	good
CTMW-05D	TOC	0639	23.54	-	good
CTMW-06S	TOC	0646	23.65	-	good
CTMW-06D	TOC	0646	23.95	-	good

10/3/17

BGS = Below Ground Surface BMP = Below Measuring Point MP = Measuring Point TOC = Top of Casing (Well Riser)

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-01S**
Field Samplers: ~~Jeff Richeson~~ E.Pearce		Recorded by: ~~Jeff Richeson~~ E.Pearce	Date: 10-3-17
Well Depth (ft BGS): —	MP Distance AGS (ft): — | Well Depth (ft BMP): 23.78	Screened/Open Interval Top:	(ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom:	(ft BGS) 24 (ft BMP)
Pump and Tubing Type: ~~Mega Monsoon~~ Mini Peristaltic Pump with Poly Tubing	Pump Intake Depth: — (ft BGS) 23.5 (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.67	Time: —	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0930		X	25.63		7.75		11.8		1.09		-82		30.1				

WATER COLUMN TOO SHORT AND RECHARGE TOO SLOW TO LOW FLOW; PURGED/SAMPLED W/ PERISTALTIC PUMP AND TOOK READINGS FROM HORIBA CUP

10/3/17

Sample ID: CTMW-01S-20171003 **Duplicate ID:** — **QA/QC Samples/ID:** — **COC Time:** 0930

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron = overflow

Sulfide= 0.08

Groundwater Color is Light yellow green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

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TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-01D
Field Samplers: ~~Jeff Richeson~~ E. Peira		Recorded by: ~~Jeff Richeson~~ E. Peira	Date: 10-3-17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 49.41	Screened/Open Interval Top: — (ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: — (ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing		Pump Intake Depth: — (ft BGS) 41.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 22.74 Time: —	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0750	/		26.25		7.26		14.1		6.48		-31		13.1		200	22.85	~~200~~ 0
0755	/		26.36		7.26		14.1		6.42		-30		12.5		200	22.89	~~400~~ 1000
0800	/		26.46		7.26		14.0		6.40		-29		12.0		200	22.87	~~600~~ 2000
0805	/		26.71		7.31		13.9		6.43		-20		0.0		200	22.87	~~800~~ 3000
0810	/		26.73		7.33		13.8		6.40		-18		0.0		200	22.88	~~1000~~ 4000
0815	/		26.71		7.34		13.7		6.42		-20		0.0		200	22.88	~~1200~~ 5000
0820	/		26.72	✓	7.34	✓	13.7	✓	0.27	✓	-20	✓	0.0	✓	200	22.89	~~1400~~ 6000
0825		x	26.72		7.34		13.7		0.28		-19		0.0		200	22.89	~~1600~~ 7000

↳ Air introduced into water column from pump line.

10/3/17

Sample ID: CTMW-01D-20171003 Duplicate ID: — QA/QC Samples/ID: — COC Time: 0825

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: [✓ Y] N COC Number:

Comments:

Ferrous Iron= 0.06 mg/L

Sulfide = 0.09 mg/L

Groundwater Color is Yellow Green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study
Task Manager: Arul Ayyaswami
Task No: M12
Well ID: CTMW-02S
Field Samplers: Jeff Richeson, D.Kendy, E. Pierce
Recorded by: Jeff Richeson, D.Kendy, E.Pierce
Date: 10/3/17
Well Depth (ft BGS): —
MP Distance AGS (ft): —
Well Depth (ft BMP): 23.77
Screened/Open Interval Top: — (ft BGS) 19 (ft BMP)
Well Diameter (in): 2
PID/FID Readings Beneath Inner Cap (ppm cge akb): —
Screened/Open Interval Bottom: — (ft BGS) 24 (ft BMP)
Pump and Tubing Type: ~~Hand Bailer~~ Pine Peristaltic Pump
Pump Intake Depth: — (ft BGS) — (ft BMP)
MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox
Depth to Water Before Pump Installation (ft BMP): 0643 Time: 23.26
GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity m (~~µ~~S/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	Horiba/HE READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
1000		X	26.14		7.30		9.15		6.52/0.26		-107		45.4		—	—	—

WATER COLUMN TOO SMALL AND RECHARGE TOO SLOW FOR LOW FLOW, PURGED WITH A PERISTALTIC PUMP AND TOOK WATER QUALITY READINGS FROM HORIBA CUP.

DK 10/3/17

Sample ID: CTMW-02S-20171003
Duplicate ID: —
QA/QC Samples/ID: —
COC Time: 1000

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)
Field Decontamination: Y N
Field Filtered: Y N
COC Number:
Comments:
Ferrous Iron= 3.23 mg/L
Sulfide = 0.07 mg/L
Groundwater Color is blackish yellow-green

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-02D
Field Samplers: Jeff Richeson, D.Keady, E. Peirce		Recorded by: Jeff Richeson, D.Keady, E.Peirce	Date: 10/3/17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 49.18	Screened/Open Interval Top: — (ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Sampre Pro (bladder) with poly tubing		Pump Intake Depth: — (ft BGS) 41 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 23.36 Time: 0643	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity m(µS/cm)		Dissolved Oxygen DO (mg/L) Hach/YSI		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0747	X		26.26		6.50		12.9		1.17/0.20		295		303		200	23.98	0
0752	X		27.39		6.69		13.6		0.19/0.20		185		175		200	24.12	1000
0757	X		27.59		6.74		13.7		0.04/0.19		111		108		200	24.18	2000
0802	X		27.64		6.72		13.7		0.00/0.18		80		61.1		200	24.24	3000
0807	X		27.72		6.74		13.7		0.00/0.17		57		37.6		200	24.30	4000
0812	X		27.69		6.73		13.6		0.00/0.15		34		39.8		200	24.36	5000
0817	X		27.70		6.71		13.6		0.00/0.15		16		38.0		200	24.38	6000
0822	X		27.74		6.70		13.5		0.00/0.14		-4		22.4		200	24.39	7000
0827	X		27.76		6.69		13.5		0.00/0.14		-8		21.4		200	24.39	8000
0832	X		27.77	✓	6.68	✓	13.5	✓	0.00/0.13	✓	-14	✓	20.2	✓	200	24.39	9000
0840		X	STABILIZATION														

DK 10/3/17

Sample ID: CTMW-02D-20171003 Duplicate ID: — QA/QC Samples/ID: — COC Time: 0840

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N Field Filtered: Y N COC Number:

Comments:

Ferrous Iron= 0.00 mg/L

Sulfide = 0.00 mg/L

Groundwater Color is Yellow-green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-03S
Field Samplers: ~~Jeff Richeson~~ E. Peirce		Recorded by: ~~Jeff Richeson~~ E. Pierce	Date: 10/5/17
Well Depth (ft BGS): —	MP Distance AGS (ft): — / Well Depth (ft BMP): 24.35	Screened/Open Interval Top: — (ft BGS)	19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):	Screened/Open Interval Bottom: — (ft BGS)	24 (ft BMP)
Pump and Tubing Type: ~~Mega Monsoon~~ Ane Peristaltic pump with poly tubing	Pump Intake Depth: — (ft BGS) 23.75 (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.74	Time: —	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1250	X		28.30		7.23		9.06		2.50		110		0.0		100	NM	0
1255	X		28.48		7.24		8.94		2.24		114		0.0		100	NM	500
1300	X		28.51		7.24		8.93		1.79		115		0.0		100	NM	1000
1305	X		28.54		7.29		8.86		0.99		119		0.0		100	NM	1500
1310	X		28.60		7.30		8.83		0.94		119		0.0		100	NM	2000
1315	X		28.66	✓	7.31	✓	8.80	✓	0.88	✓	120	✓	0.0	✓	100	NM	3000
1320		X	28.70		7.32		8.79		0.84		120		0.0		100	NM	4000

10/5/17

Sample ID: CTMW-03S-20171007 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1320

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron= 0.05 mg/L

Sulfide = 0.00 mg/L

Groundwater Color is yellowish Green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-03D**
Field Samplers: ~~Jeff Richeson~~ E. Peirce		Recorded by: ~~Jeff Richeson~~ E. Peirce	Date: 10-2-17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 39.49	Screened/Open Interval Top: — (ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 39 (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder) with poly tubing		Pump Intake Depth: — (ft BGS) 37 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 22.85 Time: 1058	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
1100	X		27.37		8.33		9.26		1.46		55		2.0		200	22.86	0
1105	X		26.40		8.12		9.25		1.23		61		0.0		200	23.05	1000
1110	X		26.10		8.00		9.27		1.48		67		0.0		200	23.08	2000
1115	X		26.19		7.97		9.25		1.51		71		0.0		200	23.08	3000
1120	X		26.19		7.97		9.25		1.55		73		0.0		200	23.09	4000
1125	X		26.17		7.98	✓	9.26	✓	1.58	✓	75		0.0	✓	200	23.09	5000
1130	X		26.17	✓	7.98		9.26		1.57		77	✓	0.0		200	23.16	6000

10/2/17

Sample ID: CTMW-03D-20171002 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1130

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N

Field Filtered: Y N

COC Number:

Comments:

Ferrous Iron= 0.15 mg/L

Sulfide = 0.00 mg/L

Groundwater Color is Green Yellow

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-04S**
Field Samplers: Jeff Richeson, D. Keady, E. Peirce		Recorded by: Jeff Richeson, D. Keady, E. Peirce	Date: 10/3/17
Well Depth (ft BGS): —	MP Distance AGS (ft): — / Well Depth (ft BMP): 24.01	Screened/Open Interval Top: —	(ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: —	(ft BGS) 24 (ft BMP)
Pump and Tubing Type: ~~Mega Monsoon~~ Peristaltic Pump with poly tubing	Pump Intake Depth:	(ft BGS) 23.75 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 22.98	Time: 0640	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity ~~µ~~ M (µS/cm)		Dissolved Oxygen DO (mg/L) Horiba/YSI		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
1327	X		29.83		6.82		11.2		1.05/0.34		-229		35.5		100	23.12	
1332	X		29.75		6.73		11.2		0.81/0.23		-250		39.4		100	23.13	
1337	X		29.76		6.68		11.2		0.78/0.20		-254		36.2		100	23.15	
1342	X		29.74		6.66		11.2	✓	0.91/0.19	✓	-248		34.8	✓	100	23.16	
1347	X		29.98	✓	6.64	✓	11.2		0.86/0.18		-242	✓	32.1		100	23.17	
1400		X	STABILIZATION														

DK 10/3/17

Sample ID: CTMW-04S-20171003 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1400

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N Field Filtered: Y N COC Number:

Comments:

Ferrous Iron= 2.02 mg/L

Sulfide = 0.00 mg/L

Groundwater Color is light yellow-green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-04D
Field Samplers: Jeff Richeson, D.Keady, E.Peirce		Recorded by: Jeff Richeson, D.Keady, E.Peirce	Date: 10/3/17
Well Depth (ft BGS): —	MP Distance AGS (ft): — Well Depth (ft BMP): 48.99	Screened/Open Interval Top: —	(ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: —	(ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder) with poly tubing	Pump Intake Depth: — (ft BGS) 41 (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 23.12 Time: 0640		GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity m (µS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1113	X		27.04		7.58		11.5		1.46/0.25		-78		114		200	23.39	
1118	X		26.98		7.41		11.6		0.53/0.22		-159		97.4		200	23.39	
1123	X		26.90		7.35		11.6		0.27/0.20		-227		67.8		200	23.39	
1128	X		26.87		7.33		11.6		0.23/0.18		-260		49.6		200	23.39	
1133	X		26.85		7.28		11.6		0.13/0.17		-303		28.8		200	23.39	
1138	X		26.85		7.28		11.6		0.00/0.17		-349		16.1		200	23.39	
1143	X		26.83		7.27		11.6		0.00/0.16		-397		6.6		200	23.39	
1148			PAUSED PURGING; CHANGED HORIBA UNITS TO CONFIRM ORP.														
1150	X		RESUMED PURGING USING OTHER HORIBA UNIT.														
1152	X		26.62		8.05		9.99		1.64/0.17		-62		0.0		200	22.39	
1157	X		26.23		7.93		10.1		0.63/0.16		-119		0.0		200	22.39	
1202	X		26.09		7.91		10.1		0.53/0.16		-128		0.0		200	22.39	
1207	X		26.00	✓	7.89	✓	10.1	✓	0.50/0.16	✓	-131	✓	0.0	✓	200	22.39	
1215		X	STABILIZED														

DK 10/3/17

Sample ID: CTMW-04D-20171003 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1215

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron= 0.00 mg/L

Sulfide = 0.00 mg/L

Groundwater Color is yellow-green

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-05S
Field Samplers: ~~Jeff Richeson~~ E. Peirce		Recorded by: ~~Jeff Richeson~~, E. Peirce	Date: 10/4/17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 24.5	Screened/Open Interval Top: — (ft BGS) 19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 24 (ft BMP)
Pump and Tubing Type: ~~Mega Monsoon~~ Pine Peristaltic Pump with poly tubing		Pump Intake Depth: — (ft BGS) 23.75 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 23.34 Time: —	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0755	X		25.20		6.49		10.1		2.65/1.96		144		0.0		200	23.58	0
0800	X		25.31		6.41		10.1		2.09/0.82		149		0.0		200	23.59	1000
0805	X		25.29		6.41		10.1		1.90/0.75		149		0.0		200	23.59	2000
0810	X		25.31		6.41		10.1		1.98/0.74		148		0.0		200	23.60	3000
0815	X		25.36		6.41		10.1	✓	1.82/0.70		148		0.0		200	23.60	4000
0820	X		25.35	✓	6.41	✓	10.1		1.80/0.68	✓	148		0.0	✓	200	23.61	5000
0825		X	25.37		6.42		10.1		1.78/0.66		147	✓	0.0		200	23.61	6000

10/4/17

Sample ID: CTMW-05S-20171004 Duplicate ID: — QA/QC Samples/ID: — COC Time: 0825

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N Field Filtered: Y N COC Number:

Comments:

Ferrous Iron= 0.08 mg/L

Sulfide = 0.01 mg/L

Groundwater Color is Yellowish Green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-05D**
Field Samplers: ~~Jeff Richeson~~ E. Peirce		Recorded by: ~~Jeff Richeson~~ E. Peirce	Date: 10-4-17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 54.00	Screened/Open Interval Top: — (ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 54 (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder) with poly tubing		Pump Intake Depth: — (ft BGS) 44 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 23.52 Time: —	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0655	X		~~19.44~~ 24.46		6.81		10.0		1.06/1.45		171		63.9		200	23.68	0
0700	X		24.14		6.83		10.0		0.98/1.53		168		54.4		200	23.68	1000
0705	X		24.07		6.84		10.0		0.88/1.46		167		51.6		200	23.70	2000
0710	X		24.02		6.84		10.0		0.80/1.77		166		46.4		200	23.70	3000
0715	X		23.94		6.86		9.96		0.77/1.78		162		43.4		200	23.70	4000
0720	X		23.54		6.88		9.93		1.21/1.83		159		31.6		200	23.70	5000
0725	X		24.40		6.89		9.91		1.26/2.20		154		26.0		200	23.70	6000
0730	X		24.49		6.91		9.90		1.28/2.35		149		19.2		200	23.71	7000
0735	X		24.50	✓	6.94	✓	9.89	✓	1.30/2.40	✓	144		15.8	✓	200	23.71	8000
0740		X	24.51		6.94		9.87		1.33/2.45		142	✓	15.0		200	23.71	9000

10/4/17

Sample ID: CTMW-05D-20171004 Duplicate ID: — QA/QC Samples/ID: — COC Time: 0740

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron= 0.19 mg/L

Sulfide = 0.01 mg/L

Groundwater Color is Yellowish Green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

TETRA TECH

Page 1 of 1

LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	**Well ID: CTMW-06S**
Field Samplers: Jeff Richeson D. Kealy, E. Peirce		Recorded by: Jeff Richeson, D. Kealy, E. Peirce	Date: 10/4/17
Well Depth (ft BGS): —	MP Distance AGS (ft): — Well Depth (ft BMP): 24.4	Screened/Open Interval Top: — (ft BGS)	19 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: — (ft BGS)	24 (ft BMP)
Pump and Tubing Type: Pine Peristaltic ~~Mega Monsoon~~ Pump with Silicone ~~poly~~ tubing	Pump Intake Depth: — (ft BGS) 24 (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 23.65	Time: 0646	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity m ~~µ~~S/cm)		Dissolved Oxygen DO (mg/L) Horiba/YSI		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0828	X		27.87		6.59		11.7		3.11 / 0.24		-98		22.4		100	23.76	0
0833	X		27.89		6.58		11.6		2.38 / 0.21		-95		17.9		100	23.77	500
0838	X		28.05		6.51		11.6		2.01 / 0.19		-96		18.3		100	23.77	1000
0843	X		28.19	✓	6.48	✓	11.6	✓	1.76 / 0.17	✓	-98	✓	17.3	✓	100	23.77	1500
0848	X		28.33		6.46		11.5		1.47 / 0.17		-101		15.6		100	23.77	2000
0900		X	STABILIZATION														

DK 10/4/17

Sample ID: CTMW-06S-20171004 **Duplicate ID:** — **QA/QC Samples/ID:** — **COC Time:** 0900

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron= 2.72 mg/L

Sulfide = 0.01 mg/L

Groundwater Color is light (yellow-green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

TETRA TECH

Page 1 of 1

LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: In-Situ Chromium Treatability Study	Task Manager: Arul Ayyaswami	Task No: M12	Well ID: CTMW-06D
Field Samplers: Jeff Richeson, D. Keady, E. Pence		Recorded by: Jeff Richeson, D. Keady, E. Pence	Date: 10/4/17
Well Depth (ft BGS): —	MP Distance AGS (ft): — Well Depth (ft BMP): 54.25	Screened/Open Interval Top: — (ft BGS)	34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: — (ft BGS)	54 (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder) with poly tubing	Pump Intake Depth: — (ft BGS) 44 (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 23.95	Time: 0646 (10/4)	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity m (μS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	Horiba/YSI READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0658	X		26.37		6.45		11.6		1.87/1.12		200		97.5		200	24.31	0
0703	X		27.01		6.57		11.9		1.24/0.95		181		113		200	24.38	1000
0708	X		27.16		6.58		11.9		1.57/0.86		178		101		200	24.38	2000
0713	X		27.29		6.56		11.9		1.26/0.61		179		99.1		200	24.38	3000
0718	X		27.35	✓	6.56	✓	11.9	✓	1.02/0.59	✓	179	✓	95.1	✓	200	24.38	4000
0723	X		27.39		6.58		11.9		1.00/0.55		180		90.7		200	24.38	5000
0730		X	STABILIZED														

DK 10/4/17

Sample ID: CTMW-06D-20171004 Duplicate ID: CTMW-06D-20171004-FD QA/QC Samples/ID: — COC Time: 0730

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
In-Situ Chromium Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Ferrous Iron= 0.27 mg/L

Sulfide = 0.24 mg/L

Groundwater Color is yellow-green

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

Chemical Reduction Study

TETRA TECH

UFIW-015

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 144-87600088 Task Number: 02.01

Client: NERS

Project Location: WEST OF AP-5 BUND

WELL ID: UFIW-015

Date: 8-5-16 Time: 0745

Personnel: M. Crews, J Lingard

Weather: 100°F Sunny + breezy

2. WELL DEVELOPMENT LOG

Method: PUMP ___ BAILER X SURGE BLOCK ___ OTHER ___

Total Depth of Well (BTOC): 28.31 ft.

Depth to Static Water (BTOC): 27.63 ft.

Depth to Product (BTOC): — ft.

Length of Water Column (h): 0.68 ft.

Screen Length: ~28.31 to ~25.31 ft bgs

Calculated Casing Vol.: 0.114 gal

*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: BAIL

Materials: Pump / [✓ Bailer]: —

Materials: Tubing / [✓ Rope]: —

Was well purged dry? YES NO

Development Criteria: —

EQUIPMENT MODELS

1. BAILER
2. HORIBA U-52
3. YSI-55
4. SOLINST WLM

Time	Flow Rate (gpm)	DTW (ft. BTOC)	Cum. Water Removed (gal)	±0.1 pH ✓	3% Temp (°C) ✓	3% Cond. (mS/cm) ✓	±10.0 ORP (mV) ✓	10% DO (mg/L) ✓	10% Turbidity (NTU)	Other	Comments
0754	BAIL		-	6.81	26.51	2.94	239	1.41	400		
0759				6.98	26.62	2.98	180	1.25	167		
0805				7.00	26.63	2.99	181	1.19	39.8		
0812		27.64		7.03	26.61	2.96	195	1.22	34.8		
0817				7.08	26.68	2.99	205	1.19	36.1		
0821				7.10	26.85	2.99	201	1.62	42.5		
0827		27.64		7.09	27.05	2.99	208	1.47	34.1		
0833				7.12	27.00	3.00	210	1.52	24.9		
0843				7.10	27.03	3.00	217	2.00	19.4		
0851				7.14	27.18	3.01	225	2.00	20.8		
0904				7.14	27.06	3.01	227	2.08	18.5		
0909			1.2	7.15	26.91	3.00	234	2.02	78.0		Stopped
1327	Bail			7.06	28.92	5.95	253	2.08	12.6		resumed
1335				7.06	28.42	5.93	292	1.62	12.9		
1340				7.07	27.16	5.82	289	1.63	19.4		
1345		27.65	2.2	7.05	28.96	5.93	299	1.61	8.0		Collected sample 1350

4. SAMPLING DATA

Method(s): SEE ABOVE

Materials: Pump / Bailer: "

Materials: Tubing / Rope: "

DTW at Time of Sampling: 27.65

Sample ID: UFIW-015-2016 08 05

Duplicate Sample ID: —

Field Filtered: [✓ YES] NO

Analyte	Method
☐ VOCs	8260B
☐ SVOCs	8270
☐ Metals	6010B / 7000 Series
☐ TPH	8015B
☒ SEE COC	
☐	

5. COMMENTS CALIBRATION: 4.00 pH, 2.25 mS/cm, 0.0 NTU, 8.08 mg/L

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

Revised 7/13/16
General\Forms and Templates\Field Forms

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 144-87600008
Task Number: 02.01
Client: NERT
Project Location: Henderson, NV

WELL ID: UFIW-011-20160802
Date: 2016-8-2
Time: 1420
Personnel: Joel L., Mike C., Hao Z.
Weather: Sunny, 84–100°F 102°F during sample

2. WELL DEVELOPMENT LOG

Method: PUMP ____ BAILER ____ SURGE BLOCK ____ OTHER ____

set pump @ 35.5 ft bgs

Total Depth of Well (BTOC): 38.12 ft.
Depth to Static Water (BTOC): 27.54 ft.
Depth to Product (BTOC): NA ft.
Length of Water Column (h): 10.58 ft.

Screen Length: 35.12 to 38.12 ft bgs
Calculated Casing Vol.: 1.77 gal

*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: ____
Materials: Pump / Bailer ____
Materials: Tubing / Rope ____
Was well purged ~~dry~~? YES [✓ NO]
Development Criteria: ____

EQUIPMENT MODELS

1. ____
2. ____
3. ____
4. ____

Time	Flow Rate (gpm)	DTW (ft. BTOC)	Cum. Water Removed ~~(gal)~~ mL	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
1440	100	27.51	0	7.40	31.13	6.62	230	2.59	4.6		
1445	100	27.51	500	7.43	31.46	6.64	228	2.98	3.3		
1450	100	27.51	1000	7.48	31.74	6.66	226	3.56	2.6		
1455	100	27.51	1500	7.51	31.75	6.63	225	3.74	2.3		
1500	100	27.51	2000	7.58	31.50	6.63	221	3.56	1.7		
1505	100	27.36	2500	7.58	32.08	6.62	218	3.93	1.5		
stable Collected GW sample @ 1510 UFIW-011-20160802											

4. SAMPLING DATA

0.1 3% 3% ±100 10% 10%

Method(s): Low-flow
Materials: Pump / Bailer: Bladder
Materials: Tubing / Rope: LDP tubing
DTW at Time of Sampling: 27.51
Sample ID: UFIW-011-20160802
Duplicate Sample ID: NA
Field Filtered: [✓ YES] NO

Analyte	Method
☐ VOCs	8260B
☐ SVOCs	8270
☐ Metals	6010B / 7000 Series
☐ TPH	8015B
☐ See COC	
☐	

5. COMMENTS

Calibrated reading: 4.0 pH 4.49 mS/cm 0 NTU (4.0 pH, 4.49 mS/cm, 0 NTU auto cal solution). ORP calibrated to 240 mV for ORP cal solution
QED setting CPM5, 8.0/4.0(12) 30psi

Note: 2-inch well = 0.167 gal/ft
4-inch well = 0.667 gal/ft

Signature: Hao Zhu

Revised 7/13/16
General\Forms and Templates\Field Forms

TETRA TECH

UFIW-01D

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 1G4-8760008 Task Number: 02.01

Client: NERT

Project Location: Henderson, NV

WELL ID: UFIW-01D

Date: 8-2-2016 Time: 1000

Personnel: Joel L., Hao Z., Mike C.

Weather: Sunny 84-100°F

2. WELL DEVELOPMENT LOG

Method: PUMP ✓ BAILER ✓ SURGE BLOCK ✓ OTHER ____

Total Depth of Well (BTOC): 48.13 ft.

Depth to Static Water (BTOC): 27.76 ft.

Depth to Product (BTOC): – ft.

Length of Water Column (h): 20.37 ft.

Screen Length: 43.13 to 48.13 ft bgs

Calculated Casing Vol.: 3.40 gal

*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: ____

Materials: Pump / Bailer ____

Materials: Tubing / Rope ____

Was well purged dry? YES [✓ NO]

Development Criteria: ____

EQUIPMENT MODELS

1. As before.
2. ____
3. ____
4. ____

Time	Flow Rate ~~(gpm)~~ (mL/min)	DTW (ft. BTOC)	Cum. Water Removed (gal)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
1030	120	27.80	0	8.18	29.48	7.74	148.8	8.34	13.2		
1033	120	27.80	360	8.21	28.97	7.76	145.5	8.27	11.6		
1036	120	~~28.65~~ 27.80	720	8.23	28.65	7.76	142.1	7.90	7.6		
1039	120	27.80	1080	8.25	28.46	7.75	139.6	7.33	4.1		
1042	120	27.80	1440	8.27	28.39	7.74	138.3	7.13	3.4		
1045	120	27.80	1800	8.28	28.33	7.74	137.4	6.99	3.0		
1048	120	27.80	2160	8.29	28.25	7.74	136.2	6.76	3.4		
Stable	Collected	GW	sample @ 1100	UFIW-01D-20160802							DTW = 27.80

4. SAMPLING DATA

0.1 3% 3% ±10 10% ±10%

Method(s): Low flow

Materials: Pump / Bailer: Bladder

Materials: Tubing / Rope: LDP tubing

DTW at Time of Sampling: 27.80

Sample ID: UFIW-01D-20160802

Duplicate Sample ID: NA

Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	*8260B*
☐	SVOCs	*8270*
☐	Metals	*6010B / 7000 Series*
☐	TPH	*8015B*
☐	See COC	
☐		

5. COMMENTS

QED setting CPM6 5/5(165) 100psi

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature: Hao Zhang

Revised 7/13/16
General\Forms and Templates\Field Forms

TETRA TECH

WELL DEVELOPMENT LOG DATA SHEET

UFIW-025

1. PROJECT INFORMATION

Project Number: 1760008
Task Number: 02.01
Client: NERT
Project Location: West of AP5 Pond (A-1)
WELL ID: UFIW-025
Date: 8-5-16
Time: 0925
Personnel: J-[illegible], m-[illegible]
Weather: 100°F Sunny sl. breeze

2. WELL DEVELOPMENT LOG

Method: PUMP ____ [✓ BAILER X] SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): 27.98 ft.
Depth to Static Water (BTOC): 27.20 ft.
Depth to Product (BTOC): – ft.
Length of Water Column (h): 0.78 ft.
Screen Length: ~28 to ~23 ft bgs
Calculated Casing Vol.: 0.130 gal
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: BAIL
Materials: Pump / [✓ Bailer] –
Materials: Tubing / [✓ Rope]
Was well purged dry? [✓ YES] NO
Development Criteria: –

EQUIPMENT MODELS
1. HORIBA U-52
2. YSI-55
3. SOLINST WLM
4.

Time	Flow Rate (gpm)	DTW (ft. BTOC)	Cum. Water Removed (gal)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
0936	Bail			7.08	27.31	4.32	179	1.14 ~~0.27~~	28.1		
0942				7.11	27.12	4.29	180	1.28	20.2		
0949		27.56		7.11	27.11	4.29	188	1.48	10.4		
0956											PURGED DRY
1135					28.48						
~~1327~~				~~7.06~~	~~28.92~~	~~5.95~~	~~299~~		~~12.6~~		
1415	Collected sample UFIW-025-20160805										
								JL			
								8-5-16			

4. SAMPLING DATA

Method(s): SEE ABOVE
Materials: Pump / [✓ Bailer] –
Materials: Tubing / [✓ Rope] –
DTW at Time of Sampling: 27.65
Sample ID: UFIW-~~[illegible]~~025
Duplicate Sample ID: –
Field Filtered: [✓ YES] NO

Analyte	Method
☐ VOCs	8260B
☐ SVOCs	8270
☐ Metals	6010B / 7000 Series
☐ TPH	8015B
☐ see COC	
☐	

5. COMMENTS

Note: 2-inch well = 0.167 gal/ft
4-inch well = 0.667 gal/ft

Signature:

TETRA TECH

UFIW-02I

WELL DEVELOPMENT LOG DATA SHEET

PURGE

1. PROJECT INFORMATION

Project Number: 174-8700008 Task Number: 02.01

Client: NERT

Project Location: HENDERSON, NV

WELL ID: UFIW-02I

Date: 8-3-2016 Time: 1028

Personnel: M. CREWS, H. ZHANG, J. LAGAVE

Weather: SUNNY 91-106°F

2. WELL DEVELOPMENT LOG

Method: PUMP ✓ BAILER ____ SURGE BLOCK ____ OTHER ____

Total Depth of Well (BTOC): 40.89 ft.

Depth to Static Water (BTOC): 27.06 ft.

Depth to Product (BTOC): — ft.

Length of Water Column (h): 13.83 ft.

Screen Length: ~36 to ~41 ft bgs

Calculated Casing Vol.: 2.31 gal

Pump @

*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: LOW FLOW

Materials: [✓ Pump] / Bailer BLADDER

Materials: [✓ Tubing] / Rope LDPE

Was well purged dry? YES [✓ NO]

Development Criteria:

EQUIPMENT MODELS

1. HORIBA U-52
2. QED MP-50
3. SOLINST WLM
4.

Time	Flow Rate (gpm)	DTW (ft. BTOC)	Cum. Water Removed ~~(gal)~~ mL	±0.10 pH ✓✓	3% Temp (°C) ✓✓	3% Cond. (mS/cm) ✓✓	±10.0 ORP (mV) ✓✓	10% DO (mg/L) >0.5	10% Turbidity (NTU) ≥5.0 ✓✓	Other	Comments
1109	100	27.26	1000	7.53	33.69	7.15	143	0.68	132		
1114		27.30	1500	7.49	33.48	7.49	144	0.54	156		
1119		27.30	2000	7.52	32.86	7.16	141	0.25	105		
1124		27.30	2500	7.48	33.58	7.21	139	0.21	40.0		PAUSE - ATTACH OTHER
											FLOW CELL
1347		27.30	3000	7.50	38.64	7.23	119	1.44	108		
1352		27.32	3500	7.82	38.26	7.04	123	0.91	91.7		DO DROP
1357		27.30	4000	7.54	36.24	7.11	126	0.73	81.1		
1402		27.30	4500	7.55	35.54	7.11	132	0.80	79.8		
1407		27.31	5000	7.54	35.32	7.11	135	0.58	76.3		
1422		27.31	5500	7.53	35.29	7.12	138	0.55	73.5		STABILIZE
1425		27.06									AFTER PUMPING
							JL				
							8-3-16				

4. SAMPLING DATA

Method(s): LOW FLOW

Materials: [✓ Pump] / Bailer BLADDER

Materials: [✓ Tubing] / Rope LDPE

DTW at Time of Sampling: 27.32

Sample ID: UFIW-02I-20160803

Duplicate Sample ID: —

Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☐	SEE COC	
☐		

5. COMMENTS

QE Cal Autocal ~~3.97~~ 4.02 (4.00 pH) 4.[illegible] (4.49 mS/cm)
0.0 NTU (0.0) 9.21 DO 130.3% DO
QED SETTING: CPM 6 3/5 (IGS), 70 FT 3001

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

Revised 7/13/16
General\Forms and Templates\Field Forms

Pg 1 of 1

TETRA TECH

UFIW-02D

WELL DEVELOPMENT LOG DATA SHEET

PURGE

1. PROJECT INFORMATION

Project Number: 194-2760008
Task Number: 02.01
Client: NERT
Project Location: HENDERSON, NV
WELL ID: UFIW-02D
Date: 8-3-2016
Time: 0630
Personnel: M. CREWS, H. ZHANG, J. LARABEE
Weather: SUNNY 91-106°F

2. WELL DEVELOPMENT LOG

Method: PUMP ✓ BAILER ____ SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): 48.60 ft.
Depth to Static Water (BTOC): 27.15 ft.
Depth to Product (BTOC): – ft.
Length of Water Column (h): 21.45 ft.
Screen Length: ~43 to ~48 ft bgs
Calculated Casing Vol.: 3.38 gal
PUMP @ ~45.1 FT BGS
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: LOW FLOW
Materials: [✓ Pump] / Bailer: BLADDER
Materials: [✓ Tubing] / Rope: LDPE - DUAL
Was well purged dry? YES [✓ NO]
Development Criteria:

EQUIPMENT MODELS
1. HORIBA U-52
2. QED MP50
3. SOLINST WLM
4.

Time	Flow Rate (gpm)	DTW (ft. BTOC)	Cum. Water Removed ~~(gal)~~ mL	±0.1 pH ✓	3% Temp (°C) ✓	3% Cond. (mS/cm) ✓	±10.0 ORP (mV) ✓	10% DO (mg/L) >0.5 ✓	10% Turbidity (NTU) ≤5.0 ✓	Other	Comments
0754	100	27.38	500	7.63	29.24	7.41	168	0.49	79.2		
0759	|	27.55	1000	7.64	28.92	7.42	163	0.28	55.4		
0804		27.59	1500	7.65	28.87	7.48	153	0.24	44.8		
0809		27.57	2000	7.66	28.85	7.42	151	0.08	43.0		
0814		27.58	2500	7.67	28.85	7.41	147	0.05	33.5		
0819		27.58	3000	7.67	28.86	7.41	143	0.01	28.3		
0824		27.58	3500	7.67	28.88	7.41	140	0.00	26.1		
0829		27.58	4000	7.68	28.88	7.41	137	0.00	22.9		PAUSE - CLEAN FLOW THRU CELL
0900		27.52	4500	7.40	29.72	7.42	197	0.42	10.2		RECALIBRATE
0905		27.54	5000	7.55	29.28	7.40	190	0.00	8.6		
0910		27.58	5500	7.60	29.24	7.40	172	0.00	8.2		
0915		27.58	6000	7.60	29.32	7.40	165	0.00	7.4		
0920		27.56	6500	7.62	29.25	7.40	159	0.00	6.9		
0925		27.54	7000	7.62	29.26	7.41	154	0.00	6.7		
0930		27.58	7500	7.62	29.29	7.42	150	0.00	6.6		stabilized
1012	↓	27.18									AFTER SAMPLING

4. SAMPLING DATA

Method(s): LOW FLOW
Materials: [✓ Pump] / Bailer: BLADDER
Materials: [✓ Tubing] / Rope: LDPE - DUAL
DTW at Time of Sampling: 27.54
Sample ID: UFIW-02D-20160803
Duplicate Sample ID: LEVEL 4
Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	*8260B*
☐	SVOCs	*8270*
☐	Metals	*6010B / 7000 Series*
☐	TPH	*8015B*
☐	SEE COC	
☐		

5. COMMENTS Calibrated Horiba U-5000 with autocal solution: 4.02 pH (4.00), 4.53 mS/cm (4.49), 0.1 NTU (0.0), 7.37 mg/L DO, 107.4% DO. – 4.02 (pH), 4.51 (COND), 0.1 (TURB), 8.59 (DO)
QED SETTING: CPM (5/5 (165) @ 80 FT / 33 PSI

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

Revised 7/13/16
General\Forms and Templates\Field Forms

TETRA TECH

UFIW-035

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 144-8760008
Task Number: 02.01
Client: NERT
Project Location: WEST OF AT-5 POND
WELL ID: UFIW-035
Date: 8-4-16
Time: 1320
Personnel: M. CREWS, J. LAGADE
Weather: 85°F - OVERCAST

2. WELL DEVELOPMENT LOG

Method: PUMP X BAILER ___ SURGE BLOCK ___ OTHER ___
Total Depth of Well (BTOC): 29.89 ft.
Depth to Static Water (BTOC): 27.35 / 29.35 ft.
Depth to Product (BTOC): — ft.
Length of Water Column (h): 2.54 ft.
Screen Length: ~30 to ~25 ft bgs
Calculated Casing Vol.: 0.42 gal
Pump @ 29.39 FT BGS
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: LOW FLOW
Materials: [✓ Pump] / Bailer: BLADDER
Materials: [✓ Tubing] / Rope: LDPE
Was well purged dry? YES NO
Development Criteria: —

EQUIPMENT MODELS
1. HORIBA U-52
2. QED MP50
3. SOLINST WLM
4 YSI-55

Time	Flow Rate ~~(gpm)~~ (mL/min)	DTW (ft. BTOC)	Cum. Water Removed ~~(gal)~~ mL	±0.1 pH ✓	3% Temp (°C) ✓	3% Cond. (mS/cm) ✓	±10.0 ORP (mV) ✓	10% DO (mg/L) >0.5	10% Turbidity (NTU) >5.0	Other	Comments
1340	50	27.53	500	7.12	28.26	8.21	110	2.98	0.0		
1350		27.59	1000	7.14	28.38	8.22	104	1.24	0.0		
1400		27.62	1500	7.11	28.41	8.28	101	1.68	0.0		
1410		27.61	2000	7.10	28.55	8.22	103	1.28	0.0		
1420		27.62	2500	7.10	28.58	8.22	102	1.22	0.0		
1430		27.63	3000	7.10	28.68	8.24	101	1.25	0.0		STABLE
1450		27.60									AFTER PUMPING
				JL							
				8-4-16							

4. SAMPLING DATA

Method(s): SEE ABOVE
Materials: Pump / Bailer: "
Materials: Tubing / Rope: "
DTW at Time of Sampling: 27.61
Sample ID: UFIW-035-20160804
Duplicate Sample ID: —
Field Filtered: [✓ YES] NO

3/8

	Analyte	Method
☐	VOCs	*8260B*
☐	SVOCs	*8270*
☐	Metals	*6010B / 7000 Series*
☐	TPH	*8015B*
☐	SEE COC	
☐		

5. COMMENTS QED SETTINGS: CPM6 6/4 C(10), 35 FT 25 PSI. SHALLOW WELL SLOW RECHARGE

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

Revised 7/13/16
General\Forms and Templates\Field Forms

TETRA TECH

UFIW-03I

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 144-F7C00008
Task Number: 02.01
Client: NERT
Project Location: WEST OF AP-5 POND

WELL ID: UFIW-03I
Date: 8-~~4~~-16
Time: 0930
Personnel: M. CREWS, J. LAGINE
Weather: 85°F DRIZZLE

2. WELL DEVELOPMENT LOG

Method: PUMP X BAILER ____ SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): 40.23 ft.
Depth to Static Water (BTOC): 27.02/27.02 ft.
Depth to Product (BTOC): — ft.
Length of Water Column (h): 13.21 ft.
Screen Length: ~35 to ~40 ft bgs
Calculated Casing Vol.: 2.21 gal
PUMP @ 37.5 FT BGS
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

100 mL/min

3. DEVELOPMENT DATA

Purge Method: LOW FLOW
Materials: [✓ Pump] / Bailer: BLADDER
Materials: [✓ Tubing] / Rope: LDPE
Was well purged dry? YES [✓ NO]
Development Criteria: —

EQUIPMENT MODELS
1. HORIBA U-52
2. QED MP50
3. SOLINST WLM
4. YSI 55

Time	Flow Rate ~~(gpm)~~ (mL/min)	DTW (ft. BTOC)	Cum. Water Removed ~~(gal)~~ mL	±0.1 pH ✓	3% Temp (°C) ✓	3% Cond. (mS/cm) ✓	±100 ORP (mV) ✓	10% DO (mg/L) ✓ >0.5	10% Turbidity (NTU) >5.0	Other	Comments
0945	100	27.06	500	7.53	26.89	7.28	131	0.68	164		
0950		27.06	1000	7.52	26.99	7.27	128	0.38	95.3		
0955		27.07	1500	7.51	27.03	7.26	125	0.15	55.9		
1000		27.06	2000	7.51	27.04	7.24	121	0.03	35.4		
1005		27.06	2500	7.51	27.04	7.23	118	0.00	19.6		
1010		27.06	3000	7.50	27.01	7.31	111	0.12	14.0		
1015		27.06	3500	7.51	26.92	7.23	111	1.38	16.9		YSI 55 METER → DO
1020		27.06	4000	7.52	26.79	7.21	110	1.26	9.0		
1025		27.06	4500	7.51	26.71	7.20	107	1.22	9.2		
1030		27.06	5000	7.56	26.71	7.21	103	1.16	8.8		STABLE
1035		27.02									NO PUMPING
											JL
											8-4-16

4. SAMPLING DATA

Method(s): SEE ABOVE
Materials: Pump / Bailer: ~
Materials: Tubing / Rope: ~
DTW at Time of Sampling: 27.06
Sample ID: UFIW-03I-20160804 2/8
Duplicate Sample ID: —
Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☐	SEE COC	
☐		

5. COMMENTS QED SETTING: CPM 5/5, 70 FT 30 PSI, CALIBRATED YSI 55 (DO): 1600 FT ELEVD, 7.23 (COND), 4.0 PPT (SALINITY)

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

Revised 7/13/16
General\Forms and Templates\Field Forms

TETRA TECH

UFIU-03D

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-8760008 Task Number: 02.01
Client: NERT
Project Location: West of APS Pond
WELL ID: UFIU-03D
Date: 8-4-16 Time: 0730
Personnel: M. CREWS, J. LAGADE
Weather: 80°F - DRIZZLE

2. WELL DEVELOPMENT LOG

Method: PUMP X BAILER ___ SURGE BLOCK ___ OTHER ___
Total Depth of Well (BTOC): 50.41 ft. Screen Length: ~45 to ~50 ft bgs 100 mL/min
Depth to Static Water (BTOC): 27.43/27.47 ft. Calculated Casing Vol.: 3.84 gal
Depth to Product (BTOC): — ft. PUMP @ ~47.5 FT BGS
Length of Water Column (h): 22.98 ft. *Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: LOW FLOW
Materials: [✓ Pump] / Bailer: BLADDER
Materials: Tubing / Rope: LDPE
Was well purged dry? YES NO
Development Criteria: —

EQUIPMENT MODELS
1. HORIBA U-52
2. QED MP50
3. SOLINST WLM
4.

Time	Flow Rate ~~(gpm)~~ mL/min	DTW (ft. BTOC)	Cum. Water Removed ~~(gal)~~ mL	±0.1 pH ✓	3% Temp (°C) ✓	3% Cond. (mS/cm) ✓	±10.0 ORP (mV) ✓	10% DO (mg/L) ✓	10% Turbidity (NTU) ✓	Other	Comments
0810	100	27.10	500	7.51	26.66	7.26	142	2.32	84.0		
0815		27.12	1000	7.61	26.72	7.26	134	2.87	47.8		
0820		27.11	1500	7.63	26.80	7.28	130	3.09	23.0		
0825		27.25	2000	7.66	26.82	7.26	124	3.13	12.2		
0830		27.31	2500	7.68	26.88	7.28	122	3.43	7.2		
0835		27.32	3000	7.70	26.90	7.25	123	4.41	3.8		
0840		27.29	3500	7.71	26.94	7.24	124	4.49	1.8		
0845		27.30	4000	7.71	26.97	7.29	123	4.43	0.8		STABLE
0900		27.42									W/O PUMP

JL 8-4-16

4. SAMPLING DATA

Method(s): SEE ABOVE LOW FLOW
Materials: Pump / Bailer
Materials: Tubing / Rope
DTW at Time of Sampling: 27.43 DAY LIFE
Sample ID: UFIU-03D-20160804 1/7
Duplicate Sample ID: —
Field Filtered: [✓ YES] NO

Analyte		Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☐	SEE COC	
☐		

5. COMMENTS

CALIBRATION: PH 7.84, EVPD 4.51 mS/cm, TUR 0.1 NTU, DO 7.68 mg/L
QED SETTING: CPM 6 5/5 (10S), 80 FT 35 PSI

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

MWY
26 CONTAIN
31 H2O

Revised 7/13/16
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TETRA TECH

WELL DEVELOPMENT LOG DATA SHEET

UFIW-04S

1. PROJECT INFORMATION

Project Number: ~~[illegible]~~ 87600008 Task Number: 02.01
Client: MERT
Project Location:
WELL ID: UFIW-04S
Date: 8-5-2016 Time: 1030
Personnel: Mike C., Joel L., Heero
Weather: Sunny, 100°F

2. WELL DEVELOPMENT LOG

Method: PUMP ____ BAILER X SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): 27.95 ft.
Depth to Static Water (BTOC): 27.31 ft.
Depth to Product (BTOC): – ft.
Length of Water Column (h): 0.64 ft.
Screen Length: ~28 to ~23 ft bgs
Calculated Casing Vol.: 0.107 gal
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: BAIL
Materials: Pump / [✓ Bailer] –
Materials: Tubing / [✓ Rope] –
Was well purged dry? [✓ YES] NO
Development Criteria:

EQUIPMENT MODELS
1. HORIBA U-52
2. YSI 55
3. SOLINST WLM
4

Time	Flow Rate (gpm)	DTW (ft. BTOC)	Cum. Water Removed (gal)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
1045				7.22	29.64	4.07	274	1.23 ~~0.66~~	112		
1055								1.64			PURGED DRY
1120				7.10	28.16	4.19	340	2.18	31.2		
1132				7.14	27.98	4.22	331	2.20	25.1		Purged/Dry
1417	Collected sample UFIW-04S_20160805										

JL
8-5-16

4. SAMPLING DATA

Method(s): BAIL
Materials: Pump / [✓ Bailer] –
Materials: Tubing / [✓ Rope] –
DTW at Time of Sampling: 27.45
Sample ID: UFIW-04S-20160805
Duplicate Sample ID:
Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☐	see COC	
☐		

5. COMMENTS

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

TETRA TECH

WELL ~~DEVELOPMENT~~ LOG DATA SHEET
PURG & SAMPLING

1. PROJECT INFORMATION

Project Number: 194-8760008
Task Number: 02.01
Client: NERT
Project Location: HENDERSON, NV
WELL ID: UFIW-041
Date: 8-2-2016
Time: 0720
Personnel: Joel L, Hao Z, Mike G
Weather: Sunny, 84-100°F

2. WELL DEVELOPMENT LOG

Method: PUMP ✓ BAILER ____ SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): 38.30 ft.
Depth to Static Water (BTOC): 27.42 ft.
Depth to Product (BTOC): NA ft.
Length of Water Column (h): 10.58 ft.
Screen Length: 28.30 to 38.30 ft bgs set 35.35ft bgs
Calculated Casing Vol.: 1.77 gal
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. ~~DEVELOPMENT~~ DATA

~~Purge~~ Method: Purge Low Flow (HB) Development: Bail-Surge, Bail-pump
Materials: Pump / Bailer: Bladder pump
Materials: Tubing / Rope: Two color bonded
Was well purged dry? YES [✓ NO]
Development Criteria:

EQUIPMENT MODELS
1. Horiba U-52 Water quality meter
2. QED Micro Purg® MP50 Controller/Compressor
3. Solint 101 200' water level meter
4. YSI MPS 556 water quality meter

Time	Flow Rate ~~(gpm)~~ (mL/min)	DTW (ft. BTOC)	Cum. Water Removed (gal)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
0846	110	26.60	0	8.06	28.31	7.37	133.9	3.18	3.7		
0849	110	26.60	330	8.09	28.13	7.37	133.5	3.18	3.7		
0851	110	26.60	660	8.13	27.95	7.35	132.3	3.11	3.6		
0854	110	26.60	990	8.13	27.91	7.35	131.9	2.94	3.1		
0857	110	26.60	1320	8.15	27.81	7.34	130.8	2.97	2.1		
0900	110	26.60	1650	8.17	27.79	7.34	130.5	3.00	0.5		
Stable	collected GW sample @ 0905 UFIW-041-20160802										DTW=27.40
	collected GW duplicate sample @ 0908 UFIW-041-20160802-FD										

4. SAMPLING DATA

0.1 5% 3% ±10 10% 10%

Method(s): Low Flow Sampling
Materials: Pump / Bailer: Bladder
Materials: Tubing / Rope: LDP tubing
DTW at Time of Sampling: 27.42
Sample ID: UFIW-041-20160802
Duplicate Sample ID: ~~NA~~ UFIW-041-20160802-FD
Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☐	See COC	
☐		

5. COMMENTS Calibrated Horiba U-52 with auto-calibration solution, pH = 3.92 (4.00), Conductivity = 4.51 mS/cm (4.49), NTU = 0.0 (0.0); 8.06 mg/L DO, 110.6% DO
QED setting: CPM6 5/5 (165) 110psi

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature: Hao Z

Revised 7/13/16
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TETRA TECH

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-8600008
Task Number: 02.01
Client: NERT
Project Location: Henderson, NV
WELL ID: UFIW-D4D (165)
Date: 8-1-2016
Time: 0900
Personnel: Mike C., Joel L., Hao Z.
Weather: Partly cloudy, 84-106°F

2. WELL DEVELOPMENT LOG

2"-Dia well

Method: PUMP ✓ BAILER ___ SURGE BLOCK ___ OTHER ___
Total Depth of Well (BTOC): 48.04 ft.
Depth to Static Water (BTOC): 27.43 ft ft.
Depth to Product (BTOC): NA ft.
Length of Water Column (h): 20.59 ft.
Screen Length: 43 to 48 ft bgs
Set @ 45.2 ft bgs.
Calculated Casing Vol.: 3.44 gal
3PV = 10.32 gal.
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: Low Flow
Materials: Pump / Bailer
Materials: Tubing / Rope
Was well purged dry? YES [✓ NO]
Development Criteria:

EQUIPMENT MODELS

1. Bonded two color tubing
2. Horiba U-52 water quality meter/monitor
3. QED MicroPurge MP50 controller/Compressor
4. Solinst 101 200' water level meter
YSI MPS 556

Time	Flow Rate ~~(gpm)~~ (mL/min)	DTW (ft. BTOC)	Cum. Water ~~Removed~~ ~~(gal)~~ mL	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
0950	100mL/min	(27.43)		8.24	31.37	7.48	2000	4.29	0.9		
0953	100			8.25	30.84	7.56	2000	4.61	1.8		
0956	100			8.32	29.74	7.60	2000	4.70	1.5		
Change water quality monitor to YSI and Horiba											DTW = 27.43
1330	100	25.7		7.33	29.08	7.146	136.4	3.87	3.8		
1333	100			7.34	29.07	7.141	136.3	3.69	3.5		
1336	100			7.35	29.01	7.141	135.8	3.56	3.1		
1339	100			7.35	29.02	7.128	135.3	3.49	2.8		
1342	100			7.35	29.29	7.117	134.7	3.23	3.6		
1345	100			7.33	30.19	7.122	134.1	3.55	3.7		
1348	100			7.37	29.42	7.180	133.3	3.77	1.7		
1351	100			7.38	29.08	7.141	132.2	3.61	1.9		
Stable	Collect LIW sample @ 1400										DTW = 27.43

4. SAMPLING DATA

0.1 3% 3% ±10 10% 1.5

Method(s): Low Flow
Materials: Pump / Bailer: Bladder
Materials: Tubing / Rope: PE 1/2 Blue LDP tubing
DTW at Time of Sampling: 27.43
Sample ID: UFIW-D4D-20160801
Duplicate Sample ID: NA
Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☐	See COC	
☐		

5. COMMENTS

QED settings: CPM 6 5/5 (165) 110 PSI

Note: 2-inch well = 0.167 gal/ft ✓ *4-inch well = 0.667 gal/ft*

Signature:

TETRA TECH

UFIW-055

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-8760000 Task Number: 02.01
Client: NERT
Project Location: WEST OF AP-5 POND
WELL ID: UFIW-055
Date: 8-19-16 Time: 0715
Personnel: J. LAGADE
Weather: CLOUDY 90°F SLIGHT BREEZE

2. WELL DEVELOPMENT LOG

Method: PUMP ____ BAILER X SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): 29.42 ft. Screen Length: ~24.42 to ~24.42 ft bgs
Depth to Static Water (BTOC): 28.00 ft. Calculated Casing Vol.: 0.2374 gal
Depth to Product (BTOC): — ft.
Length of Water Column (h): 1.42 ft. *Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: BAIL
Materials: Pump / [✓ Bailer]
Materials: Tubing / [✓ Rope] TWINE
Was well purged dry? YES NO
Development Criteria: —

EQUIPMENT MODELS
1. HORIBA U-52
2. SOLINST WLM
3. YSI-55
4.

Time	Flow Rate (gpm)	DTW (ft. BTOC)	Cum. Water Removed (gal)	±0.1 pH	3% Temp (°C)	3% Cond. (mS/cm)	±10.0 ORP (mV)	10% DO (mg/L)	10% Turbidity (NTU)	Other	Comments
0813	—	28.00	—	7.73	25.86	4.02	42	1.35	9.2		
0818	—	—	—	7.77	25.70	3.91	37	1.25	33.9		
0824	—	—	—	7.71	25.65	3.59	41	1.21	17.9		
0830	—	—	—	7.78	25.75	3.88	59	1.17	16.9		
0843	—	—	>1.0	7.80	25.44	3.89	58	1.30	19.4		GREATER THAN
0850	—	28.36									3 CASING WELL
											VOLUME

OL
8-19-16

4. SAMPLING DATA

Method(s): SEE ABOVE
Materials: Pump / Bailer —
Materials: Tubing / Rope —
DTW at Time of Sampling:
Sample ID: UFIW-055-20160819
Duplicate Sample ID: — Field Filtered: [✓ YES] NO

Analyte	Method
☐ VOCs	*8260B*
☐ SVOCs	*8270*
☐ Metals	*6010B / 7000 Series*
☐ TPH	*8015B*
☒ SEE COC	
☐	

5. COMMENTS

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

Revised 7/13/16
General\Forms and Templates\Field Forms

TETRA TECH

UFIW05I

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-8760008 Task Number: 02.01
Client: NEKI
Project Location: WEST OF AP-5 POND
WELL ID: UFIW-05I
Date: 8-15-16 Time: 0945
Personnel: J. LAGAPE, M. FARMER
Weather: SUNNY, WINDY 98°F

2. WELL DEVELOPMENT LOG

Method: PUMP X BAILER ____ SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): 39.17 ft.
Depth to Static Water (BTOC): 28.10 ft.
Depth to Product (BTOC): — ft.
Length of Water Column (h): 11.07 ft.
Screen Length: ~34.17 to ~39.12 ft bgs
Calculated Casing Vol.: 1.878 gal
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: LOW FLOW
Materials: [✓ Pump] / Bailer: BLADDER
Materials: [✓ Tubing] / Rope: LDPE
Was well purged dry? YES [✓ NO]
Development Criteria: —

EQUIPMENT MODELS
1. QED MP50
2. SOLINST WLM
3. HORIBA U-52
4. YSI-55

Time	Flow Rate ~~(gpm)~~ mL/min	DTW (ft. BTOC)	Cum. Water Removed ~~(gal)~~ mL	±0.1 pH	3% Temp (°C)	3% Cond. (mS/cm)	±10 ORP (mV)	10% DO (mg/L) ≥0.5	10% Turbidity (NTU) >5.0	Other	Comments
1003	100	28.11	500	7.72	38.18	3.90	134	1.95	0.0		
10:08	100	28.11	1000	8.02	39.25	3.76	125	1.98	0.0		
10:13	100	28.11	1500	8.15	39.84	.001	120	4.45	91.5		BATTERY DEAD
10 28	100	28.11	2000	8.06	38.41	3.76	122	2.25	0.0		REPLACE BATTERY
10:33	100	28.21	2500	8.06	31.89	3.79	130	3.35	0.6		
10:40	100	28.21	3000	8.03	30.84	3.80	128	2.83	0.0		
10:45	100	28.22	3500	7.96	30.54	3.82	129	2.72	0.0		
10:52	100	28.21	4000	7.92	31.48	3.85	125	2.65	0.0		
10:57	100	28.19	4500	7.90	32.18	3.86	125	2.58	0.0		Stabilized
11 15	—	28.12									AFTER Pump

JL
8-15-16

4. SAMPLING DATA

Method(s): SEE ABOVE
Materials: [✓ Pump] / Bailer: —
Materials: [✓ Tubing] / Rope: —
DTW at Time of Sampling: 28.19
Sample ID: UFIW-05I-20160815
Duplicate Sample ID: UFIW-05I-20160815-FF
Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	*8260B*
☐	SVOCs	*8270*
☐	Metals	*6010B / 7000 Series*
☐	TPH	*8015B*
☒	SEE COC	
☐		

5. COMMENTS

QED CPMC S/S CL(5)

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

TETRA TECH

WFIW-05D

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-8760008 Task Number: 02.01
Client: NEAI
Project Location: WEST OF AP-5 POND
WELL ID: WFIW-05D
Date: 8-15-18 Time: 0700
Personnel: J. LAGADE, M. FARMER
Weather: 95°F SUNNY

2. WELL DEVELOPMENT LOG

Method: PUMP X BAILER ____ SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): 49.54 ft.
Screen Length: ~44.57 to ~49.54 ft bgs
Depth to Static Water (BTOC): 28.20 ft.
Calculated Casing Vol.: 3.56 gal
Depth to Product (BTOC): - ft.
Length of Water Column (h): 21.34 ft.
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: PUMP LOW FLOW
Materials: [✓ Pump] / Bailer BLADDER
Materials: [✓ Tubing] / Rope LDPE
Was well purged dry? YES [✓ NO]
Development Criteria: -

EQUIPMENT MODELS
1. QED MP 50
2. HORIBA U-52
3. YSI 55
4. SOLINST WLM

Time	Flow Rate ~~(gpm)~~ ML/M	DTW (ft. BTOC)	Cum. Water Removed ~~(gal)~~ mL	±0.1 pH ✓	3% Temp (°C)	3% Cond. (mS/cm) ✓	±10 ORP (mV) ✓	10% DO (mg/L) >0.5	10% Turbidity (NTU) >5.0	Other	Comments
8:00	100	28.58	500mL	7.83	30.95	5.14	136	1.46	17.7		
8:05	100	28.49	1000ml	7.83	31.14	5.15	134	1.42	11.8		
8:10	100	28.45	1500ml	7.89	31.82	5.18	134	1.22	11.8		
0815	100	28.45	2000	7.82	32.23	5.10	128	1.18	11.9		
0820	100	28.45	2500	7.81	32.10	5.16	127	1.20	11.8		STABILIZED
0905		28.39									~~[illegible]~~ Samp
											JL 8-15-18

4. SAMPLING DATA

Method(s): SEE ABOVE
Materials: Pump / Bailer -
Materials: Tubing / Rope -
DTW at Time of Sampling: 28.45
Sample ID: WFIW-05D-20180815
Duplicate Sample ID: -
Field Filtered: [✓ YES] NO

1/20

Analyte	Method
☐ VOCs	*8260B*
☐ SVOCs	*8270*
☐ Metals	*6010B / 7000 Series*
☐ TPH	*8015B*
☒ SEE COC	
☐	

5. COMMENTS

QED: Cam 6 7.6/2.4 (152)

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

Revised 7/13/16
General\Forms and Templates\Field Forms

TETRA TECH

UFIW-06S

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-F7600008
Task Number: 02.01
Client: NERF
Project Location: WEST OF AP-5 POND
WELL ID: UFIW-06S
Date: 8-16-16
Time: 0945
Personnel: J. LAGASSE
Weather: SUNNY 100°F

2. WELL DEVELOPMENT LOG

Method: PUMP X BAILER ___ SURGE BLOCK ___ OTHER ___
Total Depth of Well (BTOC): 38.60 ft.
Depth to Static Water (BTOC): 28.20 ft.
Depth to Product (BTOC): — ft.
Length of Water Column (h): 7.4 ft.
Screen Length: ~31.6 to ~26.6 ft bgs
Calculated Casing Vol.: 0.5078 gal
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: LOW FLOW
Materials: [✓ Pump] / Bailer: BLADDER
Materials: [✓ Tubing] / Rope: LDPE
Was well purged dry? YES [✓ NO]
Development Criteria: —

EQUIPMENT MODELS
1. HORIBA U-52
2. QED MP50
3. SOLINST WLM
4. YSI 55

Time	Flow Rate ~~(gpm)~~ mL/m	DTW (ft. BTOC)	Cum. Water Removed ~~(gal)~~ mL	±0.1 pH ✓	3% Temp (°C) ✓	3% Cond. (mS/cm) ✓	±10.0 ORP (mV) ✓	10% DO (mg/L) >0.5	10% Turbidity (NTU) >5.0	Other	Comments
0949	100	28.2	500	7.35	28.58	4.19	128	1.17	4.9		
0954	100	28.2	1000	7.30	28.23	4.17	125	1.96	4.16		
0959	100	28.2	1500	7.39	28.08	4.17	121	1.91	0.0		
1004	100	28.2	2000	7.40	28.02	4.17	120	1.95	0.0		
1009	100	28.2	2500	7.36	28.03	4.17	122	1.90	0.0		STABILIZE
1030	—	28.2									AFTER PUMP

JL
8-16-16

4. SAMPLING DATA

Method(s): SEE ABOVE
Materials: [✓ Pump] / Bailer: —
Materials: [✓ Tubing] / Rope: —
DTW at Time of Sampling: 28.2
Sample ID: UFIW-06S-20160816
Duplicate Sample ID: —
Field Filtered: [✓ YES] NO

Analyte	Method
☐ VOCs	8260B
☐ SVOCs	8270
☐ Metals	6010B / 7000 Series
☐ TPH	8015B
☐ SEE COC	
☐	

5. COMMENTS

QED CPMG S/S (6S) 60 FT

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

Revised 7/13/16
General\Forms and Templates\Field Forms

TETRA TECH

UFIW-08I

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 174-8760008
Task Number: 02.01
Client: NEAT
Project Location: WEST OF AP-5 POND
WELL ID: UFIW-08I
Date: 8-16-16
Time: 0745
Personnel: J. LAGADE
Weather: SUNNY 95°F

2. WELL DEVELOPMENT LOG

Method: PUMP X BAILER ____ SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): 44.79 ft.
Depth to Static Water (BTOC): 28.17 ft.
Depth to Product (BTOC): – ft.
Length of Water Column (h): 16.62 ft.
Screen Length: ~34.79 to ~44.79 ft bgs
Calculated Casing Vol.: 2.77 gal
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: LOW FLOW
Materials: [✓ Pump] / Bailer: BLADDER
Materials: [✓ Tubing] / Rope: LDPE
Was well purged dry? YES [✓ NO]
Development Criteria: –

EQUIPMENT MODELS
1. HORIBA U-52
2. QED MP50
3. SOLINST VLM
4. YSI - 55

Time	Flow Rate ~~(gpm)~~ mL/m	DTW (ft. BTOC)	Cum. Water Removed ~~(gal)~~ mL	± 0.1 pH ✓	3% Temp (°C) ✓	3% Cond. (mS/cm) ✓	± 10 ORP (mV) ✓	10% DO (mg/L) >0.5	10% Turbidity (NTU) >5.0 ✓	Other	Comments
0803	200	27.95	500	7.75	27.36	4.28	158	2.76	0.0		
0808	200	27.44	1000	7.74	27.47	4.29	156	3.70	0.0		
0813	200	27.90	1500	7.76	27.42	4.29	152	3.61	0.0		
0818	200	27.90	2000	7.78	27.36	4.29	150	3.65	0.0		
0823	200	27.92	2500	7.78	27.34	4.28	146	3.69	0.0		STABLE
0850	—	28.18									AFTER PUMP

JL
8-16-16

4. SAMPLING DATA

Method(s): SEE ABOVE
Materials: Pump / Bailer: –
Materials: Tubing / Rope: –
DTW at Time of Sampling: 27.90
Sample ID: UFIW-08I-20160816
Duplicate Sample ID: –
Field Filtered: [✓ YES] NO

Analyte	Method
☐ VOCs	8260B
☐ SVOCs	8270
☐ Metals	6010B / 7000 Series
☐ TPH	8015B
☒ SEE COC	
☐	

5. COMMENTS QED SETTING CPM 5/5 (165) 70 FT
WHITE CRYSTALS OBSERVED ON EQUIPMENT
CALIBRATION 3.90 pH 4.50 mS/cm 0.0 NTU 7.60 mg/L 103.090 DO

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

TETRA TECH

UFIW-06D

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 144-F26d0008 Task Number: 02.01
Client: NERI
Project Location: WEST OF AP-5 POND
WELL ID: UFIW-06D
Date: 8-15-16 Time: 1325
Personnel: J. LAGADE, M. FARMER
Weather: 112°F WINDY, SUNNY

2. WELL DEVELOPMENT LOG

Method: PUMP X BAILER ____ SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): 51.68 ft.
Depth to Static Water (BTOC): 28.38 ft.
Depth to Product (BTOC): – ft.
Length of Water Column (h): 28.30 ft.
Screen Length: ~46.68 to ~51.68 ft bgs
Calculated Casing Vol.: 4.7261 gal
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: LOW FLOW
Materials: [✓ Pump] / Bailer: BLADDER
Materials: [✓ Tubing] / Rope: LDPE
Was well purged dry? YES [✓ NO]
Development Criteria: –

EQUIPMENT MODELS
1. HORIBA U-52
2. QED MP50
3. SOLINST WLM
4. YSI 55

Time	Flow Rate ~~(gpm)~~ mL/m	DTW (ft. BTOC)	Cum. Water Removed ~~(gal)~~ ML	±0.1 pH	3% Temp (°C)	3% Cond. (mS/cm)	±10 ORP (mV)	10% DO (mg/L) >0.5	10% Turbidity (NTU) >5.0	Other	Comments
1401	100	28.8	500	7.80	37.82	6.64	123	1.45	24.7		
1406	100	28.89	1000	7.85	34.64	6.67	117	1.39	22.0		
1412	100	28.9	1500	7.85	33.64	6.69	115	1.46	18.1		
1418	100	28.91	2000	7.89	33.00	6.72	111	1.52	15.4		
1425	100	28.91	2500	7.89	32.63	6.71	112	1.51	12.7		
1431	100	28.91	3000	7.86	32.52	6.72	115	1.61	11.1		
1438	100	28.91	3500	7.88	~~30~~ 32.5[illegible]	6.72	113	1.67	9.1		
1445	100	28.91	4000	7.82	32.58	6.75	117	1.72	7.4		
1450	100	28.91	4500	7.85	32.28	6.74	118	1.75	6.3		
1455	100	28.87	5000	7.84	32.38	6.71	119	1.83	5.6		
1500	100	28.84	5500	7.86	32.09	6.73	119	1.87	5.4		
1505	100	28.86	6000	7.87	32.10	6.71	118	1.86	4.8	STABLE	CONSISTENT DECREASE
1515	—	28.40									OF TURBIDITY
											JL
											8-15-16

4. SAMPLING DATA

Method(s): SEE ABOVE
Materials: Pump / Bailer: –
Materials: Tubing / Rope: –
DTW at Time of Sampling: 28.85
Sample ID: UFIW-06D-20160815
Duplicate Sample ID: –
Field Filtered: [✓ YES] NO

Analyte	Method
☐ VOCs	8260B
☐ SVOCs	8270
☐ Metals	6010B / 7000 Series
☐ TPH	8015B
☐ SEE WO	
☐	

5. COMMENTS QED UPM6 S/S (165) 80 FT

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

TETRA TECH

4FIWG075

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-F760008 Task Number: 02.01

Client: NEAR

Project Location: WEST OF AP-5 POND

WELL ID: 4FIW~~G~~075

Date: 8-17-16 Time: 0830

Personnel: J. LAGANE

Weather: DUSTY, LOW WIND 90°F

2. WELL DEVELOPMENT LOG

Method: PUMP X BAILER ____ SURGE BLOCK ____ OTHER ____

Total Depth of Well (BTOC): 30.80 ft.

Depth to Static Water (BTOC): 28.12 ft.

Depth to Product (BTOC): — ft.

Length of Water Column (h): 2.68 ft.

Screen Length: ~25.80 to ~30.80 ft bgs

Calculated Casing Vol.: 0.448 gal

*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: LOW FLOW

Materials: [✓ Pump] / Bailer: BLADDER PUMP PRO

Materials: Tubing / Rope: LDPE

Was well purged dry? YES [✓ NO]

Development Criteria: —

EQUIPMENT MODELS

1. HORIBA U-52
2. QED MP50
3. SOLINST WLM
4. 2HI-55

Time	Flow Rate ~~(gpm)~~ mL/min	DTW (ft. BTOC)	Cum. Water Removed ~~(gal)~~ mL	±0.1 pH ✓	3% Temp (°C) ✓	3% Cond. (mS/cm) ✓	±10.0 ORP (mV) ✓	10% DO (mg/L) >0.50 ✓	10% Turbidity (NTU) >5.0 ✓	Other	Comments
0845	100	28.16	500	7.28	28.01	4.52	168	1.07	28.3		
0850	100	28.16	1000	7.34	27.70	4.52	155	1.36	19.5		
0855	100	28.16	1500	7.36	27.56	4.50	146	1.35	4.8		
0900	100	28.16	2000	7.35	27.51	4.50	140	1.39	1.2		
0905	100	28.16	2500	7.34	27.44	4.49	139	1.29	0.0		STABILIZE
0925	—	28.12									AFTER PMNT

JL 8-17-16

4. SAMPLING DATA

Method(s): SEE ABOVE

Materials: Pump / Bailer: —

Materials: Tubing / Rope: —

DTW at Time of Sampling: 28.11

Sample ID: 4FIW-075-20160817

Duplicate Sample ID: —

Field Filtered: [✓ YES] NO

Analyte	Method
☐ VOCs	8260B
☐ SVOCs	8270
☐ Metals	6010B / 7000 Series
☐ TPH	8015B
☐ SEE COC	
☐	

5. COMMENTS QED SETTING CPM5 D/C (1.16) 75 FT

CALIBRATION 3.95 pH, 4.51 mS/cm, 7.60 mg/L, 103 % DO

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

Revised 7/13/16
General\Forms and Templates\Field Forms

UFIW-07I

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-8760006 Task Number: 02.01
Client: NERT
Project Location: WEST OF AP-5 POND
WELL ID: UFIW-07I
Date: 8-17-16 Time: 0705
Personnel: J. LAGADE
Weather: DUSTY, LOW WIND 90°F

2. WELL DEVELOPMENT LOG

Method: PUMP X BAILER ____ SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): 41.19 ft.
Screen Length: ~36.19 to ~41.19 ft bgs
Depth to Static Water (BTOC): 28.10 ft.
Calculated Casing Vol.: 2.19 gal
Depth to Product (BTOC): – ft.
Length of Water Column (h): 13.09 ft.
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: LOW FLOW
Materials: [✓ Pump] / Bailer: BLADDER
Materials: [✓ Tubing] / Rope: LDPE
Was well purged dry? YES [✓ NO]
Development Criteria: ✓

EQUIPMENT MODELS
1. HORIBA U-52
2. QED MP50
3. SOLINST WLM
4. BLADDER PUMP ARU

Time	Flow Rate ~~(gpm)~~ ML/m	DTW (ft. BTOC)	Cum. Water Removed ~~(gal)~~ mL	±0.1 pH ✓	3% Temp (°C) ✓	3% Cond. (mS/cm) ✓	±10.0 ORP (mV) ✓	10% DO (mg/L) >0.5 ✓	10% Turbidity (NTU) <5.0 ✓	Other	Comments
0710	100	27.85	500	7.40	25.91	4.45	153	1.05	18.7		
0715	100	27.83	1000	7.50	25.84	4.46	132	1.65	8.9		
0720	100	27.75	1500	7.62	25.80	4.47	103	1.29	3.4		
0725	100	27.83	2000	7.66	26.84	4.47	98	1.49	1.3		
0730	100	27.85	2500	7.73	26.84	4.47	101	1.85	0.0		
0735	100	27.85	3000	7.73	26.84	4.47	104	1.97	0.0		
0740	100	27.83	3500	7.75	26.82	4.49	103	2.02	0.0		STABILIZED
0800	–	28.10									AFTER PUMP

JL
8-17-16

4. SAMPLING DATA

Method(s): SEE ABOVE
Materials: Pump / Bailer: –
Materials: Tubing / Rope: –
DTW at Time of Sampling: 27.85
Sample ID: UFIW-07I-20160817
Duplicate Sample ID: –
Field Filtered: [✓ YES] NO

Analyte	Method
☐ VOCs	8260B
☐ SVOCs	8270
☐ Metals	6010B / 7000 Series
☐ TPH	8015B
☑ SEE COC	
☐	

5. COMMENTS QED METING CMS 06.885:2.0 80 FT

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

TETRA TECH

UFIW-07D

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 114-8710008 Task Number: 02.01
Client: NEAT
Project Location: WEST OF AP-5 POND
WELL ID: UFIW-07D
Date: 8-16-16 Time: 1325
Personnel: J. LAGMOE
Weather: WINDY SUNNY 104°F

2. WELL DEVELOPMENT LOG

Method: PUMP X BAILER ____ SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): 51.25 ft.
Depth to Static Water (BTOC): 28.35 ft.
Depth to Product (BTOC): — ft.
Length of Water Column (h): 22.9 ft.
Screen Length: ~46.25 to ~51.25 ft bgs
Calculated Casing Vol.: 3.82 gal
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: LOW FLOW
Materials: [✓ Pump] / Bailer: BLADDER
Materials: [✓ Tubing] / Rope: LDPE
Was well purged dry? YES [✓ NO]
Development Criteria: —

EQUIPMENT MODELS
1. HORIBA U-52
2. QED MP50
3. SOLINST WLM
4 YSI-55

Time	Flow Rate ~~(gpm)~~ mL/M	DTW (ft. BTOC)	Cum. Water Removed ~~(gal)~~ mL	±0.1 pH ✓	3% Temp (°C) ✓	3% Cond. (mS/cm) ✓	±10.0 ORP (mV) ✓	10% DO (mg/L) >0.5 ✓	10% Turbidity (NTU) 25.0	Other	Comments
1408	100	25.84	500	7.54	37.64	5.14	137	3.53	27.5		
1415	100	25.84	1200	7.60	34.60	5.23	140	3.54	25.1		
1420	100	25.84	1700	7.61	37.52	5.21	139	3.76	20.5		
1425	100	25.84	2200	7.71	36.60	5.22	137	3.85	15.1		
1430	100	25.84	2700	7.71	35.41	5.21	138	4.02	8.8		
1435	100	25.84	3200	7.70	35.09	5.20	139	3.93	7.6		
1440	100	25.84	3700	7.70	35.21	5.20	139	4.01	7.7		
1445	100	25.84	4200	7.70	35.06	5.24	137	4.03	7.5		STABILIZE
1500	—	28.33									AFTER PURGE

JL 8-16-16

4. SAMPLING DATA

Method(s): SEE ABOVE
Materials: Pump / Bailer: —
Materials: Tubing / Rope: —
DTW at Time of Sampling: 25.84
Sample ID: UFIW-07D-20160816
Duplicate Sample ID: —
Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☒	SEE COC	
☐		

5. COMMENTS

REA SETTINGS CIMG 515 (165)

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

TETRA TECH

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-87600008
Task Number: 02.01
Client: NERT
Project Location: NERT-Henderson, NV, west of AP-5 pond
WELL ID: UFIW-085
Date: 08/19/16
Time: 0700
Personnel: M. Parmer
Weather: cloudy, 90° F

2. WELL DEVELOPMENT LOG

Method: PUMP ____ BAILER X SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): 29.55' ft.
Depth to Static Water (BTOC): 28.02' ft.
Depth to Product (BTOC): ____ ft.
Length of Water Column (h): 1.53' ft.
Screen Length: ____ to ____ ft bgs
Calculated Casing Vol.: ~~24-87466~~ 1/4 gal
mp 08/19/16
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: Bail
Materials: Pump / [✓ Bailer]
Materials: Tubing / [✓ Rope] Twine
Was well purged dry? YES NO
Development Criteria:

EQUIPMENT MODELS

1. HORIBA U-52
2. Solinst WLM
3. YSI 1-85
4.

Time	Flow Rate (gpm)	DTW (ft. BTOC)	Cum. Water Removed (gal)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
0722	—	—	~~40~~	6.33	27.19	5.12	187	1.15	60.1		
0734	—	—	~~44~~	7.38	26.25	5.21	162	1.6	73		
0741	—	—	~~318~~	7.42	26.02	5.22	161	1.11	70.3		
0750	—	—	—	7.45	25.72	5.23	159	1.29	70.3		3X casing
0759	—	—	—	7.46	25.78	5.28	154	1.15	86.0		volume
0805	—	28.0	71								Reached

4. SAMPLING DATA

Method(s): SEE above
Materials: Pump / Bailer
Materials: Tubing / Rope
DTW at Time of Sampling:
Sample ID: UFIW
Duplicate Sample ID:
Field Filtered: YES NO

	Analyte	Method
☐	VOCs	*8260B*
☐	SVOCs	*8270*
☐	Metals	*6010B / 7000 Series*
☐	TPH	*8015B*
☒	SEE COC	
☐		

5. COMMENTS @0655-Calibration: Temp = 30.38C, pH = 4.02, ORP = 288 mV, Cond. = 4.50 mS/cm, Turbidity = 0.0 NTU, DO = 7.41 mg/L, DO = 100.2%

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature: Miranda Parmer

Revised 7/13/16
General\Forms and Templates\Field Forms

TETRA TECH

UFIW-08I

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 144-8760008 Task Number: 02.01

Client: NERT

Project Location: WEST OF AP-5 POND

WELL ID: UFIW-08I

Date: 8-17-16 Time: 1310

Personnel: J. LAGADE

Weather: CLOUDY, WINDY 105°F

2. WELL DEVELOPMENT LOG

Method: PUMP X BAILER ____ SURGE BLOCK ____ OTHER ____

Total Depth of Well (BTOC): 39.79 ft.

Depth to Static Water (BTOC): 27.96 ft.

Depth to Product (BTOC): — ft.

Length of Water Column (h): 11.83 ft.

Screen Length: ~34.79 to ~39.79 ft bgs

Calculated Casing Vol.: 1.98 gal

*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: LOW FLOW

Materials: [✓ Pump] / Bailer: BLADDER PUMP MP

Materials: [✓ Tubing] / Rope: LDPE

Was well purged dry? YES [✓ NO]

Development Criteria: —

EQUIPMENT MODELS

1. HORIBA U-52
2. QED MP50
3. SOLINST WLM
4. YSI-55

Time	Flow Rate ~~(gpm)~~ mL/min	DTW (ft. BTOC)	Cum. Water Removed ~~(gal)~~ mL	±0.1 pH ✓	3% Temp (°C) ✓	3% Cond. (mS/cm) ✓	±10.0 ORP (mV) ✓	10% DO (mg/L) >0.5 ✓	10% Turbidity (NTU) >5.0	Other	Comments
1318	100	28.00	500	7.49	32.81	5.17	144	1.77	28.8		
1323	100	28.00	1000	7.53	33.50	5.19	141	1.75	14.9		
1328	100	28.01	1500	7.58	33.17	5.20	138	1.24	10.8		
1333	100	28.00	2000	7.59	33.00	5.18	137	1.33	9.8		
1338	100	28.01	2500	7.61	32.62	5.18	135	1.35	8.9		
1343	100	28.01	3000	7.65	32.55	5.18	133	1.37	7.6		
1348	100	27.99	3500	7.64	32.69	5.18	132	1.82	6.0		
1353	100	27.99	4000	7.63	33.13	5.19	132	1.34	6.3		
1358	100	28.00	4500	7.63	33.25	5.19	133	1.31	6.2		STABILIZE
1415	—	27.97	—	—	—	—	—	—	—		AFTER PUMP

JL 8-17-16

4. SAMPLING DATA

Method(s): SEE ABOVE

Materials: Pump / Bailer: —

Materials: Tubing / Rope: —

DTW at Time of Sampling: 28.00

Sample ID: UFIW-08I-20160817

Duplicate Sample ID: —

Field Filtered: [✓ YES] NO

Analyte	Method
☐ VOCs	8260B
☐ SVOCs	8270
☐ Metals	6010B / 7000 Series
☐ TPH	8015B
☒ SEE COC	
☐	

5. COMMENTS QED SETTING CPM5 6/4 (124) 60 FT

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

TETRA TECH

UFIW-08D

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-8760008 Task Number: 02.01

Client: NERT

Project Location: WEST OF AP-5 POND

WELL ID: UFIW-08D

Date: 8-17-16 Time: 1000

Personnel: J. LAGADE

Weather: DUSTY, LOW WIND 95°F

2. WELL DEVELOPMENT LOG

Method: PUMP X BAILER ____ SURGE BLOCK ____ OTHER ____

Total Depth of Well (BTOC): 50.06 ft.

Depth to Static Water (BTOC): 28.14 ft.

Depth to Product (BTOC): — ft.

Length of Water Column (h): 21.92 ft.

Screen Length: ~45.01 to ~50.06 ft bgs

Calculated Casing Vol.: 3.66 gal

*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: LOW FLOW

Materials: [✓ Pump] / Bailer BLADDER PUMP PRO

Materials: [✓ Tubing] / Rope LDPE

Was well purged dry? YES [✓ NO]

Development Criteria: —

EQUIPMENT MODELS

1. HORIBA U-52
2. QED MP50
3. SOLINST WLM
4. YSI 55

Time	Flow Rate ~~(gpm)~~ ML/M	DTW (ft. BTOC)	Cum. Water Removed ~~(gal)~~ ML	±0.1 pH ✓	3% Temp (°C) ✓	3% Cond. (mS/cm) ✓	±10.0 ORP (mV) ✓	10% DO (mg/L) ≥0.5 ✓	10% Turbidity (NTU) ≥5.0 ✓	Other	Comments
1010	80	26.35	500	7.59	29.43	6.64	142	1.42	12.9		
1016	80	26.42	1000	7.66	29.81	6.94	135	1.27	6.1		
1022	80	26.40	1500	7.70	29.52	6.98	132	1.42	3.1		
1028	80	26.43	2000	7.70	29.61	6.99	130	1.34	1.2		
1034	80	26.44	2500	7.70	29.55	7.10	126	1.43	0.1		STABILIZE
1050	—	28.16									AFTER PUMP

JL 8-17-16

4. SAMPLING DATA

Method(s): SEE ABOVE

Materials: [✓ Pump] / Bailer —

Materials: [✓ Tubing] / Rope —

DTW at Time of Sampling:

Sample ID: 26.40

Duplicate Sample ID: —

Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☒	SEE COC	
☐		

5. COMMENTS QED SETTING CPM 5' (6/6) 80 FT

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

Revised 7/13/16
General\Forms and Templates\Field Forms

TETRA TECH

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 1448760008
Task Number: 02.01
Client: NERT
Project Location: Henderson, NV
WELL ID: UFMW-DIS
Date: 8-9-16
Time: 1300
Personnel: Hao Z.
Weather: Sunny; ~102 °F

2. WELL DEVELOPMENT LOG

Method: PUMP ____ BAILER ____ SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): 29.31 ft.
Depth to Static Water (BTOC): 27.90 ft.
Depth to Product (BTOC): ____ ft.
Length of Water Column (h): 1.41 ft.
Screen Length: 24.31 to 29.31 ft bgs
Calculated Casing Vol.: 0.235 gal
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: ____
Materials: Pump / Bailer ____
Materials: Tubing / Rope ____
Was well purged dry? YES [✓ NO]
Development Criteria: ____

EQUIPMENT MODELS
1. ____
2. ____
3. ____
4 ____

Time	Flow Rate (gpm)	DTW (ft. BTOC)	Cum. Water Removed (gal)	pH ±0.1	Temp (°C) 3%	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments DO from YSI
Bail to dry. first round											
1340				7.62	29.84	6.53	164	2.26	1.9		
1421				7.75	28.58	7.27	164	0.81	0.0		2.15 DO YSI
1425				7.75	28.66	7.56	196	1.18	118 0.0		3.08
1439				7.82	28.61	7.68	197	1.85	0.0		1.84
1444				7.80	27.52	7.80	208	0.78	68		2.02
1500		28.90	~1 gal	7.90	27.36	7.87	200	1.91	0.0		2.07

Comments for turbidity samples not clear with high turbidity. But meter shows 0.0 NTU Out of Range.

4. SAMPLING DATA

Method(s): Bailing
Materials: Pump / Bailer ✓
Materials: Tubing / Rope
DTW at Time of Sampling: ____
Sample ID: UFMW-DIS-20160809
Duplicate Sample ID: ✓
Field Filtered: YES [✓ NO]

Analyte		Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☐	See COC.	
☐		

5. COMMENTS Bailed ~1 gallon, didn't bail to dry.
Turbidity out of range reading, sample not filtered due to high turbidity: clogging filter

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature: Hao Zhang

Revised 7/13/16
General\Forms and Templates\Field Forms

TETRA TECH

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 144-87600008
Task Number: 02.01
Client: NERT
Project Location: Henderson, NV
WELL ID: UEMW-01I
Date: 8-9-2016
Time: 1000
Personnel: Hao Z.
Weather: Sunny, 97°F

2. WELL DEVELOPMENT LOG

Method: PUMP ____ BAILER ____ SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): 39.32 ft.
Screen Length: 34.32 to 39.32 ft bgs see pump@36.82
Depth to Static Water (BTOC): 27.79 ft.
Calculated Casing Vol.: 1.93 gal
Depth to Product (BTOC): ____ ft.
Length of Water Column (h): 11.53 ft.
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: ____
Materials: Pump / Bailer ____
Materials: Tubing / Rope ____
Was well purged dry? YES NO
Development Criteria: ____

EQUIPMENT MODELS
1. ____
2. ____
3. ____
4 ____

Time	Flow Rate (gpm)	DTW (ft. BTOC)	Cum. Water Removed (gal)	±0.1 pH	±3% Temp (°C)	±3% Cond. (mS/cm)	±10 ORP (mV)	±10% DO (mg/L) YSI	±10% Turbidity (NTU)	Other	Comments
1033	120	28.01	0	7.64	29.68	6.52	181	1.80	10.3		0.0 from Horiba DO
1037	120	28.01	480	7.55	29.82	6.53	178	1.30	6.7		0.0 DO from Horiba
1041	120	28.01	960	7.62	29.86	6.53	169	1.12	2.9		0.0 DO
1045	120	28.01	1440	7.63	29.87	6.53	168	0.76	2.5		0.0
1049	120	28.01	1920	7.62	29.85	6.53	167	0.59	2.6		0.0
1053	120	28.01	2400	7.61	29.85	6.53	166	0.58	2.4		0.0
1057	120	28.01	2880	7.62	29.84	6.53	164	0.56	1.9		0.0
Stable, collect sample @ 1120 UFMW-01I -											After sample DTW- 27.85 ft bgs

4. SAMPLING DATA

Method(s): Low Flow
Materials: [✓ Pump] / Bailer: Bladder
Materials: [✓ Tubing] / Rope: LDP tubing
DTW at Time of Sampling: 28.01
Sample ID: UEMW-01I
Duplicate Sample ID: UEMW-01I-FD.
Field Filtered: [✓ YES] NO

Analyte	Method
☐ VOCs	*8260B*
☐ SVOCs	*8270*
☐ Metals	*6010B / 7000 Series*
☐ TPH	*8015B*
☐ See COC	
☐	

5. COMMENTS QED setting: CPM6 5.0/5.0(165) 30psi

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature: ____

TETRA TECH

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-8786 00008
Task Number: 02.01
Client: NERT
Project Location: Henderson, NV
WELL ID: UFMD-01D
Date: 8-9-16
Time: 0630
Personnel: Hao Z.
Weather: Sunny, ~84°F

2. WELL DEVELOPMENT LOG

Method: PUMP ____ BAILER ____ SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): 49.12 ft.
Screen Length: 44.12 to 49.12 ft bgs 48.62 ft set pump
Depth to Static Water (BTOC): 27.89 ft.
Calculated Casing Vol.: 3.55 gal
Depth to Product (BTOC): ____ ft.
Length of Water Column (h): 21.23 ft.
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: ____
Materials: Pump / Bailer ____
Materials: Tubing / Rope ____
Was well purged dry? YES NO
Development Criteria: ____

EQUIPMENT MODELS

1. ____
2. ____
3. ____
4. ____

Time	Flow Rate ~~(gpm)~~ ml/min	DTW (ft. BTOC)	Cum. Water Removed ~~(gal)~~ ml	±0.1 pH	±3% Temp (°C)	±3% Cond. (mS/cm)	±10 ORP (mV)	±10% DO (mg/L)	±10% Turbidity (NTU)	Other	Comments ±10%.
0825	100	26.80	0.0	7.92	29.54	7.11	211	3.32	64.0		4.84 DO from YSI 55
0830	100	26.70	500	7.92	29.33	6.74	206	3.22	64.2		4.76
0835	100	26.70	1000	7.92	29.21	6.75	200	3.36	55.9		5.09
0840	100	26.70	1500	7.94	29.21	6.74	192	3.42	67.3		5.12
0845	100	26.70	2000	7.93	29.12	6.75	187	3.29	51.0		5.14
0850	100	26.70	2500	7.95	29.13	6.74	185	3.32	48.1		5.60
0855	100	26.70	3000	7.96	29.16	6.74	181	3.40	40.8		6.25
0900	100	26.70	3500	7.97	29.18	6.74	180	3.46	36.2		5.64
0905	100	26.70	4000	7.98	29.22	6.73	179	3.61	33.6		6.31
0910	100	26.70	4500	7.97	29.21	6.73	180	3.54	33.0		6.26
Stable	collect sample	UFMW-01D @ 0920									DTW after sampling =27.89 ft bgs

4. SAMPLING DATA

Method(s): Low Flow
Materials: [✓ Pump] / Bailer: Bladder
Materials: [✓ Tubing] / Rope: LDP tubing
DTW at Time of Sampling: 26.70
Sample ID: UFMW-01D
Duplicate Sample ID: ____
Field Filtered: [✓ YES] NO

Analyte		Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☐	see COC	
☐		

5. COMMENTS: 0630 calibrated Horiba U-52 with auto cal solution; pH = 4.02(4.00), cond = 4.53(4.49 mS/cm)
NTU = 0.0 (0.0), 7.40 mg/L DO, 105.1% DO, ORP calibrated to (240mV / 240mV)
YSI 55 DO Cal: 99.6/99.
QED setting CPM 6 50/50 (16.5) ~~120 psi (13)~~ 50 psi

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature: Hao Zh

Revised 7/13/16
General\Forms and Templates\Field Forms

Pg 1 of 1

TETRA TECH

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 164-8760008 Task Number: 02.01
Client: NERT
Project Location: Henderson, NV
WELL ID: NEMW-02S
Date: 8-10-16 Time: 1310
Personnel: Hao Z., Daniel K.
Weather: Sunny, ~100°F

2. WELL DEVELOPMENT LOG

Method: PUMP ____ BAILER ____ SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): 28.99 ft. Screen Length: 23.99 to 28.99 ft bgs set pump 26.49 ft
Depth to Static Water (BTOC): 27.59 ft. Calculated Casing Vol.: 0.23 gal
Depth to Product (BTOC): ____ ft.
Length of Water Column (h): 1.40 ft. *Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA 11.2 7.12 ft recover to 80% @27.87 ft bgs

Purge Method:
Materials: Pump / Bailer
Materials: Tubing / Rope
Was well purged dry? YES NO
Development Criteria:

EQUIPMENT MODELS
1.
2.
3.
4

Time	Flow Rate ~~(gpm)~~ mL/min	DTW (ft. BTOC)	Cum. Water Removed (gal)	pH ±0.1	Temp (°C) ±3%	Cond. (mS/cm) ±3%	ORP (mV) ±10	±10% DO (mg/L) Horiba	±10% Turbidity (NTU)	Other	Comments
1443	100	27.69	0.0	7.18	32.97	10.3	130	1.51	26.2		2.74 DO YSI
1448	100	27.90	500	7.34	32.13	10.2	132	1.44	6.5		3.46 DO YSI
1452	100		1000	7.39	31.88	10.2	141	1.87	2.0		4.11 DO YSI
1458	100		1500	7.30	31.55	10.2	149	1.90	12.6		2.58 DO YSI
~~1503~~											
						TOO LOW	RECHARGE;	PUMPING	NOT		
						POSSIBLE.	SWITCH	TO HAND	BAIL.		
								DK	8.10.16		
1520				7.28	29.10	6.63	211	5.42	8.13		
1524				7.38	28.59	10.3	209	3.92	0.0		
1527				7.26	27.85	10.3	201	2.73	0.0		
1530				7.22	27.15	10.3	206	2.21	0.0		
1533				7.25	27.31	10.3	208	2.42	0.0		

Hand Bail Readings

4. SAMPLING DATA

Method(s): See Page 2
Materials: Pump / Bailer
Materials: Tubing / Rope
DTW at Time of Sampling:
Sample ID:
Duplicate Sample ID:
Field Filtered: YES NO

	Analyte	Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☐		
☐		

5. COMMENTS 1430 calibrated YSI 55 DO meter, DO = 90.8/93. (alt 48, Sal = 4.0) ✓
first reading = 5.81 mg/L @31.5°C
Turbidity reading out of range, too turbid.

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

Revised 7/13/16
General\Forms and Templates\Field Forms

TETRA TECH

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: See Page 1 144-8760008
Task Number: 02.01
Client: NERT
Project Location: Henderson NV
WELL ID: UFMW-02S
Date: 08-10-16
Time: 1310
Personnel: Hao Z , D.K
Weather: Sunny ~100°F

2. WELL DEVELOPMENT LOG

Method: PUMP ____ BAILER ____ SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): ________ ft.
Screen Length: ____ to ____ ft bgs
Depth to Static Water (BTOC): ________ ft.
Calculated Casing Vol.: ________ gal
Depth to Product (BTOC): ________ ft.
Length of Water Column (h): ________ ft.
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: ________
Materials: Pump / Bailer ________
Materials: Tubing / Rope ________
Was well purged dry? YES NO
Development Criteria: ________

EQUIPMENT MODELS

1. ________
2. ________
3. ________
4. ________

Time	Flow Rate (gpm)	DTW (ft. BTOC)	Cum. Water Removed (gal)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
									Out of Range		too turbid-
1533				7.23	27.11	10.3	212	2.56	0.0		
1535				7.14	27.04	10.3	215	2.24	0.0		
1537				7.15	27.03	10.3	219	1.89	0.0		
			w/1.0gal								
Wait till the groundwater recovered to 27.87 ft bgs (80% recovery)											
Then Bail to collect sample UFMW-02S 20160810											

4. SAMPLING DATA

Method(s): Purge to Bail
Materials: Pump / Bailer ✓
Materials: Tubing / Rope ✓
DTW at Time of Sampling: 27.87
Sample ID: UFMW-02S-20160810 too turbid
Duplicate Sample ID: NA
Field Filtered: YES [✓ NO]

Analyte	Method
☐ VOCs	*8260B*
☐ SVOCs	*8270*
☐ Metals	*6010B / 7000 Series*
☐ TPH	*8015B*
☐	See COC.
☐	

5. COMMENTS Turbidity reading out of range, too turbid. sample not filtered.

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature: Hao Zh

Revised 7/13/16
General\Forms and Templates\Field Forms

TETRA TECH

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 144-87600008 Task Number: 02.01

Client: NERT

Project Location: Henderson, NV

WELL ID: UFMW-02I

Date: 8-10-16 Time: 1000

Personnel: Hao Z.

Weather: Sunny,

2. WELL DEVELOPMENT LOG

Method: PUMP ____ BAILER ____ SURGE BLOCK ____ OTHER ____

Total Depth of Well (BTOC): 39.08 ft. Screen Length: 34.08 to 39.08 ft bgs Set pump 36.58 ft bgs

Depth to Static Water (BTOC): 27.68 ft. Calculated Casing Vol.: 1.90 gal

Depth to Product (BTOC): ____ ft.

Length of Water Column (h): 11.40 ft. *Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: ____

Materials: Pump / Bailer ____

Materials: Tubing / Rope ____

Was well purged dry? YES NO

Development Criteria: ____

EQUIPMENT MODELS

1. ____
2. ____
3. ____
4. ____

Time	Flow Rate (gpm)	DTW (ft. BTOC)	Cum. Water Removed (gal)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L) Horiba	Turbidity (NTU)	Other ____	Comments
1020	100	28.01	0.0	7.65	30.34	7.38	206	0.82	780		1.07 DO YSI
1025	100	28.01	500	7.58	30.10	7.41	201	0.25	36.5		0.89
1030	100	28.01	1000	7.64	30.02	7.42	199	0.09	24.6		0.80
1035	100	28.01	1500	7.65	30.10	7.43	188	0.02	17.8		0.69
1040	100	28.01	2000	7.67	30.18	7.43	183	0.00	11.9		0.62
1045	100	28.01	2500	7.66	30.30	7.44	181	0.00	7.0		~~0.62~~ 0.63
1050	100	28.01	3000	7.63	30.46	7.45	181	0.00	3.5		0.66
1055	100	28.01	3500	7.64	30.49	7.45	179	0.00	1.8		0.64
1100	100	28.01	4000	7.60	30.60	7.45	180	0.00	1.1		0.66
Stable, collect sample UFMW-02I-20160810											DTW=28.01
				~~7.28~~	~~29.10~~	~~6.63~~	~~211~~	5.44	After sampling DTW=27.84		

4. SAMPLING DATA

Method(s): Low Flow

Materials: [✓ Pump] / Bailer Bladder

Materials: [✓ Tubing] / Rope LDP

DTW at Time of Sampling: 28.01

Sample ID: UFMW-02I

Duplicate Sample ID: –

Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☐	See COC	
☐		

5. COMMENTS

QED setting CPM6 5.0/5.0(165) 30psi

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature: Hao Zh

TETRA TECH

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 144-87600008 Task Number: 02.01

Client: NERT

Project Location: Henderson, NV

WELL ID: UFMW-02D

Date: 8-10-16 Time: 0630

Personnel: Hao Z.

Weather: Sunny, 82°F

2. WELL DEVELOPMENT LOG

Method: PUMP ____ BAILER ____ SURGE BLOCK ____ OTHER ____

Total Depth of Well (BTOC): 49.08 ft. Screen Length: 44.08 to 49.08 ft bgs set pump@ 46.58 ft bgs

Depth to Static Water (BTOC): 27.74 ft. Calculated Casing Vol.: 3.56 gal

Depth to Product (BTOC): ____ ft.

Length of Water Column (h): 21.34 ft. *Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: ____

Materials: Pump / Bailer ____

Materials: Tubing / Rope ____

Was well purged dry? YES NO

Development Criteria: ____

EQUIPMENT MODELS

1. ____
2. ____
3. ____
4. ____

Time	Flow Rate ~~(gpm)~~ ml/min	DTW (ft. BTOC)	Cum. Water Removed ~~(gal)~~ ml	pH ±.1	Temp (°C) ±3%	Cond. (mS/cm) ±3%	ORP (mV) ±10	±10% DO (mg/L) Horiba	±10% Turbidity (NTU)	Other	±10% Comments
0816	100	28.05	0	7.81	29.73	8.05	206	0.51	42.1		1.04 DO from YSI
0821	100	28.05	500	7.76	29.38	8.04	201	0.16	25.6		0.91 DO from YSI
0826	100	28.05	1000	7.82	29.30	8.03	196	0.00	18.7		0.68
0831	100	28.05	1500	7.78	29.26	8.02	194	0.00	13.8		0.73
0836	100	28.05	2000	7.78	29.29	8.02	190	0.00	14.3		0.69
0841	100	28.05	2500	7.76	29.28	8.02	187	0.00	10.4		0.64
0846	100	28.05	3000	7.77	29.34	8.02	181	0.00	7.2		0.61
0851	100	28.05	3500	7.81	29.40	8.01	174	0.00	6.9		0.60
0856	100	28.05	4000	7.81	29.39	8.02	171	0.00	5.6		0.57
0901	100	28.05	4500	7.79	29.39	8.02	171	0.00	5.5		0.58
Stable, collect sample UFMW-02D											DTW=28.05
											DTW=27.85
											after finishing sampling

4. SAMPLING DATA

Method(s): Low Flow

Materials: ~~Pump~~ / Bailer: Bladder

Materials: ~~Tubing~~ / Rope: LDP tubing

DTW at Time of Sampling: 28.05

Sample ID: UFMW-02D-20160810 Level 4 fms/MD

Duplicate Sample ID: –

Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☐	see COC	
☐		

5. COMMENTS Calibrated Water Quality Monitor Horiba U-52 with autocal Solution, cal reading pH=4.0(4.0); conductivity=4.62 (4.49 mS/cm); NTU=0.0(0.0); 7.51 mg/L DO, 100.0% DO ORP=240(240 mV); YSI 55 cal=94.0(93.0) set altitude=18, salinity=4; first reading=7.21 mg/L@27.5 QED setting CPM6 5.0/5.0 (1ft) 30psi

Note: 2-inch well = 0.167 gal/ft 4-inch well = 0.667 gal/ft

Signature: Hao Zh

TETRA TECH

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-8760008 Task Number: 02.01
Client: NERT
Project Location: Henderson, NV

WELL ID: UEM-W-03S
Date: 8-8-2016 Time: 1535
Personnel: Hao Z.
Weather: Sunny, 100°F

2. WELL DEVELOPMENT LOG

Method: PUMP ____ BAILER ____ SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): 25.88 ft.
Depth to Static Water (BTOC): Dry ft.
Depth to Product (BTOC): ____ ft.
Length of Water Column (h): ____ ft.
Screen Length: 24.5 to 25.5 ft bgs
Calculated Casing Vol.: ____ gal
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: ____
Materials: Pump / Bailer ____
Materials: Tubing / Rope ____
Was well purged dry? YES NO
Development Criteria: ____

EQUIPMENT MODELS
1. ____
2. ____
3. ____
4. ____

Time	Flow Rate (gpm)	DTW (ft. BTOC)	Cum. Water Removed (gal)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
well	dry.										

4. SAMPLING DATA

Method(s): ____
Materials: Pump / Bailer ____
Materials: Tubing / Rope ____
DTW at Time of Sampling: ____
Sample ID: No sample collected
Duplicate Sample ID: ____
Field Filtered: YES NO

	Analyte	Method
☐	VOCs	*8260B*
☐	SVOCs	*8270*
☐	Metals	*6010B / 7000 Series*
☐	TPH	*8015B*
☐		
☐		

5. COMMENTS

Well dry, total depth @ 25.88 ft btoc. No GW encountered

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature: Hao Zhang

TETRA TECH

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-8760008
Task Number: 02.01
Client: NERT
Project Location: Henderson, NV
WELL ID: UFMW-031
Date: 8-8-16
Time: 1300
Personnel: Hao Z.
Weather: Sunny, ~100°F

2. WELL DEVELOPMENT LOG

Method: PUMP ____ BAILER ____ SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): 40.30 ft.
Screen Length: 30.30 to 40.30 ft bgs Set 35.0 ft bgs
Depth to Static Water (BTOC): 27.04 ft.
Calculated Casing Vol.: 2.21 gal
Depth to Product (BTOC): ____ ft.
Length of Water Column (h): 13.26 ft.
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: ____
Materials: Pump / Bailer ____
Materials: Tubing / Rope ____
Was well purged dry? YES NO
Development Criteria: ____

EQUIPMENT MODELS
1. ____
2. ____
3. ____
4 ____

Time	Flow Rate (~~gpm~~) mL/min	DTW (ft. BTOC)	Cum. Water Removed (~~gal~~) ml	±0.1 pH	3% Temp (°C)	3% Cond. (mS/cm)	±10 ORP (mV)	10% DO (mg/L) Horiba	10% Turbidity (NTU)	Other	Comments
1414	700	27.15	0.0	7.66	36.47	6.76	176	4.22	1.2		0.62 DO from YSI
1419	100	27.15	500	7.66	34.80	6.80	169	3.39	4.7		0.76
1424	100	27.18	1000	7.61	34.17	6.81	167	2.89	3.3		1.07
1429	100	27.18	1500	7.61	33.97	6.79	166	2.75	3.0		0.86
1434	100	27.18	2000	7.62	33.53	6.82	162	2.33	1.9		0.82
1439	100	27.18	2500	7.62	33.58	6.84	158	1.97	0.6		0.78
1444	100	27.18	3000	7.63	33.59	6.85	156	1.72	0.7		0.76
1449	100	27.18	3500	7.62	33.36	6.83	156	1.65	0.4		0.67
1454	100	27.18	4000	7.61	33.42	6.84	155	1.51	0.0		0.61
1459	100	27.18	4500	7.64	33.48	6.85	152	1.50	0.0		0.58
Stable, collected sample UFMW-031 @ 1510											

4. SAMPLING DATA

Method(s): Low Flow
Materials: [✓ Pump] / Bailer: Bladder
Materials: [✓ Tubing] / Rope: LDP tubing
DTW at Time of Sampling: 27.18
Sample ID: UFMW-031
Duplicate Sample ID: ____
Field Filtered: [✓ YES] NO

Analyte		Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☐	see COC	
☐		

5. COMMENTS QED setting CPM6 5.0/5.0(165) ~~25 PSI~~ 43[illegible]

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature: Hao Zh

TETRA TECH

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: G4-8760008 Task Number: C2.01
Client: MERT
Project Location: Henderson, NV
WELL ID: UFMW-03D
Date: 8-8-2016 Time: 0830
Personnel: Hao Z.
Weather: Sunny, ~95°F

2. WELL DEVELOPMENT LOG

Method: PUMP ____ BAILER ____ SURGE BLOCK ____ OTHER ____
Total Depth of Well (BTOC): 50.40 ft. Screen Length: 45 to 50 ft bgs See pump @ ~~[illegible]~~ ft bgs
Depth to Static Water (BTOC): 27.09 ft. Calculated Casing Vol.: 3.84 gal
Depth to Product (BTOC): ____ ft.
Length of Water Column (h): 23.31 ft. *Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: ____
Materials: Pump / Bailer ____
Materials: Tubing / Rope ____
Was well purged dry? YES NO
Development Criteria: ____

EQUIPMENT MODELS
1. ____
2. ____
3. ____
4 ____

Time	Flow Rate (gpm)	DTW (ft. BTOC)	Cum. Water Removed (gal)	±0.1 pH	3% Temp (°C)	3% Cond. (mS/cm)	±10 ORP (mV)	10% DO (mg/L)	10% Turbidity (NTU)	Other	Comments
1042	100	27.11	0	7.75	32.26	7.24	197	2.[illegible] ~~1.29~~	11.8		1.29 ~~DO~~ from Horiba
1047	100	27.12	500	7.73	31.42	7.29	189	1.82	0.0		1.40 -
1052	100	27.12	1000	7.77	31.20	7.31	182	2.34	0.0		1.47
1057	100	27.12	1500	7.74	31.03	7.34	181	2.28	0.0		1.56
1102	100	27.12	2000	7.76	30.90	7.34	175	[illegible]	0.0		1.74
1107	100	27.12	2500	7.76	31.02	7.37	172	2.51	0.0		1.86
1112	100	27.12	3000	7.77	30.80	7.33	170	2.56	0.0		1.95
1117	100	27.12	3500	7.75	30.65	7.36	169	2.52	0.0		2.03
Stable	Collect	sample	UFMW-03D	@	1125						DTW=27.16

4. SAMPLING DATA

Method(s): Low Flow
Materials: [✓ Pump] / Bailer: Bladder
Materials: [✓ Tubing] / Rope: LDP tubing
DTW at Time of Sampling: 27.12
Sample ID: UFMW-03D
Duplicate Sample ID: ____
Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☐	see COC	
☐		

5. COMMENTS

Calibrated Horiba U-52 Water quality monitor with autocal solution
pH=4.02 (4.0) Cond=4.53 (4.49 mS/cm) NTU=0.0 (0.0) 9.93 mg/L DO 111.2 % DO ORP=240 (240
DO reading from Horiba in comments
QED setting CPM 6 5.0/5.0 (165) ~~100 PSI~~ (H2) 50 PSI

Note: 2-inch well = 0.163 gal/ft *4-inch well = 0.667 gal/ft*

Signature: Hao Zh

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TETRA TECH

UFMW-04S

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-8760000ß Task Number: 02.01

Client: NERT

Project Location: WEST of AP-5 pond

WELL ID: UFMW-04S

Date: 08/19/16 Time: 0825

Personnel:

Weather: cloudy

2. WELL DEVELOPMENT LOG

Method: PUMP ____ BAILER X SURGE BLOCK ____ OTHER ____

Total Depth of Well (BTOC): 29.46 ft.

Depth to Static Water (BTOC): 27.75 ft.

Depth to Product (BTOC): – ft.

Length of Water Column (h): 1.71 ft.

Screen Length: ~24.46 to ~29.46 ft bgs

Calculated Casing Vol.: .28 gal

*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: bail

Materials: Pump / [✓ Bailer]

Materials: Tubing / [✓ Rope] twine

Was well purged dry? YES NO

Development Criteria: –

EQUIPMENT MODELS

1. Horiba U-52
2. Solinst wlm
3.
4.

Time	Flow Rate (gpm)	DTW (ft. BTOC)	Cum. Water Removed (gal)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
0900	–	27.75	–	8.18	26.04	4.99	111	1.88	41.0		
0907	–	–	–	8.05	25.87	5.04	124	1.34	193		
0914	–	–	–	7.93	25.88	4.84	129	0.74	185		
0921	–	–	–	7.86	26.00	4.81	128	0.84	175		
0928	–	28.00	>1.0	7.91	25.45	4.80	133	0.96	196		3 WELL CASING
											VOLUME ACHIEVED

JL
8-19-16

4. SAMPLING DATA

Method(s): SEE ABOVE

Materials: Pump / [✓ Bailer] –

Materials: Tubing / [✓ Rope] –

DTW at Time of Sampling:

Sample ID: UFMW-04S-20160819

Duplicate Sample ID: –

Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☑	SEE COC	
☐		

5. COMMENTS

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

Revised 7/13/16
General\Forms and Templates\Field Forms

TETRA TECH

UFMW-04I

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-S7GUUU08 Task Number: 02.01

Client: NERT

Project Location: WQ + UF AP-5 POND

WELL ID: UFMW-04I

Date: 8-18-16 Time: 0855

Personnel:

Weather:

2. WELL DEVELOPMENT LOG

Method: PUMP X BAILER ___ SURGE BLOCK ___ OTHER ___

Total Depth of Well (BTOC): 39.45 ft. Screen Length: ~34.45 to ~39.45 ft bgs

Depth to Static Water (BTOC): 27.76 ft. Calculated Casing Vol.: 1.55 gal

Depth to Product (BTOC): — ft.

Length of Water Column (h): 11.69 ft. *Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: LOW FLOW

Materials: [✓ Pump] / Bailer BLADDER PUMP PRO

Materials: [✓ Tubing] / Rope LDPE

Was well purged dry? YES [✓ NO]

Development Criteria: —

EQUIPMENT MODELS

1. HORIBA U-52
2. QED MP50
3. SOLINST WLM
4. YSI T-35

Time	Flow Rate ~~(gpm)~~ ML/M	DTW (ft. BTOC)	Cum. Water Removed ~~(gal)~~ ML	±0.1 pH ✓	3% Temp (°C) ✓	3% Cond. (mS/cm) ✓	±10.0 ORP (mV) ✓	10% DO (mg/L) ✓ 0.5	10% Turbidity (NTU) ✓ 5.0 ✓	Other	Comments
0903	100	27.88	500	7.58	29.59	4.34	164	1.27	38.3		BATTERY REPLACEMENT
0910	100	27.88	1000	7.67	29.32	4.26	149	1.46	24.5		
0915	100	27.90	1500	7.74	29.06	4.27	141	1.71	17.8		
0920	100	27.89	2000	7.76	29.05	4.27	138	2.01	16.9		
0925	100	27.89	2500	7.79	29.10	4.27	131	1.93	11.7		
0930	100	27.90	3000	7.79	29.14	4.27	131	2.00	11.9		
0935	100	27.88	3500	7.80	29.04	4.29	128	2.05	11.1		
0940	100	27.90	4000	7.84	29.16	4.28	125	2.12	12.0		STABILIZED
1020	—	27.76									AFTER PUMP

JL
8-18-16

4. SAMPLING DATA

Method(s): SEE ABOVE

Materials: Pump / Bailer —

Materials: Tubing / Rope —

DTW at Time of Sampling:

Sample ID: UFMW-04I-20160818

Duplicate Sample ID: UFMW-04I-20160818-FD

Field Filtered: [✓ YES] NO

Analyte	Method
☐ VOCs	8260B
☐ SVOCs	8270
☐ Metals	6010B / 7000 Series
☐ TPH	8015B
☑ SEE COC	
☐	

5. COMMENTS

QED CMS 6/6 (09) 20 FT

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

Revised 7/13/16
General\Forms and Templates\Field Forms

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TETRA TECH

UFMW-04D

WELL DEVELOPMENT LOG DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-F7600008 Task Number: 02.01

Client: NERT

Project Location: WEST OF AP-5 NNA

WELL ID: UFMW-04D

Date: 8-18-16 Time: 0720

Personnel: J. LAGARP

Weather: CLOUDY 90°F SLIGHT WIND

2. WELL DEVELOPMENT LOG

Method: PUMP X BAILER ____ SURGE BLOCK ____ OTHER ____

Total Depth of Well (BTOC): 49.80 ft.

Depth to Static Water (BTOC): 27.73 ft.

Depth to Product (BTOC): – ft.

Length of Water Column (h): 21.87 ft.

Screen Length: ~44.60 to ~44.60 ft bgs

Calculated Casing Vol.: 3.65 gal

*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. DEVELOPMENT DATA

Purge Method: LOW FLOW

Materials: [✓ Pump] / Bailer BLADDER PUMP PRO

Materials: [✓ Tubing] / Rope LDPE

Was well purged dry? YES [✓ NO]

Development Criteria: –

EQUIPMENT MODELS

1. HORIBA U-52
2. GED MP50
3. SOLINST WLM
4. YSI-55

Time	ML/min Flow Rate ~~(gpm)~~ ML/min	DTW (ft. BTOC)	Cum. Water Removed ~~(gal)~~ ML	±0.1 pH ✓	3% Temp (°C) ✓	3% Cond. (mS/cm) ✓	±10.0 ORP (mV) ✓	10% DO (mg/L) >0.5 ✓	10% Turbidity (NTU) >5.0 ✓	Other	Comments
0741	100	27.85	500	7.42	27.24	5.09	169	1.54	39.5		
0746	100	27.85	1000	7.67	27.25	5.05	151	1.08	13.1		
0751	100	27.85	1500	7.76	27.43	5.04	140	0.81	6.4		
0756	100	27.85	2000	7.81	27.69	5.03	134	0.88	4.0		
0801	100	27.85	2500	7.77	27.95	5.06	129	0.93	3.0		
0806	100	27.85	3000	7.79	28.01	5.04	130	0.95	0.1		STABILIZED
0828	–	27.73									AFTER PUMP

JL
8-18-16

4. SAMPLING DATA

Method(s): SEE ABOVE

Materials: [✓ Pump] / Bailer –

Materials: [✓ Tubing] / Rope –

DTW at Time of Sampling: 27.85

Sample ID: UFMW-04D-20160818

Duplicate Sample ID: –

Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☒	SEE COC	
☐		

5. COMMENTS QED SETTING CPMS 6/6 C(24) 40 FT

CALIBRATION 3.93 pH, 4.52 mS/cm, 7.61 mg/L, 103% DO

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

TETRA TECH

UFMW-055

WELL DEVELOPMENT LOG DATA SHEET ~~(CONT.)~~

casing vol = .32 gal x 3

DTW = 27.90 FT BGS   TD = 29.81 FT BGS

1. PROJECT INFORMATION

Project Number: 194-87600008   Task Number: 02.01

Client: NERT

Project Location: West of AP-5 Pond

WELL ID: UFMW-055

Date: 08/19/16   Time: 0930

Personnel: M. Farmer

Weather: Cloudy

Time	Flow Rate (gpm)	DTW (ft. BTOC)	Cum. Water Removed (gal)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
0933				8.28	26.62	5.97	129	1.07	100		
0945				8.23	27.01	~~8~~4.00	109	7.72	114		
0951				8.20	25.88	4.98	~~205~~ 105	1.69	245		Water Removed
1000				7.99	25.70	1.28	59	6.91	184		71 Gallon
1017				8.14	26.66	5.65	31	1.13	205		
1019		28.28	>1Gal								

2. COMMENTS

Signature:

Revised 7/13/16
General\Forms and Templates\Field Forms

Pg ___ of ___

TETRA TECH

GROUNDWATER PURGE AND SAMPLING FIELD DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-8760008 Task Number: K01
Client: NERT
Project Location: Henderson, NV
WELL ID: UFMW-05I
Date: 8-23-16 Time: 0700
Personnel: D. KEADY, E. PEIRCE
Weather: Sunny, 105°F, windy

2. WELL DATA

Casing Diameter: 2 in.
Slot Size: 0.020 in.
Total Depth of Well (BTOC): 39.75 ft.
Depth to Static Water (BTOC): 27.82 ft.
Depth to Product (BTOC): N/A ft.
Length of Water Column (h): 11.93 ft.
Type of Casing: PVC
Type of Screen: PVC
Screen Length: ~34.75 to ~39.75 ft bgs
Calculated Casing Vol.: — gal
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. PURGE DATA

Purge Method: Low Flow
Materials: [✓ Pump] / Bailer: QED Sample Pro
Materials: [✓ Tubing] / Rope: Poly Bonded 1/4" Tubing
Pumping Rate: 100 mL/min
Was well purged dry? YES [✓ NO]

EQUIPMENT MODELS
1. Horiba U-52
2. YSI 55
3. Solinst 104
4. MP 50
5. —

Time	DTW (ft. BTOC)	Cum. Water Removed (mL)	±0.1 pH	3% Temp (°C)	3% Cond. (mS/cm)	±10 ORP (mV)	10% DO (mg/L) Horiba	10% Turbidity (NTU)	10% Other YSI DO	Comments
0720	28.00	500	7.71	26.91	~~135~~ 5.39	135	0.68	73.3	1.14	Cond. = 5.39 mS/c
0725	28.00	~~500~~ 1000	7.69	26.78	5.46	135	0.60	59.4	0.80	
0730	28.00	1500	7.70	26.67	5.47	133	0.53	37.0	0.76	
0735	28.00	2000	7.71	26.49	5.44	130	0.62	33.5	1.27	
0740	28.00	2500	7.72	26.53	5.41	128	0.47	20.2	0.89	
0745	28.00	3000	7.76	26.92	5.41	125	0.39	15.5	0.73	
0750	28.00	3500	7.79	26.51	5.40	122	0.34	12.5	0.73	
0755	28.00	4000	7.79	26.54	5.38	121	0.32	10.3	0.76	
0800	28.00	4500	7.79	26.54	5.37	120	0.31	8.5	0.75	
0805	28.00	5000	7.76	26.55	5.37	121	0.31	8.1	0.74	
0810	28.00	5500	7.81	26.57	5.37	119	0.32	7.8	0.76	STABLE

DK 8-23-16

4. SAMPLING DATA

Method(s): Same as above
Materials: Pump / Bailer: "
Materials: Tubing / Rope: "
DTW at Time of Sampling: 28.00
Sample ID: UFMW-05I-20160823 0820
Duplicate Sample ID: N/A
Field Filtered: [✓ YES] NO For perchlorate

Analyte		Method
☐	VOCs	*8260B*
☐	SVOCs	*8270*
☐	Metals	*6010B / 7000 Series*
☐	TPH	*8015B*
☒	SEE COC	
☐		

5. COMMENTS

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature: DK

TETRA TECH

GROUNDWATER PURGE AND SAMPLING FIELD DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-8760008 Task Number: K01

Client: NERT

Project Location: Henderson, NV

WELL ID: UFMW-05D

Date: 8-22-16 Time: 1340

Personnel: E.Peirce, D.Keady

Weather: Sunny, 100°F, windy

2. WELL DATA

Casing Diameter: 2 in.

Slot Size: 0.020 in.

Total Depth of Well (BTOC): 49.70 ft.

Depth to Static Water (BTOC): 27.72 ft.

Depth to Product (BTOC): N/A ft.

Length of Water Column (h): 22.02 ft.

Type of Casing: PVC

Type of Screen: PVC

Screen Length: ~44.70 to ~49.70 ft bgs

Calculated Casing Vol.: ______ gal

*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. PURGE DATA

Purge Method: Low Flow

Materials: [✓ Pump] / Bailer: QED Sample Pro

Materials: [✓ Tubing] / Rope: Poly Bonded 1/4" Tubing

Pumping Rate: 100 mL/min

Was well purged dry? YES NO

EQUIPMENT MODELS

1. Horiba U-52
2. YSI 55
3. Solinst 104
4. MP 50
5. —

Time	DTW (ft. BTOC)	Cum. Water Removed (mL)	±0.1 pH	3% Temp (°C)	3% Cond. (mS/cm)	±10 ORP (mV)	10% DO (mg/L)	10% Turbidity (NTU)	10% Other YSI DO	Comments
1400	27.81	0	7.72	33.21	5.91	119	0.69	1000*	1.28	*Turbidity Flashing
1405	27.81	500	7.73	31.26	6.10	111	0.33	228	0.73	
1410	27.80	1000	7.71	31.06	6.12	109	0.26	152	0.70	Horiba DO unreliable;
1415	27.80	1500	7.71	31.10	6.08	106	—	90.7	0.64	relying on YSI DO
1420	27.80	2000	7.70	30.93	6.11	105	—	72.5	0.57	
1425	27.80	2500	7.71	30.94	6.09	103	—	51.3	0.55	
1430	27.80	3000	7.71	30.88	6.12	101	—	46.3	0.52	
1435	27.80	3500	7.72	30.80	6.10	99	—	44.2	0.48	
1440	27.80	4000	7.72	30.77	6.11	98	—	39.9	0.50	
1445	27.80	4500	7.73	30.81	6.10	96	—	37.9	0.52	
1450	27.80	5000	7.73	30.97	6.11	94	—	35.4	0.54	
1455	27.80	5500	7.74	30.98	6.10	93	—	34.8	0.55	STABLE
					DK	8-22-16				

4. SAMPLING DATA

Method(s): Same as above

Materials: Pump / Bailer: "

Materials: Tubing / Rope: "

DTW at Time of Sampling: 27.80

Sample ID: UFMW-05D-20160822 1505

Duplicate Sample ID: ______

Field Filtered: [✓ YES] NO For perchlorate

Analyte		Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☒	SEE COC	
☐		

5. COMMENTS

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

Revised 12/22/15

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TETRA TECH

UFMW-06S

WELL DEVELOPMENT LOG DATA SHEET ~~(CONT.)~~

DTW= 27.56 FT BGL TD = 29.80 WATER COLUMN = 2,24 FT

1. PROJECT INFORMATION

Project Number: 194-8760008
Task Number: 02.01
Client: NERT
Project Location: West of AP-5 Pond
WELL ID: UFMW-065
Date: 08/19/2016
Time: 1300
Personnel: M. Farmer
Weather: Cloudy, 95°

Time	Flow Rate (gpm)	DTW (ft. BTOC)	Cum. Water Removed (gal)	± 0.1 pH	3% Temp (°C)	3% Cond. (mS/cm)	±10.0 ORP (mV)	10% DO (mg/L)	10% Turbidity (NTU)	Other	Comments
1309	100mL	27.65	500mL	7.55	28.90	5.34	104	1.36	193		
1314	1mL	27.65	1000mL	7.55	29.22	5.34	103	0.73	75.5		
1320		27.65	1500mL	7.54	29.49	5.34	100	0.44	29.2		
1328		27.65	2000mL	7.51	29.61	5.34	96	1.07	12.0		switched to YSI for DO
1333		27.65	2500mL	7.56	29.53	5.34	92	0.91	9.2		
1338		27.65	3000mL	7.54	29.54	5.38	88	0.87	7.8		
1343		27.65	3500	7.54	29.64	5.33	90	0.85	6.7		
1348		27.65	4000	7.57	29.50	5.34	89	0.85	5.7		
1353		27.65	4500	7.53	29.56	5.32	90	0.86	5.7		
1358		27.65	5000	7.57	29.61	5.32	88	0.85	5.4		

2. COMMENTS

Signature: Miranda Farmer

Revised 7/13/16
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Pg __ of __

TETRA TECH

GROUNDWATER PURGE AND SAMPLING FIELD DATA SHEET

1. PROJECT INFORMATION

Project Number: 1948760008 Task Number: K01
Client: NERT
Project Location: Henderson, NV

WELL ID: UFMW-06I
Date: 8-22-16 Time: 0645
Personnel: E. Peirce, D. Keady
Weather: Sunny, 100°F, windy

2. WELL DATA

Casing Diameter: ~~6~~ 2 in.
Slot Size: 0.020 in.
Total Depth of Well (BTOC): 39.88 ft.
Depth to Static Water (BTOC): 27.49 ft.
Depth to Product (BTOC): N/A ft.
Length of Water Column (h): 12.39 ft.

Type of Casing: PVC
Type of Screen: PVC
Screen Length: ~34.88 to ~39.88 ft bgs
Calculated Casing Vol.: ______ gal

Purge Vol. Calculation (one casing vol. = $0.041 \cdot d^2 \cdot h$)

3. PURGE DATA

Purge Method: Low Flow
Materials: [✓ Pump] / Bailer: QED SAMPLEPRO
Materials: [✓ Tubing] / Rope: 1/4" POLYBONDED TUBING
Pumping Rate: 100 mL/min
Was well purged dry? YES [✓ NO]

EQUIPMENT MODELS
1. Horiba U-52
2. YSI 55
3. Solinst 104
4. MP50
5.

Time	DTW (ft. BTOC)	Cum. Water Removed (mL)	±0.1 pH	3% Temp (°C)	3% Cond. (mS/cm)	±10 ORP (mV)	10% DO (mg/L)	10% Turbidity (NTU)	10% Other YSI DO	Comments
0755	27.67	0	7.44	27.05	5.42	154	1.23	6.3	—	
0800	27.67	500	7.46	26.89	5.42	148	0.61	5.7	—	
0805	27.62	1000	7.51	26.82	5.43	140	0.42	5.2	—	Horiba DO broken
0810	27.60	1500	7.49	26.82	5.43	136	0.41	4.6	1.03	YSI DO started
0815	CHANGED HORIBA BATTERIES; PUMP ON HOLD									
0820	27.[illegible]	2000	7.57	27.18	5.44	126	—	5.1	1.37	DTW: 27.60
0825	27.60	2500	7.53	27.01	5.43	126	—	3.3	0.77	
0830	27.60	3000	7.52	26.87	5.43	124	—	2.4	0.73	
0835	27.60	3500	7.52	26.84	5.43	123	—	2.1	0.72	
0840	27.60	4000	7.52	26.84	5.43	121	—	2.3	0.67	STABLE

DK 8-22-16

4. SAMPLING DATA

Method(s): Same as above
Materials: Pump / Bailer: "
Materials: Tubing / Rope: "
DTW at Time of Sampling: 27.60
Sample ID: UFMW-06I-20160822 0855
Duplicate Sample ID: N/A
Field Filtered: [✓ YES] NO For perchlorate

☐	Analyte	Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☒	SEE COC	
☐		

5. COMMENTS

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

Revised 12/22/15
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TETRA TECH

GROUNDWATER PURGE AND SAMPLING FIELD DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-8160008 Task Number: K01
Client: NERT
Project Location: Henderson, NV
WELL ID: UFMW-06D
Date: 8-22-16 Time: 0930
Personnel: E. Peirce, D. Keady
Weather: Sunny, 100°F, windy

2. WELL DATA

Casing Diameter: 2 in.
Slot Size: 0.020 in.
Total Depth of Well (BTOC): 49.91 ft.
Depth to Static Water (BTOC): 27.56 ft.
Depth to Product (BTOC): N/A ft.
Length of Water Column (h): 22.35 ft.
Type of Casing: PVC
Type of Screen: PVC
Screen Length: ~44.91 to ~49.91 ft bgs
Calculated Casing Vol.: ______ gal
*Purge Vol. Calculation (one casing vol. = 0.041*d ^{2} *h)*

3. PURGE DATA

Purge Method: Low Flow
Materials: [✓ Pump] / Bailer — QED Sample ~~Pro~~ Pro
Materials: [✓ Tubing] / Rope — Poly Bonded 1/4" tubing
Pumping Rate: 100 mL/min
Was well purged dry? YES [✓ NO]

EQUIPMENT MODELS
1. Horiba U52
2. YSI 55
3. Solinst 104
4. MP 50
5. —

Time	DTW (ft. BTOC)	Cum. Water Removed (mL)	±0.1 pH	3% Temp (°C)	3% Cond. (mS/cm)	±10 ORP (mV)	10% DO (mg/L) Horiba	10% Turbidity (NTU)	10% Other YSI DO	Comments
1010	27.91	0	7.77	29.62	6.65	144	6.06	11.2	3.32	
1015	27.91	500	7.78	29.52	6.60	141	3.92	8.7	2.87	Horiba DO still unreliable;
1020	27.92	1000	7.79	29.28	6.60	139	2.58	5.5	2.77	relying on YSI DO
1025	27.92	1500	7.78	29.20	6.62	138	—	4.3	2.58	
1030	27.93	2000	7.78	29.30	6.62	136	—	6.0	2.40	
1035	27.93	2500	7.78	29.57	6.61	135	—	4.4	2.37	
1040	27.94	3000	7.78	29.47	6.60	135	—	5.2	2.45	
1045	27.94	3500	7.79	29.58	6.59	133	—	5.3	2.48	
1050	27.95	4000	7.78	29.67	6.61	134	—	5.2	2.46	STABLE

DK 8-22-16

4. SAMPLING DATA

Method(s): Same as above
Materials: Pump / Bailer: "
Materials: Tubing / Rope: "
DTW at Time of Sampling: 27.95
Sample ID: UFMW-06D-20160822 1100
Duplicate Sample ID: N/A
Field Filtered: [✓ YES] NO For perchlorate

	Analyte	Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☒	SEE COC	
☐		

5. COMMENTS

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

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Water Levels

UFIW-	08 S	27.98	8/9
	08 I	28.28	8/9
	08 D	28.11	8/9
UFIW	07 S	24.00	8/10
	07 I	28.43	8/10
	07 D	28.26	8/10
UFIW	06 S	27.59	8/5
	06 I	24.92	8/8
	06 D	27.55	8/5
UFIW	05 S	28.28	8/3
	05 I	28.13	8/8
	05 D	28.18	8/3
UFMW-	04 S	27.70	8/10
	04 I	27.75	8/10
	04 D	27.70	8/10
E1-1		27.55	8/11
E1-2		27.40	8/11
E1-3		27.71	8/11
E2-2		27.05	8/11

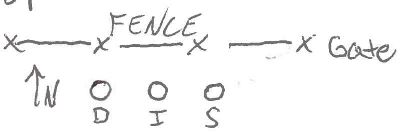
TPH C6-C4, VOC, Title 22, Perc, Hex Cr.

NERT - Soil Flushing IRM
DTW Readings

8/26/16

Start 0848 Finish

Well	DTW (bToc)
E1-1	27.68
UFMW-01S	27.96
01 I	27.94
01 D	28.04
UFMW-02 S	27.75
02 I	27.84
02 D	27.91
E1-2	27.53
E1-3	27.61
UFMW-03S	Dry TD (25.85)
03 I	27.22
03 D	27.31
UFIW-01 S	27.79
01 I	27.71
01 D	27.76
UFIW-02 S	27.33
02 I	27.23
02 D	23.31
UFIW-03 S	27.48
03 I	27.16
03 D	27.58
UFIW-04 S	27.54
04 I	27.63
04 D	27.65



E2-1	26.93
E2-2	27.02
E2-3	27.32
E2-4	27.41
E2-5	27.70
UFMW-04S	27.75
04 I	27.80
04 D	27.73
UFMW-05S	27.90
05 I	27.71
05 D	27.81
UFMW-06S	27.59
06 I	27.52
06 D	27.57
UFIW-05S	27.99
05 I	28.13
05 D	28.16
UFIW-06S	28.18
06 I	28.16
06 D	28.39
UFIW-07S	28.14
07 I	28.09
07 D	28.22
UFIW-08S	28.01
08 I	28.02
08 D	28.15
DFW-03	31.63
-04	32.41
-05	32.29
-06	35.41

Soil Flushing IRM - Daily/Bi-Weekly GW Gauging Form

Project Name: NERT Task K01 - Soil Flushing IRM
Date: 1/23/17
Address: 510 S. 4th Street, Henderson, NV 89015
Gate Access Code: 6932
Technician: Jacob Souza
Weather: 49°F

Well ID	Depth to Water (ft btoc)	Total Depth of Well (ft btoc)	Notes (well condition, etc.)
			PLOT 1 (NORTH)
Injection Wells			
UFIW-01S	26.25		2007
UFIW-01I	26.47		2008
UFIW-01D	26.86		2010
UFIW-02S	25.48		2012
UFIW-02I	25.52		2013
UFIW-02D	25.75		2014
UFIW-03S	25.25		2016
UFIW-03I	25.22		2017
UFIW-03D	25.61		2019
UFIW-04S	25.45		2021
UFIW-04I	25.34		2022
UFIW-04D	25.59		2024
Monitoring Wells			
UFMW-01S	27.68		1940
UFMW-01I	27.96		1942
UFMW-01D	28.15		1944
UFMW-02S	27.33		1947
UFMW-02I	28.26		1949
UFMW-02D	28.39		1951
UFMW-03S	25.78		2001
UFMW-03I	26.14		2002
UFMW-03D	26.24		2004
Extraction Wells			
E1-1	35.27		1933
E1-2	35.96		1934
E1-3	43.66		1935
			PLOT 2 (SOUTH)
Injection Wells			
UFIW-05S			
UFIW-05I			
UFIW-05D			
UFIW-06S			
UFIW-06I			
UFIW-06D			
UFIW-07S			
UFIW-07I			
UFIW-07D			
UFIW-08S			
UFIW-08I			
UFIW-08D			
Monitoring Wells			
UFMW-04S	25.83		2026
UFMW-04I	25.91		2028
UFMW-04D	25.86		2029
UFMW-05S	26.06		2031
UFMW-05I	25.95		2032
UFMW-05D	25.83		2034
UFMW-06S	25.76		2038
UFMW-06I	25.77		2039
UFMW-06D	25.72		2041
Extraction Wells			
E2-1			
E2-2			
E2-3			
E2-4			
E2-5			

TETRA TECH

WELL GAUGING DATA

Project Number: 194-87600008 Task Number: K01
Client: NERT
Project Location: Henderson, NV

Date: 1/25- 01/26 Time: ______
Personnel: Jesse Funker
Weather: Sunny - Windy 32°F - 40°F

Well ID	Time	DTW (ft.)	Depth to Well Bottom (ft.)	Well ID	Time	DTW (ft.)	Depth to Well Bottom (ft.)	Notes / Well Conditions:
01/25/17 E1-1	1623	36.71		UFIW-02S	1523	26.68	28	01/25/17
E1-2	1626	37.84		UFIW-02I	1526	26.58		
E1-3	1629	44.49		UFIW-02D	1532	26.65		
UFMW-01S	1615	28.60	29	UFIW-03S	1536	26.44	30	
UFMW-01I	1617	28.92		UFIW-03I	1539	26.35		
UFMW-01D	1618	29.11		UFIW-03D	1541	26.51		
UFMW-02S	1609	28.32	29	UFIW-4S	1545	26.65	28	
UFMW-02I	1610	29.23		UFIW-04I	1548	26.47		
UFMW-02D	1611	29.37		UFIW-04D	1549	26.50		
UFMW-03S	1559	—	25.82	E2-1	0958	25.30		01/26/17
UFMW-03I	1601	27.03		E2-2	1002	25.34		
UFMW-03D	1603	27.13		E2-3	1005	25.62		
UFIW-01S	1512	27.44	28.56	E2-4	1007	25.75		
UFIW-01I	1518	27.55		E2-5	1010	25.07		
UFIW-01D	1520	27.58						

Signature:

Revised: 08/25/2015
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TETRA TECH

WELL GAUGING DATA

Project Number: 194-87600008
Task Number: K01
Client: NERT
Project Location: Henderson, NV

Date: 01/25 - 01/26
Time:
Personnel: Jesse Burke
Weather: Sunny - Windy 30°F - 40°F

	Well ID	Time	DTW (ft.)	Depth to Well Bottom (ft.)	Well ID	Time	DTW (ft.)	Depth to Well Bottom (ft.)	Notes / Well Conditions:
01/25/17	UFMW-04S	1442	26.75	29	UFIW-07S	0932	26.50	31	01/28/17
	UFMW-04I	1443	26.79		UFIW-07I	0933	26.16		
	UFMW-04D	1444	26.76		UFIW-07D	0936	26.32		
	UFMW-05S	1448	26.96	30	UFIW-08S	0926	26.48	30	
	UFMW-05I	1448	26.85		UFIW-08I	0930	26.41		
	UFMW-05D	1449	26.72		UFIW-08D	0840	26.15		
	UFMW-06S	1452	26.67	30					
	UFMW-06I	1453	26.59						
	UFMW-06D	1455	26.61						
01/26/17	UFIW-05S	0951	26.21	29.5					
	UFIW-05I	0949	26.43						
	UFIW-05D	0953	25.98						
	UFIW-06S	0944	26.45	32					
	UFIW-06I	0942	26.53						
	UFIW-06D	0946	26.60						

Signature:

Revised: 08/25/2015
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TETRA TECH

GROUNDWATER PURGE AND SAMPLING FIELD DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-87600008 Task Number: K01
Client: NERT
Project Location: Henders, NV

WELL ID: UFIW-015
Date: 1/26/17 Time: 1213
Personnel: Jesse Bunkers
Weather: cold, clear

2. WELL DATA

Casing Diameter: 2 in.
Slot Size: 0.010 in.
Total Depth of Well (BTOC): 28.25 ft.
Depth to Static Water (BTOC): 27.49 ft.
Depth to Product (BTOC): – ft.
Length of Water Column (h): 0.76 ft.

Type of Casing: PVC
Type of Screen: PVC
Screen Length: 23 to 28 ft bgs
Calculated Casing Vol.: 0.1246 gal
3WV = 0.3739
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. PURGE DATA

Purge Method: bailer
Materials: Pump / [✓ Bailer]
Materials: Tubing / [✓ Rope]
Pumping Rate: – mL/min
Was well purged dry? YES [✓ NO]

EQUIPMENT MODELS
1. Horiba U-52
2.
3.
4.
5.

Time	DTW (ft. BTOC)	Cum. Water Removed (mL)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
1213	27.49	1 gal	7.48	12.85	4.31	-83	7.63	~~0.0~~		>1000 NTU Sample
							JL			
							01-26-17			

4. SAMPLING DATA

Method(s): see above
Materials: Pump / Bailer –
Materials: Tubing / Rope –
DTW at Time of Sampling: 27.49
Sample ID: UFIW-015-20170126
Duplicate Sample ID: –
Field Filtered: YES [✓ NO]

Analyte		Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☒	Perchl	
☒	Hex Cr	

5. COMMENTS Dye observed

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

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TETRA TECH

GROUNDWATER PURGE AND SAMPLING FIELD DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-87600008 Task Number: K01

Client: NERT

Project Location: Henders, NV

WELL ID: UFIW-025

Date: 1/26/17 Time: 1250

Personnel: Jesse Bunkers

Weather: cold, clear

2. WELL DATA

Casing Diameter: 2 in.

Slot Size: 0.010 in.

Total Depth of Well (BTOC): 28.10 ft.

Depth to Static Water (BTOC): 26.15 ft.

Depth to Product (BTOC): — ft.

Length of Water Column (h): 1.95 ft.

Type of Casing: PVC

Type of Screen: PVC

Screen Length: 23 to 28 ft bgs

Calculated Casing Vol.: 0.3198 gal

3CV = 0.9594 gal

*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. PURGE DATA

Purge Method: bailer

Materials: Pump / [✓ Bailer]

Materials: Tubing / [✓ Rope]

Pumping Rate: — mL/min

Was well purged dry? YES [✓ NO]

EQUIPMENT MODELS

1. Horiba U-52
2.
3.
4.
5.

Time	DTW (ft. BTOC)	Cum. Water Removed (mL)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
1250	26.15	1gal	7.06	12.94	4.23	-42	6.83	767		sample
							JL			
							01-26-17			

4. SAMPLING DATA

Method(s): see above

Materials: Pump / Bailer —

Materials: Tubing / Rope —

DTW at Time of Sampling: 26.15

Sample ID: UFLW-025-20170126

Duplicate Sample ID: —

Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☒	Perch	
☒	Hex Cr	

5. COMMENTS Dye observed

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

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TETRA TECH

GROUNDWATER PURGE AND SAMPLING FIELD DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-87600008 Task Number: K01
Client: NERT
Project Location: Henders, NV

WELL ID: UFIW-03S
Date: 1/26/17 Time: 1304
Personnel: Jesse Bunkers
Weather: cold, clear

2. WELL DATA

Casing Diameter: 2 in.
Slot Size: 0.010 in.
Total Depth of Well (BTOC): 29.81 ft.
Depth to Static Water (BTOC): 26.49 ft.
Depth to Product (BTOC): — ft.
Length of Water Column (h): 3.32 ft.

Type of Casing: pvc
Type of Screen: pvc
Screen Length: 25 to 30 ft bgs
Calculated Casing Vol.: 0.5445 gal
3WV = 1.63 gal
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. PURGE DATA

Purge Method: bailer
Materials: Pump / [✓ Bailer]
Materials: Tubing / [✓ Rope]
Pumping Rate: — mL/min
Was well purged dry? YES [✓ NO]

EQUIPMENT MODELS
1. Horiba U-52
2.
3.
4.
5.

Time	DTW (ft. BTOC)	Cum. Water Removed (mL)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
1304	26.49	2 gal	6.98	12.83	4.51	-70	7.13	416		sample
							JL			
							01-26-17			

4. SAMPLING DATA

Method(s): see above
Materials: Pump / Bailer —
Materials: Tubing / Rope —
DTW at Time of Sampling: 26.49
Sample ID: UFIW-03S-20170126
Duplicate Sample ID: —
Field Filtered: [✓ YES] NO

Analyte		Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☒	Perch	
☒	Hex Cr	

5. COMMENTS

Bags decanted

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

TETRA TECH

GROUNDWATER PURGE AND SAMPLING FIELD DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-87600008 Task Number: K01
Client: NERT
Project Location: Henders, NV

WELL ID: UFIW-045
Date: 1/26/17 Time: 1328
Personnel: Jesse Bunkers
Weather: cold, clear

2. WELL DATA

Casing Diameter: 2 in.
Slot Size: 0.010 in.
Total Depth of Well (BTOC): 28.10 ft.
Depth to Static Water (BTOC): 26.72 ft.
Depth to Product (BTOC): – ft.
Length of Water Column (h): 1.38 ft.

Type of Casing: PVC
Type of Screen: PVC
Screen Length: 23 to 28 ft bgs
Calculated Casing Vol.: 0.2263 gal
3wv = 0.6789 gal
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. PURGE DATA

Purge Method: bailer
Materials: Pump / [✓ Bailer]
Materials: Tubing / [✓ Rope]
Pumping Rate: – mL/min
Was well purged dry? YES [✓ NO]

EQUIPMENT MODELS

1. Horiba U-52
2.
3.
4.
5.

Time	DTW (ft. BTOC)	Cum. Water Removed (mL)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
1328	26.72	1 gal	7.12	12.80	5.47	11	8.03	79.2		sample
							JL			
							01-26-17			

4. SAMPLING DATA

Method(s): See above
Materials: Pump / Bailer –
Materials: Tubing / Rope –
DTW at Time of Sampling: 26.72
Sample ID: NFIW-045-20170126
Duplicate Sample ID: –
Field Filtered: [✓ YES] NO

Analyte	Method
☐ VOCs	8260B
☐ SVOCs	8270
☐ Metals	6010B / 7000 Series
☐ TPH	8015B
☒ Perch	
☒ Hex Cr	

5. COMMENTS ~~[illegible]~~ JL Dye observed

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

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TETRA TECH

GROUNDWATER PURGE AND SAMPLING FIELD DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-87600008 Task Number: K01

Client: NERT

Project Location: Henders, NV

WELL ID: 4FIW-05S

Date: 27 Jan 17 Time: 0900

Personnel: J. Laguda

Weather: Sunny - Windy 35°F

2. WELL DATA

PP=3.5''

Casing Diameter: 2 in.

Slot Size: 0.010 in.

Total Depth of Well (BTOC): 29.57 ft.

Depth to Static Water (BTOC): 26.16 ft.

Depth to Product (BTOC): – ft.

Length of Water Column (h): 3.41' ft.

Type of Casing: PVC

Type of Screen: PVC

Screen Length: 24.5 to 29.5 ft bgs

Calculated Casing Vol.: 0.55924 gal

3WV = 1.68 gal

*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. PURGE DATA

Purge Method: bail

Materials: Pump / [✓ Bailer]

Materials: Tubing / [✓ Rope]

Pumping Rate: – mL/min

Was well purged dry? YES [✓ NO]

EQUIPMENT MODELS

1. Horiba U-52
2.
3.
4.
5.

Time	DTW (ft. BTOC)	Cum. Water Removed (mL)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
0900										Begin bailing
0923	–	2gal								End -3 WV bail
~~1200~~	~~26.20~~									
1250	26.20	2.25g	6.72	16.28	4.75	-141	1.51	320		
1255	26.20									Sampled

JL

JL 01-27-17

4. SAMPLING DATA

Method(s): See above

Materials: Pump / Bailer –

Materials: Tubing / Rope –

DTW at Time of Sampling: 26.20

Sample ID: 4FIW-09S-20170127

Duplicate Sample ID: –

Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☐	Perch	
☐	Hex Cr	

5. COMMENTS Pink Algal

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

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TETRA TECH

GROUNDWATER PURGE AND SAMPLING FIELD DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-87600008 Task Number: K01
Client: NERT
Project Location: Henders, NV

WELL ID: UFIW-065
Date: 27 Jan 17 Time: 0835
Personnel: J. [illegible]
Weather: Sunny - Windy 35°F

2. WELL DATA

Casing Diameter: 2 in.
Slot Size: 0.040 in.
Total Depth of Well (BTOC): 31.88 ft.
Depth to Static Water (BTOC): 26.41 ft.
Depth to Product (BTOC): – ft.
Length of Water Column (h): 5.47 ft.

Type of Casing: PVC
Type of Screen: PVC
Screen Length: 27 to 32 ft bgs
Calculated Casing Vol.: 0.892 gal
3WV = 2.7
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. PURGE DATA

Purge Method: bail
Materials: Pump / [✓ Bailer]
Materials: Tubing / [✓ Rope]
Pumping Rate: mL/min
Was well purged dry? YES [✓ NO]

EQUIPMENT MODELS
1. Horiba U-52
2.
3.
4.
5.

Time	DTW (ft. BTOC)	Cum. Water Removed (mL)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
0838										Begin bail
1000	–	3 gal								End 3WV bail
1315	26.34									Sample
〃	〃	3.2 gal	7.14	15.38	4.20	-197	6.11	>1,000	—	〃

JL
01-27-17

4. SAMPLING DATA

Method(s): see above
Materials: Pump / Bailer 〃
Materials: Tubing / Rope 〃
DTW at Time of Sampling: 26.34
Sample ID: UFIW-065-20170127
Duplicate Sample ID: –
Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☐	Perch	
☐	Hex Cr	

5. COMMENTS

Tank fluid

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

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TETRA TECH

GROUNDWATER PURGE AND SAMPLING FIELD DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-87600008 Task Number: K01
Client: NERT
Project Location: Henders, NV

WELL ID: UFIW-075
Date: 27 Jan 17 Time: 1015
Personnel: J. Longnecker
Weather: Sunny - Windy 35°F

2. WELL DATA

pf =3.5"

Casing Diameter: 2 in.
Slot Size: 0.010 in.
Total Depth of Well (BTOC): 31.15 ft.
Depth to Static Water (BTOC): 26.5 ft.
Depth to Product (BTOC): — ft.
Length of Water Column (h): 4.65 ft.

Type of Casing: PVC
Type of Screen: PVC
Screen Length: 26 to 31 ft bgs
Calculated Casing Vol.: 0.7628 gal
3WV= 2.29
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. PURGE DATA

Purge Method: Bail
Materials: Pump / [✓ Bailer]
Materials: Tubing / [✓ Rope]
Pumping Rate: — mL/min
Was well purged dry? YES [✓ NO]

EQUIPMENT MODELS
1. Horiba U-52
2.
3.
4.
5.

Time	DTW (ft. BTOC)	Cum. Water Removed (mL)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
1015										Begin Bail
1040	—	3GAL								End 3WV Bail
1340	26.53	3.2	7.11	16.71	5.47	-155	1.19	270	—	Sample

JL
01-27-17

4. SAMPLING DATA

Method(s): See above
Materials: Pump / Bailer —
Materials: Tubing / Rope —
DTW at Time of Sampling: 26.53
Sample ID: UFIW-075-20170127
Duplicate Sample ID: —
Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	*8260B*
☐	SVOCs	*8270*
☐	Metals	*6010B / 7000 Series*
☐	TPH	*8015B*
☒	Perc	
☒	Hex Cr	

5. COMMENTS

Pink Fluid

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

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TETRA TECH

GROUNDWATER PURGE AND SAMPLING FIELD DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-87600008 Task Number: K01
Client: NERT
Project Location: Henders, NV

WELL ID: WFIW-08S
Date: 27 Jan 17
Time: 1055
Personnel: J. Lagunda
Weather: Sunny - Windy 35 °F

2. WELL DATA

Casing Diameter: 2 in.
Slot Size: 0.010 in.
Total Depth of Well (BTOC): 30.01 ft.
Depth to Static Water (BTOC): 26.54 ft.
Depth to Product (BTOC): — ft.
Length of Water Column (h): 3.47 ft.

Type of Casing: PVC
Type of Screen: PVC
Screen Length: 25 to 30 ft bgs
Calculated Casing Vol.: 0.569 05 gal
3WV = 1.71 Gal

*Purge Vol. Calculation (one casing vol. = 0.041*d ^{2} *h)*

3. PURGE DATA

Purge Method: Bail
Materials: Pump / [✓ Bailer]
Materials: Tubing / [✓ Rope]
Pumping Rate: — mL/min
Was well purged dry? YES [✓ NO]

EQUIPMENT MODELS
1. Horiba U-52
2.
3.
4.
5.

Time	DTW (ft. BTOC)	Cum. Water Removed (mL)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
1055										Begin Bail
1115	—	2 gal								End 3WV Bail
1400	26.50	2.15 g								Sample
			6.83	16.79	6.28	-160	3.09	200	—	

JL
01-27-17

4. SAMPLING DATA

Method(s): See above
Materials: Pump / Bailer —
Materials: Tubing / Rope —
DTW at Time of Sampling: 26.50
Sample ID: WFIW-08S-20170125
Duplicate Sample ID: —
Field Filtered: [✓ YES] NO

Analyte		Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☒	Perch	
☒	Hex Cr	

5. COMMENTS

Pink Fluid

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

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TETRA TECH

GROUNDWATER PURGE AND SAMPLING FIELD DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-87600008 Task Number: K01
Client: NERT
Project Location: Henders, NV

WELL ID: UFMW-015
Date: 1/26/17 Time: 1128
Personnel: Jesse Bunkers
Weather: cold, clear

2. WELL DATA

Casing Diameter: 2 in.
Slot Size: 0.010 in.
Total Depth of Well (BTOC): 29.30 ft.
Depth to Static Water (BTOC): 28.65 ft.
Depth to Product (BTOC): – ft.
Length of Water Column (h): 0.65 ft.

Type of Casing: PVC
Type of Screen: PVC
Screen Length: 24 to 29 ft bgs
Calculated Casing Vol.: 0.1066 gal
3WV = 0.3198 gal
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. PURGE DATA

Purge Method: Bail
Materials: Pump / [✓ Bailer]
Materials: Tubing / [✓ Rope]
Pumping Rate: mL/min
Was well purged dry? YES [✓ NO]

EQUIPMENT MODELS
1. Horiba U-52
2.
3.
4.
5.

Time	DTW (ft. BTOC)	Cum. Water Removed (mL)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
1128	28.60	0.5gal	5.97	16.59	3.77	1.208	6.94	370		Sample
								JL		
								01-26-17		

4. SAMPLING DATA

Method(s): see above
Materials: Pump / Bailer –
Materials: Tubing / Rope –
DTW at Time of Sampling: 28.60
Sample ID: UFMW-015-20170126
Duplicate Sample ID: –
Field Filtered: [✓ YES] NO

Analyte		Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☒	Perch	
☒	Hex Cr	

5. COMMENTS

No dye

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

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TETRA TECH

GROUNDWATER PURGE AND SAMPLING FIELD DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-87600008 Task Number: K01
Client: NERT
Project Location: Henders, NV

WELL ID: UFMW-025
Date: 1/26/17 Time: 1153
Personnel: Jesse Bunkers
Weather: cold, clear

2. WELL DATA

Casing Diameter: 2 in.
Slot Size: 0.010 in.
Total Depth of Well (BTOC): 29.97 ft.
Depth to Static Water (BTOC): 28.37 ft.
Depth to Product (BTOC): — ft.
Length of Water Column (h): 1.6 ft.

Type of Casing: PVC
Type of Screen: PVC
Screen Length: 24 to 29 ft bgs
Calculated Casing Vol.: 0.2624 gal
SWV = 0.7872

*Purge Vol. Calculation (one casing vol. = 0.041*d ² *h)*

3. PURGE DATA

Purge Method: bailer
Materials: Pump / [✓ Bailer]
Materials: Tubing / [✓ Rope]
Pumping Rate: — mL/min
Was well purged dry? YES [✓ NO]

EQUIPMENT MODELS
1. Horiba U-52
2.
3.
4.
5.

Time	DTW (ft. BTOC)	Cum. Water Removed (mL)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
1153	28.37	1.0 gal	7.34	16.38	2.73	147	7.80	249		sample
							JL			
							01-26-17			

4. SAMPLING DATA

Method(s): see above
Materials: Pump / Bailer —
Materials: Tubing / Rope
DTW at Time of Sampling: 28.37
Sample ID: UFMW-025-20170126
Duplicate Sample ID: —
Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	*8260B*
☐	SVOCs	*8270*
☐	Metals	*6010B / 7000 Series*
☐	TPH	*8015B*
☒	Perch	
☒	Hex Cr	

5. COMMENTS

No dupe

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

Revised 12/22/15
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TETRA TECH

GROUNDWATER PURGE AND SAMPLING FIELD DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-87600008 Task Number: K01
Client: NERT
Project Location: Henders, NV

WELL ID: UFMW-045
Date: 27 Jan 17 Time: 1130
Personnel: J. Loyd
Weather: Sunny - Windy 35°F

2. WELL DATA

Casing Diameter: 2 in.
Slot Size: 0.010 in.
Total Depth of Well (BTOC): 24.00 ft.
Depth to Static Water (BTOC): 21.75 ft.
Depth to Product (BTOC): — ft.
Length of Water Column (h): 2.25 ft.

Type of Casing: PVC
Type of Screen: PVC
Screen Length: 24 to 29 ft bgs
Calculated Casing Vol.: 0.384 gal
3 CV = 1.107 Gal
*Purge Vol. Calculation (one casing vol. = 0.041*d ² *h)*

3. PURGE DATA

Purge Method: Bail
Materials: Pump / [✓ Bailer]
Materials: Tubing / [✓ Rope]
Pumping Rate: — mL/min
Was well purged dry? YES NO

EQUIPMENT MODELS
1. Horiba U-52
2.
3.
4.
5.

Time	DTW (ft. BTOC)	Cum. Water Removed (mL)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
1130										Begin bail
1145	—	1.5 gal								End 3WV bail
1420	2600	1.75g	7.53	8.49	5.71	-10	3.34	140	—	sample
							JL 01-27-17			

4. SAMPLING DATA

Method(s): See Above
Materials: Pump / Bailer —
Materials: Tubing / Rope —
DTW at Time of Sampling:
Sample ID: UFMW-045-20170127
Duplicate Sample ID: UFMW-045-20170127-D Field Filtered: [✓ YES] NO

Analyte		Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☒	Perch	
☒	Hex Cr	

5. COMMENTS No dye

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

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TETRA TECH

GROUNDWATER PURGE AND SAMPLING FIELD DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-87600008 Task Number: K01
Client: NERT
Project Location: Henders, NV

WELL ID: 4FMW-U55
Date: 27 Jan 17
Time: 1155
Personnel: J Lagrde
Weather: Sunny - Windy 95°F

2. WELL DATA

Casing Diameter: 2 in.
Slot Size: 0.010 in.
Total Depth of Well (BTOC): 30.15 ft.
Depth to Static Water (BTOC): 26.96 ft.
Depth to Product (BTOC): — ft.
Length of Water Column (h): 3.14 ft.

Type of Casing: PVC
Type of Screen: PVC
Screen Length: 25 to 30 ft bgs
Calculated Casing Vol.: 0.523 gal
3WV = 1.57 gal
Purge Vol. Calculation (one casing vol. = $0.041 \cdot d^2 \cdot h$)

3. PURGE DATA

Purge Method: Bail
Materials: Pump / [✓ Bailer]
Materials: Tubing / [✓ Rope]
Pumping Rate: mL/min
Was well purged dry? YES [✓ NO]

EQUIPMENT MODELS

1. Horiba U-52
2.
3.
4.
5.

Time	DTW (ft. BTOC)	Cum. Water Removed (mL)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
1153										Begin Bail
1205	←	2 gal								End 3WV Bail
1440	27.00	2.16g	7.25	16.35	5.76	36	1.11	545	—	Sample

JL
01-27-16

4. SAMPLING DATA

Method(s): See above
Materials: Pump / Bailer —
Materials: Tubing / Rope —
DTW at Time of Sampling: 27.00
Sample ID: UFMW-U55 LV4
Duplicate Sample ID: —
Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☒	Perch	
☒	Hex Cr	

5. COMMENTS No dye

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

Pg 1 of 1

TETRA TECH

GROUNDWATER PURGE AND SAMPLING FIELD DATA SHEET

1. PROJECT INFORMATION

Project Number: 194-87600008 Task Number: K01
Client: NERT
Project Location: Henders, NV

WELL ID: UFMW-06S
Date: 27 Jun 17
Time: 1215
Personnel: J. Lugade
Weather: Sunny - Windy 98°F

2. WELL DATA

Casing Diameter: 2 in.
Slot Size: 0.01 in.
Total Depth of Well (BTOC): 30.32 ft.
Depth to Static Water (BTOC): 26.67 ft.
Depth to Product (BTOC): — ft.
Length of Water Column (h): 3.65 ft.

Type of Casing: PVC
Type of Screen: PVC
Screen Length: 25 to 30 ft bgs
Calculated Casing Vol.: 0.5986 gal
3 WV = 1.795
*Purge Vol. Calculation (one casing vol. = 0.041*d² *h)*

3. PURGE DATA

Purge Method: Bail
Materials: Pump / [✓ Bailer]
Materials: Tubing / [✓ Rope]
Pumping Rate: — mL/min
Was well purged dry? YES [✓ NO]

EQUIPMENT MODELS
1. Horiba U-52
2.
3.
4.
5.

Time	DTW (ft. BTOC)	Cum. Water Removed (mL)	pH	Temp (°C)	Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Other	Comments
1215										
1230	—	2 GAL								Begin Bail
1500	26.71	2.156	~~7.44~~	26.35	5.32	-25	6.32	348	—	End 3WV bail sample
							JL			
							06-27-17			

4. SAMPLING DATA

Method(s): See above
Materials: Pump / Bailer —
Materials: Tubing / Rope —
DTW at Time of Sampling: 26.71
Sample ID: UFMW-06S-20170127
Duplicate Sample ID: —
Field Filtered: [✓ YES] NO

	Analyte	Method
☐	VOCs	8260B
☐	SVOCs	8270
☐	Metals	6010B / 7000 Series
☐	TPH	8015B
☒	Perc	
☒	Hex Cr	

5. COMMENTS

No odor

Note: 2-inch well = 0.167 gal/ft *4-inch well = 0.667 gal/ft*

Signature:

Revised 12/22/15
P:\Engineering Reference Files and Proposals\Field Forms

Soil Flushing IRM - Daily/Bi-Weekly GW Gauging Form

Project Name: NERT Task K01 - Soil Flushing IRM

Date: 4/10/17

Address: 510 S. 4th Street, Henderson, NV 89015

Gate Access Code: 6932

Technician: Jacob Souza

Weather: 67°F Sunny

Monitoring Wells

Well ID	Depth to Water (ft btoc)	Total Depth of Well (ft btoc)	Notes (well condition, etc.)
			PLOT 1 (NORTH)
Injection Wells			
UFIW-01S	26.78		0955
UFIW-01I	27.00		0956
UFIW-01D	27.38		0957
UFIW-02S	26.08		0959
UFIW-02I	26.15		1001
UFIW-02D	26.30		1002
UFIW-03S	25.93		1003
UFIW-03I	25.97		1005
UFIW-03D	26.35		1006
UFIW-04S	26.29		1008
UFIW-04I	26.26		1010
UFIW-04D	26.43		1011
Monitoring Wells			
UFMW-01S	28.61		0928
UFMW-01I	28.54		0929
UFMW-01D	28.72		0930
UFMW-02S	27.79		0932
UFMW-02I	28.65		0933
UFMW-02D	28.84		0934
UFMW-03S	DRY		0936
UFMW-03I	26.50		0937
UFMW-03D	26.79		0938
Extraction Wells			
E1-1	42.76		0915
E1-2	36.13		0917
E1-3	43.67		0919
			PLOT 2 (SOUTH)
Injection Wells			
UFIW-05S			
UFIW-05I			
UFIW-05D			
UFIW-06S			
UFIW-06I			
UFIW-06D			
UFIW-07S			
UFIW-07I			
UFIW-07D			
UFIW-08S			
UFIW-08I			
UFIW-08D			
Monitoring Wells			
UFMW-04S	26.68		1034
UFMW-04I	26.71		1035
UFMW-04D	26.66		1036
UFMW-05S	26.91		1038
UFMW-05I	26.78		1039
UFMW-05D	26.67		1040
UFMW-06S	26.69		1041
UFMW-06I	26.62		1042
UFMW-06D	26.59		1044
Extraction Wells			
E2-1	25.89		1023
E2-2	26.10		1025
E2-3	26.40		1027
E2-4	26.57		1029
E2-5	26.89		1031

TETRA TECH

GROUNDWATER SAMPLING LOG
(Purge Volume Method)

Page 1 of 1

NERT, Henderson, Nevada

Task Name: AP Area Treatability Study	Task Manager: A. Ayyaswami	Well ID: UFIW-~~[illegible]~~ 015
Field Samplers: J. Engdahl	Task No.:	Date: 11 Apr 17

PURGING DATA

MP Distance AGS (ft): —	Well Depth (ft BGS): —	Well Depth (ft BMP) 28.25	Nominal Well Pipe Size (in): 2
MP Description: TOC	PID/FID Readings Beneath Inner Cap (parts per million above known background): —		

Screen Top: — (ft BGS) = — (ft BMP) Screen Bottom: — (ft BGS) = — (ft BMP) Well Riser Capacity* (gal/ft): —

Depth to Water Before Pump Installation (ft BMP): 26.60 Time: 1125 Pump and Tubing Type: Bailer

1 Well Volume (gal) = (Total Well Depth - Depth to Water) x Well Capacity = 0.29 ~0.27 Pump Intake Depth (ft BMP) —

Equipment Decon Method: 3 Rinse Groundwater Disposal: GW-11 Pond

	Time Start (hrs)	Measurement Time (hrs)	Volume Purged (gal)	Cumul. Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft BMP)	pH (pH Units)	Temp (°C)	Specific Cond. (~~µ~~mS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	Redox Poten. ORP (mV)
3WV	1120	1145	~1.0	~1.0								
	1500						4.94	22.44	4.88	199	10.96	-80

DF 4-11-17

* Well Capacity (Gal/ft) for PVC Sch 40 Nominal Pipe Sizes: 0.75" = 0.026; 1" = 0.043; 1.5" = 0.103; 2" = 0.171; 4" = 0.652; 6" = 1.484; 12" = 5.766

SAMPLING DATA

Sampling Method(s):		Sampling Initiated (hrs):	Sampling Ended (hrs):
Field Decontamination: Y N	Field Filtered: Y N	QA Duplicate: Y N	COC Time: 1500
Material Codes: VOA=40 ml glass vial; AG=Amber Glass; CG=Clear Glass; PE=polyethylene; O=Other (Specify)			COC Number:

Sample ID UFIW-015-20170411 **Duplicate ID:** — **QA/QC Samples/ID**

No.	Material Code	Volume	Preserv. Used	Intended Analysis and/or Method
AP Area Sampling Set —				

Remarks: (color, odor, sand & silt content, factors possibly affectring samples; condition of vault, wellhead, sampling appartus, etc.)

Sulfide: overflow

Signature(s):

BGS - Below Ground Surface	COC - Chain of Custody	min - Minute	MP - Measuring Point
BMP - Below Measuring Point	Cond - Specific Conductivity	mg/L - milligram/Liter	NTU - Nephelometric Units
C - Centigrade	GS - Ground Surface	mV - milli Volts	QA/QC - Quality Assurance/Quality Control

TETRA TECH

GROUNDWATER SAMPLING LOG

(Purge Volume Method)

Page 1 of 1

NERT, Henderson, Nevada

Task Name: AP Area Treatability Study

Field Samplers: J. Lagarde

Task Manager: A Ayyawuri

Task No.: MS

Well ID: MFIW-01I

Date: 12 Apr 17

PURGING DATA

MP Distance AGS (ft): –

Well Depth (ft BGS): –

Well Depth (ft BMP) 38.18

MP Description: TOC

Nominal Well Pipe Size (in): 2

PID/FID Readings Beneath Inner Cap (parts per million above known background): –

Screen Top: – (ft BGS) = – (ft BMP)

Screen Bottom: – (ft BGS) = – (ft BMP)

Well Riser Capacity* (gal/ft): –

Depth to Water Before Pump Installation (ft BMP): 26.79

Time: 0825

Pump and Tubing Type: Bailer

1 Well Volume (gal) = (Total Well Depth - Depth to Water) x Well Capacity = 1.79 x 3 5.97

Pump Intake Depth (ft BMP) –

Equipment Decon Method: 3 Rinse

Groundwater Disposal: GW-11 Pond

	Time Start (hrs)	Measurement Time (hrs)	Volume Purged (gal)	Cumul. Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft BMP)	pH (pH Units)	Temp (°C)	Specific Cond. mS/cm ~~(µS/cm)~~	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	Redox Poten. ORP (mV)
3WV	0810	0850	~6.0	~6.0								
SAMPLE	1040	1040	~0.25	~6.25	–	28.80	5.93	25.15	9.13	52.3	2.65	-71

JL
4-12-17

* Well Capacity (Gal/ft) for PVC Sch 40 Nominal Pipe Sizes: 0.75" = 0.026; 1" = 0.043; 1.5" = 0.103; 2" = 0.171; 4" = 0.652; 6" = 1.484; 12" = 5.766

SAMPLING DATA

Sampling Method(s): Bailer

Sampling Initiated (hrs): 1040

Sampling Ended (hrs): –

Field Decontamination: [✓ Y] N

Field Filtered: [✓ Y] N

QA Duplicate: Y N

COC Time: –

Material Codes: VOA=40 ml glass vial; AG=Amber Glass; CG=Clear Glass; PE=polyethylene; O=Other (Specify)

COC Number: –

Sample ID MFIW-01I - 20170412 **Duplicate ID:** –

QA/QC Samples/ID –

Sample Container Specification

No.	Material Code	Volume	Preserv. Used	Intended Analysis and/or Method
AP	Area	Sampling	Set	—

Remarks: (color, odor, sand & silt content, factors possibly affectring samples; condition of vault, wellhead, sampling appartus, etc.)

Sulfide: overflow

Signature(s):

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade

COC - Chain of Custody
Cond - Specific Conductivity
GS - Ground Surface

min - Minute
mg/L - milligram/Liter
mV - milli Volts

MP - Measuring Point
NTU - Nephelometric Units
QA/QC - Quality Assurance/Quality Control

TETRA TECH

GROUNDWATER SAMPLING LOG

(Purge Volume Method)

Page 1 of 1

NERT, Henderson, Nevada

Task Name: AP Area Treatability Study	Task Manager: Arul Ayyaswami	Well ID: UFIW-025
Field Samplers: D. Keady	Task No.: M13	Date: 4-12-17

PURGING DATA

MP Distance AGS (ft): —
Well Depth (ft BGS): —
Well Depth (ft BMP) 28.31
Nominal Well Pipe Size (in): 2
MP Description: TOC
PID/FID Readings Beneath Inner Cap (parts per million above known background): —
Screen Top: — (ft BGS) = — (ft BMP)
Screen Bottom: — (ft BGS) = — (ft BMP)
Well Riser Capacity* (gal/ft): —
Depth to Water Before Pump Installation (ft BMP): ~26.05 Time: —
Pump and Tubing Type: Bail
3 Well Volume (gal) = (Total Well Depth - Depth to Water) x Well Capacity = 1.17
Pump Intake Depth (ft BMP) —
Equipment Decon Method: — 3 bucket rinse
Groundwater Disposal: GW-11 Pond

	Time Start (hrs)	Measurement Time (hrs)	Volume Purged (gal)	Cumul. Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft BMP)	pH (pH Units)	Temp (°C)	mS/cm Specific Cond. (~~µS/cm~~)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	Redox Poten. ORP (mV)
3WV	0730	—	~1.17	~1.17	—	26.05						
SAMPLE	1020	1020	~0.25	~1.42	—	26.05	6.10	21.92	7.09	145	150	-131
	—											

JL
4-11-17

* Well Capacity (Gal/ft) for PVC Sch 40 Nominal Pipe Sizes: 0.75" = 0.026; 1" = 0.043; 1.5" = 0.103; 2" = 0.171; 4" = 0.652; 6" = 1.484; 12" = 5.766

SAMPLING DATA

Sampling Method(s): Bailer
Sampling Initiated (hrs):
Sampling Ended (hrs):
Field Decontamination: Y N
Field Filtered: Y N
QA Duplicate: Y N
COC Time:
Material Codes: VOA=40 ml glass vial; AG=Amber Glass; CG=Clear Glass; PE=polyethylene; O=Other (Specify)
COC Number: —
Sample ID UFIW-025-20170412
Duplicate ID: UFIW-025-20170412-FD
QA/QC Samples/ID —

Sample Container Specification				Intended Analysis and/or Method
No.	Material Code	Volume	Preserv. Used	
AP Area TS Sampling Set				

Remarks: (color, odor, sand & silt content, factors possibly affecting samples; condition of vault, wellhead, sampling appartus, etc.)

Sulfide : overflow
+ Dup

Signature(s):

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade

COC - Chain of Custody
Cond - Specific Conductivity
GS - Ground Surface

min - Minute
mg/L - milligram/Liter
mV - milli Volts

MP - Measuring Point
NTU - Nephelometric Units
QA/QC - Quality Assurance/Quality Control

TETRA TECH

GROUNDWATER SAMPLING LOG

(Purge Volume Method)

Page 1 of 1

NERT, Henderson, Nevada

Task Name: AP Area Treatability Study
Field Samplers: J. Lagade
Task Manager: A. Ayyarumi
Task No.: MW
Well ID: UFIW-02I
Date: 12 Apr 17

PURGING DATA

MP Distance AGS (ft): –
Well Depth (ft BGS): –
Well Depth (ft BMP) 41.00
Nominal Well Pipe Size (in): 2
MP Description: TOC
PID/FID Readings Beneath Inner Cap (parts per million above known background): –
Screen Top: – (ft BGS) = – (ft BMP)
Screen Bottom: – (ft BGS) = – (ft BMP)
Well Riser Capacity* (gal/ft): –
Depth to Water Before Pump Installation (ft BMP): 25.92
Time: 0907
Pump and Tubing Type: Bailer
1 Well Volume (gal) = (Total Well Depth - Depth to Water) x Well Capacity = 2.63 x 3 = 7.89
Pump Intake Depth (ft BMP) –
Equipment Decon Method: 3 Rinse
Groundwater Disposal: GW-11 Pond

	Time Start (hrs)	Measurement Time (hrs)	Volume Purged (gal)	Cumul. Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft BMP)	pH (pH Units)	Temp (°C)	Specific Cond. (mS/cm) ~~(µS/cm)~~	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	Redox Poten. ORP (mV)
3WV	0910	0945	~8.0	~8.0								
Sample	1120	1120	~0.25	~8.25	–	25.93	5.84	22.81	11.3	61.2	2.17	-50

JL
4-12-18

* Well Capacity (Gal/ft) for PVC Sch 40 Nominal Pipe Sizes: 0.75" = 0.026; 1" = 0.043; 1.5" = 0.103; 2" = 0.171; 4" = 0.652; 6" = 1.484; 12" = 5.766

SAMPLING DATA

Sampling Method(s): Bail
Sampling Initiated (hrs): 1120
Sampling Ended (hrs): –
Field Decontamination: [✓ Y] N
Field Filtered: [✓ Y] N
QA Duplicate: Y [✓ N]
COC Time: –
Material Codes: VOA=40 ml glass vial; AG=Amber Glass; CG=Clear Glass; PE=polyethylene; O=Other (Specify)
COC Number: –
Sample ID UFIW-02I-20170412
Duplicate ID: –
QA/QC Samples/ID –

Sample Container Specification				
No.	Material Code	Volume	Preserv. Used	Intended Analysis and/or Method
AP	Area	Sampling	SCA	–

Remarks: (color, odor, sand & silt content, factors possibly affectring samples; condition of vault, wellhead, sampling appartus, etc.)

Sulfide; overflow

Signature(s):

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade

COC - Chain of Custody
Cond - Specific Conductivity
GS - Ground Surface

min - Minute
mg/L - milligram/Liter
mV - milli Volts

MP - Measuring Point
NTU - Nephelometric Units
QA/QC - Quality Assurance/Quality Control

TETRA TECH

GROUNDWATER SAMPLING LOG
(Purge Volume Method)

Page 1 of 1

NERT, Henderson, Nevada

Task Name: AP Area Treatability Study		Task Manager: Arul Ayyaswami	Well ID: UFIW-035
Field Samplers: D. Keady		Task No.: M13	Date: 4-12-17

PURGING DATA

MP Distance AGS (ft): —	Well Depth (ft BGS): —	Well Depth (ft BMP) 30.04	Nominal Well Pipe Size (in): 2
MP Description: TOC	PID/FID Readings Beneath Inner Cap (parts per million above known background): —		

Screen Top: — (ft BGS) = — (ft BMP) Screen Bottom: — (ft BGS) = — (ft BMP) Well Riser Capacity* (gal/ft): —

Depth to Water Before Pump Installation (ft BMP): 25.95 Time: — Pump and Tubing Type: Bailer

3 Well Volume (gal) = (Total Well Depth - Depth to Water) x Well Capacity = 2.13 Pump Intake Depth (ft BMP) —

Equipment Decon Method: 3 bucket rinse Groundwater Disposal: GW-11 Pond

Time Start (hrs)	Measurement Time (hrs)	Volume Purged (gal)	Cumul. Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft BMP)	pH (pH Units)	Temp (°C)	Specific Cond. (mS ~~µS~~/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	Redox Poten. ORP (mV)
0750	—	~2.13	~2.13	—	25.95	—	—	—	—	—	—
	1055	—	—	—	—	5.71	21.68	5.81	467	8.94	-61

4-12-17

* Well Capacity (Gal/ft) for PVC Sch 40 Nominal Pipe Sizes: 0.75" = 0.026; 1" = 0.043; 1.5" = 0.103; 2" = 0.171; 4" = 0.652; 6" = 1.484; 12" = 5.766

SAMPLING DATA

Sampling Method(s): Bailer	Sampling Initiated (hrs): 1055	Sampling Ended (hrs): 1120
~~Field Decontamination: Y N~~ ~~Field Filtered: Y N~~	~~QA Duplicate: Y N~~	COC Time: 1055
~~Material Codes: VOA=40 ml glass vial; AG=Amber Glass; CG=Clear Glass; PE=polyethylene; O=Other (Specify)~~		COC Number: —

Sample ID UFIW-035-20170412 **Duplicate ID:** — **QA/QC Samples/ID** —

Sample Container Specification

No.	Material Code	Volume	Preserv. Used	Intended Analysis and/or Method
AP Area Treatability Study Sampling Set				

Remarks: (color, odor, sand & silt content, factors possibly affectring samples; condition of vault, wellhead, sampling appartus, etc.)

Sulfide: overflow

Signature(s):

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centiqrade

COC - Chain of Custody
Cond - Specific Conductivity
GS - Ground Surface

min - Minute
mg/L - milligram/Liter
mV - milli Volts

MP - Measuring Point
NTU - Nephelometric Units
QA/QC - Quality Assurance/Quality Control

TETRA TECH

GROUNDWATER SAMPLING LOG

(Purge Volume Method)

Page 1 of 1

NERT, Henderson, Nevada

Task Name: AP Area Treatability Study	Task Manager: Arul Ayyaswami	Well ID: UFIW-03I
Field Samplers: D. Keady	Task No.: M13	Date: 4-12-17

PURGING DATA

MP Distance AGS (ft): —	Well Depth (ft BGS): —	Well Depth (ft BMP) 40.59	Nominal Well Pipe Size (in): 2
MP Description: TOC	PID/FID Readings Beneath Inner Cap (parts per million above known background): —		
Screen Top: — (ft BGS) = — (ft BMP)	Screen Bottom: — (ft BGS) = — (ft BMP)	Well Riser Capacity* (gal/ft): —	
Depth to Water Before Pump Installation (ft BMP): 26.12	Time: —	Pump and Tubing Type: Bailer	
3 Well Volume (gal) = (Total Well Depth - Depth to Water) x Well Capacity = 7.56		Pump Intake Depth (ft BMP) —	
Equipment Decon Method: 3 bucket rinse		Groundwater Disposal: GW-11 Pond	

Time Start (hrs)	Measurement Time (hrs)	Volume Purged (gal)	Cumul. Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft BMP)	pH (pH Units)	Temp (°C)	Specific Cond. (mS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	Redox Poten. ORP (mV)
0950	—	~7.56	~7.56	—	26.12	—	—	—	—	—	—
	1210	—	—	—	—	6.07	25.07	7.14	52.2	8.43	-58

DK 4-12-17

* Well Capacity (Gal/ft) for PVC Sch 40 Nominal Pipe Sizes: 0.75" = 0.026; 1" = 0.043; 1.5" = 0.103; 2" = 0.171; 4" = 0.652; 6" = 1.484; 12" = 5.766

SAMPLING DATA

Sampling Method(s): Bailer	Sampling Initiated (hrs): 1210	Sampling Ended (hrs): 1230
Field Decontamination: Y N — Field Filtered: Y N	QA Duplicate: Y N	COC Time: 1210
Material Codes: VOA=40 ml glass vial; AG=Amber Glass; CG=Clear Glass; PE=polyethylene; O=Other (Specify)		COC Number: —
Sample ID UFIW-03I-20170412	Duplicate ID: —	QA/QC Samples/ID —

Sample Container Specification No.	Material Code	Volume	Preserv. Used	Intended Analysis and/or Method
AP Area TJ Sampling set —				

Remarks: (color, odor, sand & silt content, factors possibly affectring samples; condition of vault, wellhead, sampling appartus, etc.)

Sulfide: overflow

Signature(s): DK

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade

COC - Chain of Custody
Cond - Specific Conductivity
GS - Ground Surface

min - Minute
mg/L - milligram/Liter
mV - milli Volts

MP - Measuring Point
NTU - Nephelometric Units
QA/QC - Quality Assurance/Quality Control

TETRA TECH

GROUNDWATER SAMPLING LOG
(Purge Volume Method)

Page 1 of 1

NERT, Henderson, Nevada

Task Name: AP Area Treatability Study	Task Manager: Arul Ayyaswami	Well ID: UFIW-04S
Field Samplers: D. Keady	Task No.: M13	Date: 4-12-17

PURGING DATA

MP Distance AGS (ft): —	Well Depth (ft BGS): —	Well Depth (ft BMP) 28.37	Nominal Well Pipe Size (in): 2
MP Description: TOC	PID/FID Readings Beneath Inner Cap (parts per million above known background): —		
Screen Top: — (ft BGS) = — (ft BMP)	Screen Bottom: — (ft BGS) = — (ft BMP)	Well Riser Capacity* (gal/ft): —	
Depth to Water Before Pump Installation (ft BMP): 26.33	Time: —	Pump and Tubing Type: Bailer	
3 Well Volume (gal) = (Total Well Depth - Depth to Water) x Well Capacity = 1.08		Pump Intake Depth (ft BMP) —	
Equipment Decon Method: 3 bucket rinse	Groundwater Disposal: GW-11 Pond		

Time Start (hrs)	Measurement Time (hrs)	Volume Purged (gal)	Cumul. Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft BMP)	pH (pH Units)	Temp (°C)	Specific Cond. (mS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	Redox Poten. ORP (mV)
0815	—	~1.08	~1.08	—	—	—	—	—	—	—	—
	1125	—	—	—	—	5.98	22.79	4.22	135	9.78	-89

NA DK 4-12-17

* Well Capacity (Gal/ft) for PVC Sch 40 Nominal Pipe Sizes: 0.75" = 0.026; 1" = 0.043; 1.5" = 0.103; 2" = 0.171; 4" = 0.652; 6" = 1.484; 12" = 5.766

SAMPLING DATA

Sampling Method(s): Bailer	Sampling Initiated (hrs): 1125	Sampling Ended (hrs): 1145
~~Field Decontamination: Y N~~ ~~Field Filtered: Y N~~	~~QA Duplicate: Y N~~	COC Time: 1125
~~Material Codes: VOA=40 ml glass vial; AG=Amber Glass; CG=Clear Glass; PE=polyethylene; O=Other (Specify)~~		COC Number: —

Sample ID **Duplicate ID:** **QA/QC Samples/ID**

Sample Container Specification				
No.	Material Code	Volume	Preserv. Used	Intended Analysis and/or Method
AP Area TS Sampling Set				

Remarks: (color, odor, sand & silt content, factors possibly affecting samples; condition of vault, wellhead, sampling appartus, etc.)

Sulfide : overflow

Signature(s):

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade

COC - Chain of Custody
Cond - Specific Conductivity
GS - Ground Surface

min - Minute
mg/L - milligram/Liter
mV - milli Volts

MP - Measuring Point
NTU - Nephelometric Units
QA/QC - Quality Assurance/Quality Control

TETRA TECH

GROUNDWATER SAMPLING LOG

(Purge Volume Method)

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NERT, Henderson, Nevada

Task Name: AP Treatability Study		Task Manager: Arul Ayyaswami	Well ID: UFIW-04I
Field Samplers: D. Keady		Task No.: M13	Date: 4-12-17

PURGING DATA

MP Distance AGS (ft): —	Well Depth (ft BGS): —	Well Depth (ft BMP) 38.70	Nominal Well Pipe Size (in): 2
MP Description: TOC	PID/FID Readings Beneath Inner Cap (parts per million above known background): —		
Screen Top: — (ft BGS) = — (ft BMP)	Screen Bottom: — (ft BGS) = — (ft BMP)		Well Riser Capacity* (gal/ft): —
Depth to Water Before Pump Installation (ft BMP): 26.39	Time: —	Pump and Tubing Type: Bailer	
3 Well Volume (gal) = (Total Well Depth - Depth to Water) x Well Capacity = 6.45		Pump Intake Depth (ft BMP) —	
Equipment Decon Method: 3 bucket rinse	Groundwater Disposal: GW-11 Pond		

	Time Start (hrs)	Measurement Time (hrs)	Volume Purged (gal)	Cumul. Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft BMP)	pH (pH Units)	Temp (°C)	Specific Cond. ~~(µS/cm)~~ mS/cm	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	Redox Poten. ORP (mV)
3WV	1030	—	~6.45	~6.45	—	26.39	—	—	—	—	—	—
SAMPLE	1240	1240	~0.25	~6.70	—	26.34	6.11	21.61	6.62	15.6	6.63	-186

JL
4-12-17

* Well Capacity (Gal/ft) for PVC Sch 40 Nominal Pipe Sizes: 0.75" = 0.026; 1" = 0.043; 1.5" = 0.103; 2" = 0.171; 4" = 0.652; 6" = 1.484; 12" = 5.766

SAMPLING DATA

Sampling Method(s): Bailer	Sampling Initiated (hrs):	Sampling Ended (hrs):
~~Field Decontamination: Y N~~ Field Filtered: Y N	~~QA Duplicate: Y N~~	COC Time:
~~Material Codes: VOA=40 ml glass vial; AG=Amber Glass; CG=Clear Glass; PE=polyethylene; O=Other (Specify)~~		COC Number: —
Sample ID UFIW-04I-20170412 **Duplicate ID:** —		**QA/QC Samples/ID** —

Sample Container Specification				
No.	Material Code	Volume	Preserv. Used	Intended Analysis and/or Method
AP Area TS Sampling Set				

Remarks: (color, odor, sand & silt content, factors possibly affectring samples; condition of vault, wellhead, sampling appartus, etc.)

Sulfide: overflow
Level 4

Signature(s):

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centiqrade

COC - Chain of Custody
Cond - Specific Conductivity
GS - Ground Surface

min - Minute
mg/L - milligram/Liter
mV - milli Volts

MP - Measuring Point
NTU - Nephelometric Units
QA/QC - Quality Assurance/Quality Control

TETRA TECH

GROUNDWATER SAMPLING LOG

(Purge Volume Method)

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NERT, Henderson, Nevada

Task Name: AP Area Treatability Study	Task Manager: Anil Agrawal	Well ID: UFIW-055
Field Samplers: J. Lopez	Task No.: M13	Date: 10 April 17

PURGING DATA

MP Distance AGS (ft): –
Well Depth (ft BGS): –
Well Depth (ft BMP) 29.37
Nominal Well Pipe Size (in): 2
MP Description: TOC
PID/FID Readings Beneath Inner Cap (parts per million above known background): –
Screen Top: – (ft BGS) = – (ft BMP)
Screen Bottom: – (ft BGS) = – (ft BMP)
Well Riser Capacity* (gal/ft): –
Depth to Water Before Pump Installation (ft BMP): 26.71
Time: 0907
Pump and Tubing Type: Bailer
1 Well Volume (gal) = (Total Well Depth - Depth to Water) x Well Capacity = 0.46 (4 1.38)
Pump Intake Depth (ft BMP) –
Equipment Decon Method: 3 rinse
Groundwater Disposal: GW-11 Pond

	Time Start (hrs)	Measurement Time (hrs)	Volume Purged (gal)	Cumul. Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft BMP)	pH (pH Units)	Temp (°C)	(mS/cm) Specific Cond. (~~µS/cm~~)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	Redox Poten. ORP (mV)
3WV	0910	0935	~2-gal	~2-gal	–	–	–	–	–	–	–	–
sample	1350	1350	~.25	~2.25	–	26.70	6.54	26.54	5.57	25.4	0.87	-170

JL
04-10-17

* Well Capacity (Gal/ft) for PVC Sch 40 Nominal Pipe Sizes: 0.75" = 0.026; 1" = 0.043; 1.5" = 0.103; 2" = 0.171; 4" = 0.652; 6" = 1.484; 12" = 5.766

SAMPLING DATA

Sampling Method(s): Bail
Sampling Initiated (hrs):
Sampling Ended (hrs):
Field Decontamination: Y N
Field Filtered: Y N
QA Duplicate: Y N
COC Time: 1350
Material Codes: VOA=40 ml glass vial; AG=Amber Glass; CG=Clear Glass; PE=polyethylene; O=Other (Specify)
COC Number:
Sample ID UFIW-055-20170410 **Duplicate ID:** **QA/QC Samples/ID**

Sample Container Specification				
No.	Material Code	Volume	Preserv. Used	Intended Analysis and/or Method
AP Area TT Sampling Suite				

Remarks: (color, odor, sand & silt content, factors possibly affectring samples; condition of vault, wellhead, sampling appartus, etc.)

Sulfide: overflow

Signature(s):

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
Cond - Specific Conductivity
GS - Ground Surface
min - Minute
mg/L - milligram/Liter
mV - milli Volts
MP - Measuring Point
NTU - Nephelometric Units
QA/QC - Quality Assurance/Quality Control

TETRA TECH

GROUNDWATER SAMPLING LOG
(Purge Volume Method)

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NERT, Henderson, Nevada

Task Name: AP Area Treatability Study
Task Manager: A. Ayyaswami
Well ID: UFIW-051
Field Samplers: J. Legarde
Task No.: M13
Date: 10 Apr 17

PURGING DATA

MP Distance AGS (ft): -
Well Depth (ft BGS): -
Well Depth (ft BMP) 39.25
Nominal Well Pipe Size (in): 2
MP Description: TOC
PID/FID Readings Beneath Inner Cap (parts per million above known background): -
Screen Top: - (ft BGS) = - (ft BMP)
Screen Bottom: - (ft BGS) = - (ft BMP)
Well Riser Capacity* (gal/ft): -
Depth to Water Before Pump Installation (ft BMP): 26.79
Time: 1145
Pump and Tubing Type: Bail
1 Well Volume (gal) = (Total Well Depth - Depth to Water) x Well Capacity = 2.17 ~~4~~ 6.51
Pump Intake Depth (ft BMP) -
Equipment Decon Method: 3 Rinse
Groundwater Disposal: GW-11 Pond

	Time Start (hrs)	Measurement Time (hrs)	Volume Purged (gal)	Cumul. Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft BMP)	pH (pH Units)	Temp (°C)	Specific Cond. (~~µS/cm~~) mS/cm	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	Redox Poten. ORP (mV)
3 WV	1150	1230	~7.0	~7.0								
Sample	1435	1435	~0.25	~7.25	-	26.81	7.18	27.36	4.00	245	1.98	-149

JL
04-10-17

* Well Capacity (Gal/ft) for PVC Sch 40 Nominal Pipe Sizes: 0.75" = 0.026; 1" = 0.043; 1.5" = 0.103; 2" = 0.171; 4" = 0.652; 6" = 1.484; 12" = 5.766

SAMPLING DATA

Sampling Method(s):
Sampling Initiated (hrs):
Sampling Ended (hrs):
Field Decontamination: Y N
Field Filtered: Y N
QA Duplicate: Y N
COC Time: 1425
Material Codes: VOA=40 ml glass vial; AG=Amber Glass; CG=Clear Glass; PE=polyethylene; O=Other (Specify)
COC Number:
Sample ID UFIW-05I-20170410 **Duplicate ID:**
QA/QC Samples/ID

Sample Container Specification				
No.	Material Code	Volume	Preserv. Used	Intended Analysis and/or Method
AP Area II Sampling Suite				

Remarks: (color, odor, sand & silt content, factors possibly affectring samples; condition of vault, wellhead, sampling appartus, etc.)

Sulfide : overflow

Signature(s):

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
Cond - Specific Conductivity
GS - Ground Surface
min - Minute
mg/L - milligram/Liter
mV - milli Volts
MP - Measuring Point
NTU - Nephelometric Units
QA/QC - Quality Assurance/Quality Control

TETRA TECH

GROUNDWATER SAMPLING LOG

(Purge Volume Method)

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NERT, Henderson, Nevada

Task Name: AP Area Treatability Study	Task Manager: A. Ayyasuni	Well ID: UFIW-065
Field Samplers: J. Laguda	Task No.: M13	Date: 10 Apr 17

PURGING DATA

MP Distance AGS (ft): –	Well Depth (ft BGS): –	Well Depth (ft BMP) 31.70	Nominal Well Pipe Size (in): 2
MP Description: TOC	PID/FID Readings Beneath Inner Cap (parts per million above known background): –		
Screen Top: – (ft BGS) = – (ft BMP)	Screen Bottom: – (ft BGS) = ~~31.7~~ (ft BMP)	Well Riser Capacity* (gal/ft): –	
Depth to Water Before Pump Installation (ft BMP): 27.02	Time: 0941	Pump and Tubing Type:	
1 Well Volume (gal) = (Total Well Depth - Depth to Water) x Well Capacity = 0.81 → 2.43		Pump Intake Depth (ft BMP) –	
Equipment Decon Method: 3 Rinse	Groundwater Disposal: GW-11 Pond		

	Time Start (hrs)	Measurement Time (hrs)	Volume Purged (gal)	Cumul. Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft BMP)	pH (pH Units)	Temp (°C)	Specific Cond. (~~µS/cm~~ mS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	Redox Poten. ORP (mV)
3WV	0945	1005	~2.5	~2.5	–	–	–	–	–	–	–	–
sample	1450	1450	~0.25	~2.75	–	27.10	6.69	25.17	4.58	>1000	2.53	-207

JL
04-10-17

* Well Capacity (Gal/ft) for PVC Sch 40 Nominal Pipe Sizes: 0.75" = 0.026; 1" = 0.043; 1.5" = 0.103; 2" = 0.171; 4" = 0.652; 6" = 1.484; 12" = 5.766

SAMPLING DATA

Sampling Method(s):	Sampling Initiated (hrs):	Sampling Ended (hrs):
Field Decontamination: Y N / Field Filtered: Y N	QA Duplicate: Y N	COC Time: 1450
Material Codes: VOA=40 ml glass vial; AG=Amber Glass; CG=Clear Glass; PE=polyethylene; O=Other (Specify)		COC Number:

Sample ID UFIW-065-20170410 **Duplicate ID:**

QA/QC Samples/ID

Sample Container Specification

No.	Material Code	Volume	Preserv. Used	Intended Analysis and/or Method
AP Area TS Sampling Suite				

Remarks: (color, odor, sand & silt content, factors possibly affectring samples; condition of vault, wellhead, sampling appartus, etc.)

Sulfide: overflow

Signature(s):

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade

COC - Chain of Custody
Cond - Specific Conductivity
GS - Ground Surface

min - Minute
mg/L - milligram/Liter
mV - milli Volts

MP - Measuring Point
NTU - Nephelometric Units
QA/QC - Quality Assurance/Quality Control

TETRA TECH

GROUNDWATER SAMPLING LOG
(Purge Volume Method)

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NERT, Henderson, Nevada

Task Name: AP Area Treatability Study	Task Manager: A. Ayyaswami	Well ID: UFIW-06I-~~2017~~ 02
Field Samplers:	Task No.:	Date: 11 Apr 17

PURGING DATA

MP Distance AGS (ft): –
Well Depth (ft BGS): –
Well Depth (ft BMP) 44.87
Nominal Well Pipe Size (in): 2

MP Description: TOC
PID/FID Readings Beneath Inner Cap (parts per million above known background): –

Screen Top: – (ft BGS) = – (ft BMP)
Screen Bottom: – (ft BGS) = – (ft BMP)
Well Riser Capacity* (gal/ft): –

Depth to Water Before Pump Installation (ft BMP): 26.83 Time: 0822
Pump and Tubing Type: Bailer

1 Well Volume (gal) = (Total Well Depth - Depth to Water) x Well Capacity = 3.14 → 9.42
Pump Intake Depth (ft BMP) –

Equipment Decon Method: 3 rinse
Groundwater Disposal: GW-11 Pond

	Time Start (hrs)	Measurement Time (hrs)	Volume Purged (gal)	Cumul. Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft BMP)	pH (pH Units)	Temp (°C)	Specific Cond. ~~(µS/cm)~~ (mS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	Redox Poten. ORP (mV)
3WV	0830	0905	~9.5	~1.5								
Sample	1335	1335	~0.25	~9.75	—	26.83	5.61	26.73	8.71	32.4	1.05	-194

JV
4-11-17

* Well Capacity (Gal/ft) for PVC Sch 40 Nominal Pipe Sizes: 0.75" = 0.026; 1" = 0.043; 1.5" = 0.103; 2" = 0.171; 4" = 0.652; 6" = 1.484; 12" = 5.766

SAMPLING DATA

Sampling Method(s):
Sampling Initiated (hrs): 1335
Sampling Ended (hrs):

Field Decontamination: [✓ Y] N
Field Filtered: [✓ Y] N
QA Duplicate: Y [✓ N]
COC Time: –

Material Codes: VOA=40 ml glass vial; AG=Amber Glass; CG=Clear Glass; PE=polyethylene; O=Other (Specify)
COC Number: –

Sample ID UFIW-06I-20170411
Duplicate ID: –
QA/QC Samples/ID –

Sample Container Specification				
No.	Material Code	Volume	Preserv. Used	Intended Analysis and/or Method
AP	Area	Sampling	Set	

Remarks: (color, odor, sand & silt content, factors possibly affectring samples; condition of vault, wellhead, sampling appartus, etc.)

Sulfide: Chemflow

Signature(s):

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade

COC - Chain of Custody
Cond - Specific Conductivity
GS - Ground Surface

min - Minute
mg/L - milligram/Liter
mV - milli Volts

MP - Measuring Point
NTU - Nephelometric Units
QA/QC - Quality Assurance/Quality Control

TETRA TECH

GROUNDWATER SAMPLING LOG

(Purge Volume Method)

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NERT, Henderson, Nevada

Task Name: AP Area Treatability Study	Task Manager: A. Aggarwal	Well ID: UFIW-075
Field Samplers: J. Lagudo	Task No.: M13	Date: 10 Apr 17

PURGING DATA

MP Distance AGS (ft): –	Well Depth (ft BGS): –	Well Depth (ft BMP) 30.88	Nominal Well Pipe Size (in): 2
MP Description: TOC	PID/FID Readings Beneath Inner Cap (parts per million above known background): –		
Screen Top: — (ft BGS) = 25.88 (ft BMP)	Screen Bottom: — (ft BGS) = 30.88 (ft BMP)	Well Riser Capacity* (gal/ft): ~	
Depth to Water Before Pump Installation (ft BMP): 27.01	Time: 1034	Pump and Tubing Type: Bailer	
1 Well Volume (gal) = (Total Well Depth - Depth to Water) x Well Capacity = 0.67→2.01		Pump Intake Depth (ft BMP) –	
Equipment Decon Method: Al Conox	Groundwater Disposal: GW-11 Pond		

	Time Start (hrs)	Measurement Time (hrs)	Volume Purged (gal)	Cumul. Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft BMP)	pH (pH Units)	Temp (°C)	Specific Cond. (~~µ~~mS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L) Horiba/YSI	Redox Poten. ORP (mV)
3WV	1037	1055	~2.25	~2.25								
		1425					7.34	30.59	6.12	16.4	7.03/1.38	-152

JL 4-10-17

* Well Capacity (Gal/ft) for PVC Sch 40 Nominal Pipe Sizes: 0.75" = 0.026; 1" = 0.043; 1.5" = 0.103; 2" = 0.171; 4" = 0.652; 6" = 1.484; 12" = 5.766

SAMPLING DATA

Sampling Method(s):	Sampling Initiated (hrs): 1425	Sampling Ended (hrs): 1445
Field Decontamination: Y N / Field Filtered: Y [✓ N]	QA Duplicate: Y N	COC Time: 1425
Material Codes: VOA=40 ml glass vial; AG=Amber Glass; CG=Clear Glass; PE=polyethylene; O=Other (Specify)		COC Number: —
Sample ID UF IW-075-2017[illegible] **Duplicate ID:** —		**QA/QC Samples/ID** —

Sample Container Specification				
No.	Material Code	Volume	Preserv. Used	Intended Analysis and/or Method
AP Area TS Analysis Suite				

Remarks: (color, odor, sand & silt content, factors possibly affectring samples; condition of vault, wellhead, sampling appartus, etc.)

Sulfide: overflow

Signature(s):

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade

COC - Chain of Custody
Cond - Specific Conductivity
GS - Ground Surface

min - Minute
mg/L - milligram/Liter
mV - milli Volts

MP - Measuring Point
NTU - Nephelometric Units
QA/QC - Quality Assurance/Quality Control

TETRA TECH

GROUNDWATER SAMPLING LOG

(Purge Volume Method)

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NERT, Henderson, Nevada

Task Name: AP Area Treatability Study	Task Manager: A. Ayyaswami	Well ID: UFIW-07I
Field Samplers: J. Legrande	Task No.: MB	Date: 11 Apr 17

PURGING DATA

MP Distance AGS (ft): — | Well Depth (ft BGS): — | Well Depth (ft BMP) 41.27 | Nominal Well Pipe Size (in): 2

MP Description: TOC | PID/FID Readings Beneath Inner Cap (parts per million above known background): —

Screen Top: — (ft BGS) = — (ft BMP) | Screen Bottom: — (ft BGS) = — (ft BMP) | Well Riser Capacity* (gal/ft): —

Depth to Water Before Pump Installation (ft BMP): 26.84 Time: 0920 | Pump and Tubing Type: Bailer

1 Well Volume (gal) = (Total Well Depth - Depth to Water) x Well Capacity = 2.52 ×7.56 | Pump Intake Depth (ft BMP) —

Equipment Decon Method: 3 rinse | Groundwater Disposal: GW-11 End

	Time Start (hrs)	Measurement Time (hrs)	Volume Purged (gal)	Cumul. Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft BMP)	pH (pH Units)	Temp (°C)	mS/cm Specific Cond. (~~µS/cm~~)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	Redox Poten. ORP (mV)
3WV	0925	0955	~8.00	~8.00								
sample	1410	1410	~0.25	~8.25	—	26.84	5.73	25.54	8.46	40.8	1.82	-201

JL
4-11-17

* Well Capacity (Gal/ft) for PVC Sch 40 Nominal Pipe Sizes: 0.75" = 0.026; 1" = 0.043; 1.5" = 0.103; 2" = 0.171; 4" = 0.652; 6" = 1.484; 12" = 5.766

SAMPLING DATA

Sampling Method(s): Bail | Sampling Initiated (hrs): 1410 | Sampling Ended (hrs): —

Field Decontamination: [✓ Y] N | Field Filtered: [✓ Y] N | QA Duplicate: Y [✓ N] | COC Time: —

Material Codes: VOA=40 ml glass vial; AG=Amber Glass; CG=Clear Glass; PE=polyethylene; O=Other (Specify) | COC Number: —

Sample ID UFIW-07I-20170411 **Duplicate ID:** — **QA/QC Samples/ID** —

Sample Container Specification				
No.	Material Code	Volume	Preserv. Used	Intended Analysis and/or Method
AP Area Sampling Sett				

Remarks: (color, odor, sand & silt content, factors possibly affectring samples; condition of vault, wellhead, sampling appartus, etc.)

Sulfide; overflow

Signature(s):

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade

COC - Chain of Custody
Cond - Specific Conductivity
GS - Ground Surface

min - Minute
mg/L - milligram/Liter
mV - milli Volts

MP - Measuring Point
NTU - Nephelometric Units
QA/QC - Quality Assurance/Quality Control

TETRA TECH

GROUNDWATER SAMPLING LOG
(Purge Volume Method)

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NERT, Henderson, Nevada

Task Name: AP Area Treatability Study
Task Manager: A. Ayyaswami
Well ID: UFIW-085
Field Samplers: J. Lugade
Task No.: M11
Date: 10 Apr 17

PURGING DATA

MP Distance AGS (ft): –
Well Depth (ft BGS): –
Well Depth (ft BMP) 29.67
Nominal Well Pipe Size (in): 2
MP Description: TOC
PID/FID Readings Beneath Inner Cap (parts per million above known background): –
Screen Top: – (ft BGS) = 24.67 (ft BMP)
Screen Bottom: – (ft BGS) = 29.67 (ft BMP)
Well Riser Capacity* (gal/ft): –
Depth to Water Before Pump Installation (ft BMP): 26.95
Time: 1107
Pump and Tubing Type: Bailer
1 Well Volume (gal) = (Total Well Depth - Depth to Water) x Well Capacity = 0.47 / 1.41
Pump Intake Depth (ft BMP) –
Equipment Decon Method: 3 Rinse
Groundwater Disposal: GW-11 Pond

Time Start (hrs)	Measurement Time (hrs)	Volume Purged (gal)	Cumul. Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft BMP)	pH (pH Units)	Temp (°C)	Specific Cond. (mS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	Redox Poten. ORP (mV)
3WV 1110	1130	~1.50	~1.5							Horiba/YSI	
1345	1345					7.28	31.09	5.54	25.2	8.02/148	-110

4/10/17

* Well Capacity (Gal/ft) for PVC Sch 40 Nominal Pipe Sizes: 0.75" = 0.026; 1" = 0.043; 1.5" = 0.103; 2" = 0.171; 4" = 0.652; 6" = 1.484; 12" = 5.766

SAMPLING DATA

~~Sampling Method(s):~~
Sampling Initiated (hrs): 1345
Sampling Ended (hrs): 1415
~~Field Decontamination: Y N~~
~~Field Filtered: Y N~~
~~QA Duplicate: Y N~~
COC Time: 1345
Material Codes: VOA=40 ml glass vial; AG=Amber Glass; CG=Clear Glass; PE=polyethylene; O=Other (Specify)
COC Number: –
Sample ID UFIW-085-20170410
Duplicate ID: –
QA/QC Samples/ID –

Sample Container Specification				Intended Analysis and/or Method
No.	Material Code	Volume	Preserv. Used	
AP Area TS Sampling Suite				✓

Remarks: (color, odor, sand & silt content, factors possibly affectring samples; condition of vault, wellhead, sampling appartus, etc.)

Sulfide: Overflow

Signature(s):

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
Cond - Specific Conductivity
GS - Ground Surface
min - Minute
mg/L - milligram/Liter
mV - milli Volts
MP - Measuring Point
NTU - Nephelometric Units
QA/QC - Quality Assurance/Quality Control

TETRA TECH

GROUNDWATER SAMPLING LOG
(Purge Volume Method)

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NERT, Henderson, Nevada

Task Name: AP Area Treatability Study	Task Manager: A. Ayyouni	Well ID: UFIW-08I
Field Samplers: J. Lujan	Task No.: M13	Date: 11 Apr 17

PURGING DATA

MP Distance AGS (ft): —
Well Depth (ft BGS): —
Well Depth (ft BMP) 39.89
Nominal Well Pipe Size (in): 2
MP Description: TOC
PID/FID Readings Beneath Inner Cap (parts per million above known background): —
Screen Top: _______ (ft BGS) = _______ (ft BMP)
Screen Bottom: ______ (ft BGS) = ______ (ft BMP)
Well Riser Capacity* (gal/ft): —
Depth to Water Before Pump Installation (ft BMP): 28.81 Time: 1020
Pump and Tubing Type: Bailer
1 Well Volume (gal) = (Total Well Depth - Depth to Water) x Well Capacity = 2.28 + 6.84
Pump Intake Depth (ft BMP) —
Equipment Decon Method: I Rinse
Groundwater Disposal: GW-11 Pond

	Time Start (hrs)	Measurement Time (hrs)	Volume Purged (gal)	Cumul. Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft BMP)	pH (pH Units)	Temp (°C)	mS/cm Specific Cond. ~~(µS/cm)~~	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	Redox Poten. ORP (mV)
3WV	1026	1105	~7.0	~7.0								
Sample	1435	1435	~0.25	~7.25	—	26.81	5.85	24.47	9.73	+1000	3.30	-213

JL
4-11-17

* Well Capacity (Gal/ft) for PVC Sch 40 Nominal Pipe Sizes: 0.75" = 0.026; 1" = 0.043; 1.5" = 0.103; 2" = 0.171; 4" = 0.652; 6" = 1.484; 12" = 5.766

SAMPLING DATA

Sampling Method(s): Bail
Sampling Initiated (hrs): 1435
Sampling Ended (hrs): —
Field Decontamination: [✓ Y] N
Field Filtered: [✓ Y] N
QA Duplicate: Y [✓ N]
COC Time: —
Material Codes: VOA=40 ml glass vial; AG=Amber Glass; CG=Clear Glass; PE=polyethylene; O=Other (Specify)
COC Number: —
Sample ID UFIW-08I-20170411 **Duplicate ID:** — **QA/QC Samples/ID** —

Sample Container Specification				
No.	Material Code	Volume	Preserv. Used	Intended Analysis and/or Method
AP	Area	Sampling	Set	

Remarks: (color, odor, sand & silt content, factors possibly affectring samples; condition of vault, wellhead, sampling appartus, etc.)

Sulfide: Overflow

Signature(s): ____________

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade

COC - Chain of Custody
Cond - Specific Conductivity
GS - Ground Surface

min - Minute
mg/L - milligram/Liter
mV - milli Volts

MP - Measuring Point
NTU - Nephelometric Units
QA/QC - Quality Assurance/Quality Control

TETRA TECH

GROUNDWATER SAMPLING LOG
(Purge Volume Method)

Page 1 of 1

NERT, Henderson, Nevada

Task Name: AP Area Treatability Study
Field Samplers: D. Keady
Task Manager: Arul Ayyaswami
Task No.: MI3
Well ID: UFMW-015
Date: 4-12-17

PURGING DATA

MP Distance AGS (ft): —
Well Depth (ft BGS): 29
Well Depth (ft BMP) —
Nominal Well Pipe Size (in): 2
MP Description: TOC
PID/FID Readings Beneath Inner Cap (parts per million above known background): —
Screen Top: — (ft BGS) = — (ft BMP)
Screen Bottom: — (ft BGS) = — (ft BMP)
Well Riser Capacity* (gal/ft): —
Depth to Water Before Pump Installation (ft BMP): 28.61
Time: —
Pump and Tubing Type: —
1 Well Volume (gal) = (Total Well Depth - Depth to Water) x Well Capacity = —
Pump Intake Depth (ft BMP) —
Equipment Decon Method: —
Groundwater Disposal: —

Time Start (hrs)	Measurement Time (hrs)	Volume Purged (gal)	Cumul. Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft BMP)	pH (pH Units)	Temp (°C)	Specific Cond. (µS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	Redox Poten. ORP (mV)
LESS THAN 1" OF WATER OBSERVED IN WELL; UNABLE TO SAMPLE.											

HDK 4.12.17

* Well Capacity (Gal/ft) for PVC Sch 40 Nominal Pipe Sizes: 0.75" = 0.026; 1" = 0.043; 1.5" = 0.103; 2" = 0.171; 4" = 0.652; 6" = 1.484; 12" = 5.766

SAMPLING DATA

Sampling Method(s):
Sampling Initiated (hrs):
Sampling Ended (hrs):
Field Decontamination: Y N
Field Filtered: Y N
QA Duplicate: Y N
COC Time:
Material Codes: VOA=40 ml glass vial; AG=Amber Glass; CG=Clear Glass; PE=polyethylene; O=Other (Specify)
COC Number:
Sample ID
Duplicate ID:
QA/QC Samples/ID

Sample Container Specification				
No.	Material Code	Volume	Preserv. Used	Intended Analysis and/or Method

Remarks: (color, odor, sand & silt content, factors possibly affectring samples; condition of vault, wellhead, sampling appartus, etc.)

INSUFFICIENT AMOUNT OF WATER IN WELL TO SAMPLE.

Signature(s):

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
Cond - Specific Conductivity
GS - Ground Surface
min - Minute
mg/L - milligram/Liter
mV - milli Volts
MP - Measuring Point
NTU - Nephelometric Units
QA/QC - Quality Assurance/Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study
Task Manager: Arul Ayyaswami
Task No: M13
Well ID: UFMW-01I
Field Samplers: D. Keady
Recorded by: D. Keady
Date: 4-11-17
Well Depth (ft BGS): —
MP Distance AGS (ft): —
Well Depth (ft BMP): 38
Screened/Open Interval Top: — (ft BGS) 34 (ft BMP)
Well Diameter (in): 2
PID/FID Readings Beneath Inner Cap (ppm cge akb): —
Screened/Open Interval Bottom: — (ft BGS) 39 (ft BMP)
Pump and Tubing Type: Dedicated plastic pump; poly tub.
Pump Intake Depth: 36.5 (ft ~~BGS~~) BMP — (ft BMP)
MP Description: TOC
Equipment Decon. Method: 3 bucket rinse (decon of dedicated [illegible])
Depth to Water Before Pump Installation (ft BMP): 28.54
Time: 0845
GW Disposal: GW-11

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity mS/cm (~~dS/cm~~) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Hach/YSI READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0907	X		24.48		7.56		4.97		1.33/4.80		83		0.0		100	28.68	0
0912	X		25.57		7.58		4.85		0.48/3.32		88		0.0		100	28.68	500
0917	X		25.95		7.63		4.83		0.24/2.50		88		0.0		100	28.68	1000
0922	X		26.23		7.65		4.83		0.13/1.94		89		0.0		100	28.68	1500
0927	X		26.48		7.65		4.83		0.03/1.83		89		0.0		100	28.68	2000
0932	X		26.56		7.65		4.83		0.01/1.78		89		0.0		100	28.69	2500
0937	X		26.68		7.67		4.82		0.00/1.75		88		0.0		100	28.69	3000
0945		X	STABILIZATION														

DK 4-11-17

Sample ID: UFMW-01I-20170411
Duplicate ID: —
QA/QC Samples/ID: —
COC Time: 0945

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area Sampling Set				—

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N
Field Filtered: Y N
COC Number:

Comments:

Sulfide: 0.00 mg/L

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

GROUNDWATER SAMPLING LOG

(Purge Volume Method)

Page 1 of 1

NERT, Henderson, Nevada

Task Name: AT Area Treatability Study
Task Manager: A. Ayyanuni
Well ID: UFMW-~~[illegible]~~ 025
Field Samplers: J. Lugade
Task No.: M13
Date: 12 Apr 17

PURGING DATA

MP Distance AGS (ft): —
Well Depth (ft BGS): —
Well Depth (ft BMP) 29.25
Nominal Well Pipe Size (in): 2
MP Description: TOC
PID/FID Readings Beneath Inner Cap (parts per million above known background): —
Screen Top: ______ (ft BGS) = ______ (ft BMP)
Screen Bottom: ______ (ft BGS) = ______ (ft BMP)
Well Riser Capacity* (gal/ft): —
Depth to Water Before Pump Installation (ft BMP): 27.44 Time: 0806
Pump and Tubing Type: Bailer
1 Well Volume (gal) = (Total Well Depth - Depth to Water) x Well Capacity = 0.32 → 0.96
Pump Intake Depth (ft BMP) —
Equipment Decon Method: 3 Rinse
Groundwater Disposal: GW-11 Pink

	Time Start (hrs)	Measurement Time (hrs)	Volume Purged (gal)	Cumul. Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft BMP)	pH (pH Units)	Temp (°C)	mS/cm Specific Cond. ~~(µS/cm)~~	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	Redox Poten. ORP (mV)
3WV	0808	0808	~1.0	~1.0								
SAMPLE	1210	1210	~0.25	~1.25	—	27.44	6.30	26.61	6.50	211	2.95	12

JL
4-12-17

* Well Capacity (Gal/ft) for PVC Sch 40 Nominal Pipe Sizes: 0.75" = 0.026; 1" = 0.043; 1.5" = 0.103; 2" = 0.171; 4" = 0.652; 6" = 1.484; 12" = 5.766

SAMPLING DATA

Sampling Method(s): Bailer
Sampling Initiated (hrs): 1210
Sampling Ended (hrs): —
Field Decontamination: [✓ Y] N
Field Filtered: [✓ Y] N
QA Duplicate: Y [✓ N]
COC Time:
Material Codes: VOA=40 ml glass vial; AG=Amber Glass; CG=Clear Glass; PE=polyethylene; O=Other (Specify)
COC Number:
Sample ID UFMW-025
Duplicate ID: —
QA/QC Samples/ID —

Sample Container Specification				
No.	Material Code	Volume	Preserv. Used	Intended Analysis and/or Method
AT Area Sampling Set				

Remarks: (color, odor, sand & silt content, factors possibly affectring samples; condition of vault, wellhead, sampling appartus, etc.)

Sulfide 0.00 mg/L

Signature(s):

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
Cond - Specific Conductivity
GS - Ground Surface
min - Minute
mg/L - milligram/Liter
mV - milli Volts
MP - Measuring Point
NTU - Nephelometric Units
QA/QC - Quality Assurance/Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: Arul Ayyaswami	Task No: M13	**Well ID:** UFMW-02I
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 4-11-17
Well Depth (ft BGS): —	MP Distance AGS (ft): — / Well Depth (ft BMP): 39	Screened/Open Interval Top: —	(ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: —	(ft BGS) 39 (ft BMP)
Pump and Tubing Type: Dedicated plastic pump; dedicated poly	Pump Intake Depth: 36.5	(ft ~~BGS~~) BMP — (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse; no decon for dedicated tubing	Depth to Water Before Pump Installation (ft BMP): 28.65	Time: 1015	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity m(µS/cm) READ	Spec Conductivity m(µS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1026	X		29.08		7.55		5.98		2.02/3.98		105		59.3		100	28.77	
1031	X		29.17		7.76		5.22		1.02/2.41		94		24.5		100	28.78	
1036	X		29.20		7.83		5.04		0.66/2.32		90		12.8		100	28.79	
1041	X		29.20		7.83		4.90		0.31/1.73		89		5.9		100	28.80	
1046	X		29.23		7.82		4.75		0.11/1.69		88		0.0		100	28.80	
1051	X		29.26		7.84		4.75		0.09/1.68		86		0.0		100	28.80	
1056	X		29.59	✓	7.82	✓	4.73	✓	0.04/1.66	✓	86	✓	0.0	✓	100	28.80	
1105		X	STABILIZATION														

DK 4-11-17

Sample ID: UFMW-02I-20170411 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1105

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area Sampling Suite —				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Sulfide: 0.00 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

GROUNDWATER SAMPLING LOG
(Purge Volume Method)

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NERT, Henderson, Nevada

Task Name: AP Area Treatability Study
Task Manager: Anil Ayyemani
Well ID: UFMW-035
Field Samplers: D. Kendy
Task No.: M13
Date: 4-12-17

PURGING DATA

MP Distance AGS (ft): —
Well Depth (ft BGS): —
Well Depth (ft BMP)
Nominal Well Pipe Size (in): 2
MP Description: TOC
PID/FID Readings Beneath Inner Cap (parts per million above known background): —
Screen Top: — (ft BGS) = — (ft BMP)
Screen Bottom: — (ft BGS) = — (ft BMP)
Well Riser Capacity* (gal/ft): —
Depth to Water Before Pump Installation (ft BMP): DRY
Time: —
Pump and Tubing Type: —
1 Well Volume (gal) = (Total Well Depth - Depth to Water) x Well Capacity = —
Pump Intake Depth (ft BMP) —
Equipment Decon Method: —
Groundwater Disposal: —

Time Start (hrs)	Measurement Time (hrs)	Volume Purged (gal)	Cumul. Volume Purged (gal)	Purge Rate (gpm)	Depth to Water (ft BMP)	pH (pH Units)	Temp (°C)	Specific Cond. (µS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	Redox Poten. ORP (mV)
WELL OBSERVED TO BE DRY; UNABLE TO SAMPLE											

4-12-17

* Well Capacity (Gal/ft) for PVC Sch 40 Nominal Pipe Sizes: 0.75" = 0.026; 1" = 0.043; 1.5" = 0.103; 2" = 0.171; 4" = 0.652; 6" = 1.484; 12" = 5.766

SAMPLING DATA

Sampling Method(s):
Sampling Initiated (hrs):
Sampling Ended (hrs):
Field Decontamination: Y N
Field Filtered: Y N
QA Duplicate: Y N
COC Time:
Material Codes: VOA=40 ml glass vial; AG=Amber Glass; CG=Clear Glass; PE=polyethylene; O=Other (Specify)
COC Number:

Sample ID
Duplicate ID:
QA/QC Samples/ID

Sample Container Specification				
No.	Material Code	Volume	Preserv. Used	Intended Analysis and/or Method

Remarks: (color, odor, sand & silt content, factors possibly affecting samples; condition of vault, wellhead, sampling appartus, etc.)

DRY; UNABLE TO SAMPLE

Signature(s):

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade

COC - Chain of Custody
Cond - Specific Conductivity
GS - Ground Surface

min - Minute
mg/L - milligram/Liter
mV - milli Volts

MP - Measuring Point
NTU - Nephelometric Units
QA/QC - Quality Assurance/Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: Arul Ayyaswami	Task No: M13	**Well ID:** UFMW-03I
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 4-11-17
Well Depth (ft BGS): —	MP Distance AGS (ft): — Well Depth (ft ~~BMP~~ BGS): 40	Screened/Open Interval Top: 30 (ft BGS)	— (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: 40 (ft BGS)	— (ft BMP)
Pump and Tubing Type: Dedicated plastic pump; dedicated poly tubing	Pump Intake Depth: 35	(ft ~~BGS~~) — (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse; no decon for dedicated	Depth to Water Before Pump Installation (ft BMP): 26.50	Time: 1315	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity m~~µ~~S/cm READ	Spec Cond. CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1324	X		35.12		7.77		3.66		2.44/3.35		108		3.4		100	26.43	
1329	X		31.52		7.81		3.29		2.25/2.80		106		0.6		100	26.43	
1334	X		29.99		7.80		3.26		1.81/2.18		104		0.0		100	26.43	
1339	X		29.27		7.81		3.26		1.27/1.45		100		0.0		100	26.43	
1344	X		28.78		7.87		3.25		1.12/1.37		95		0.0		100		
1349	X		28.73		7.88		3.29		0.98/1.36		94		0.0				
1400		X	STABILIZATION														

DK 4/11/17

Sample ID: UFMW-03I-20170411 Duplicate ID: —

QA/QC Samples ~~ID~~: MS/MSD

COC Time: 1400

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area TS Sampling Set —				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments: Sulfide: 0.00 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP AREA Treatability Study
Task Manager: Arul Ayyaswami
Task No: M13
Well ID: UFMW-04S
Field Samplers: Jacob Souza
Recorded by: Jacob Souza
Date: 4/7/17
Well Depth (ft BGS): /
MP Distance AGS (ft): /
Well Depth (ft BMP): 29.69
Screened/Open Interval Top: / (ft BGS) 24.00 (ft BMP)
Well Diameter (in): 2
PID/FID Readings Beneath Inner Cap (ppm cge akb): /
Screened/Open Interval Bottom: / (ft BGS) 29.00 (ft BMP)
Pump and Tubing Type: QED Sample Pro/poly tubing
Pump Intake Depth: / (ft BGS) 26.50 (ft BMP)
MP Description: T.O.C.
Equipment Decon. Method: Liquinox & water (x3)
Depth to Water Before Pump Installation (ft BMP): 26.79 Time: 0755
GW Disposal: GW-11 pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0850			25.84		7.21		4500		2.11		150		3.5		105	26.50	0
0855			26.31		7.38		4490		1.63		142		0.0		105	26.50	525
0900			26.76		7.47		4490		1.77		136		0.0		105	26.50	1050
0905			26.58		7.47		4400		3.69		135		18.00		105	27.02	1575
0910			26.56		7.43		4540		1.85		129		10.3		105	27.04	2100
0915			26.98		7.52		4470		1.35		129		0.00		105	27.06	2625
0920			26.96		7.52		4470		1.23		129		0.00		105	27.05	3150
0925			26.96		7.51		4470		1.13		131		0.00		105	27.07	3675
0930			26.99		7.51		4470		1.10		128		0.00		105	27.07	4200
0935			26.97		7.51		4480		1.12		128		0.00		105	27.07	4725

Sample ID: UFMW-04S-20170407
Duplicate ID: NA
QA/QC Samples/ID: NA
COC Time: 0940

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
Ap Area Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N
Field Filtered: Y N
COC Number:

Comments:
Sulfide = 0.02 mg/L
* at 0905 adjusted pump to 27.50 ft due to loss of flow.

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP AREA Treatability Study
Task Manager: Arul Ayyaswami
Task No: M13
Well ID: UFMW-04I
Field Samplers: Jacob Souza
Recorded by: Jacob Souza
Date: 4/6/17
Well Depth (ft BGS): /
MP Distance AGS (ft): /
Well Depth (ft BMP): 39.79
Screened/Open Interval Top: / (ft BGS) 34.00 (ft BMP)
Well Diameter (in): 2
PID/FID Readings Beneath Inner Cap (ppm cge akb): /
Screened/Open Interval Bottom: / (ft BGS) 39.00 (ft BMP)
Pump and Tubing Type: QED Sample Pro / poly tubing
Pump Intake Depth: / (ft BGS) 36.50 (ft BMP)
MP Description: T.O.C.
Equipment Decon. Method: liquinox & water (x3)
Depth to Water Before Pump Installation (ft BMP): 26.79
Time: 1429
GW Disposal: GW-11 pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
1459			32.31		7.61		4240		1.20		118		19.8		120	26.85	0
1503			31.21		7.70		4280		1.03		116		23.6		120	26.85	480
1507			30.34		7.69		4350		0.87		116		17.6		120	26.85	960
1511			29.97		7.74		4410		1.29		119		15.2		120	26.85	1440
1515			29.91		7.73		4430		0.92		123		13.1		120	26.85	1920
1519			30.23		7.74		4470		1.05		117		10.0		120	26.85	2400
1523			30.76		7.74		4520		0.92		113		7.7		120	26.85	2880
1527			30.85		7.74		4530		1.16		113		6.1		120	26.85	3360
1531			30.81		7.74		4520		1.10		110		6.3		120	26.85	3840
1535			30.76		7.74		4520		1.08		112		5.8		120	26.85	4320

Sample ID: UFMW-04I-20170406
Duplicate ID: NA
QA/QC Samples/ID: NA
COC Time: 1540

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)
Field Decontamination: Y N
Field Filtered: Y N
COC Number:
Comments:
Sulfide = 0.00 mg/L
Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP AREA Treatability Study	Task Manager: Arul Ayyaswami	Task No: M13	Well ID: UFMW-055
Field Samplers: Jacob Souza		Recorded by: Jacob Souza	Date: 4/7/17
Well Depth (ft BGS): /	MP Distance AGS (ft): / Well Depth (ft BMP): 30.04	Screened/Open Interval Top: /	(ft BGS) 25.00 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): /	Screened/Open Interval Bottom: /	(ft BGS) 30.00 (ft BMP)
Pump and Tubing Type: QED Sample Pro / poly tubing	Pump Intake Depth: / (ft BGS) 27.50 (ft BMP)		MP Description: T.O.C.
Equipment Decon. Method: Liquinox & water (x3)	Depth to Water Before Pump Installation (ft BMP): 27.01 Time: 1030		GW Disposal: GW-11 pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1055			27.61		7.31		7390		1.66		145		623		100	27.09	0
1100			27.65		7.30		7360		1.43		145		359		100	27.10	500
1105			27.73		7.29		7240		1.35		142		57.3		100	27.14	1000
1110			27.75		7.30		7200		1.23		137		17.2		100	27.21	1500
1115			27.79		7.31		7180		1.16		134		4.4		100	27.25	2000
1120			27.82		7.30		7110		1.16		132		0.0		100	27.28	2500
1125			27.84		7.31		7060		1.14		131		0.0		100	27.28	3000
1130			27.86		7.31		7120		1.14		127		0.0		100	27.28	3500

Sample ID: UFMW-055-20170407 Duplicate ID: NA QA/QC Samples/ID: NA COC Time: 1135

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area Sampling Sop —				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments: Sulfide = 0.00 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP AREA Treatability Study
Task Manager: Arul Ayyaswami
Task No: M13
Well ID: UFMW-05I
Field Samplers: Jacob Souza
Recorded by:
Date: 4/7/17
Well Depth (ft BGS): /
MP Distance AGS (ft): /
Well Depth (ft BMP): 39.87
Screened/Open Interval Top: / (ft BGS) 35.00 (ft BMP)
Well Diameter (in): 2
PID/FID Readings Beneath Inner Cap (ppm cge akb): /
Screened/Open Interval Bottom: / (ft BGS) 40.00 (ft BMP)
Pump and Tubing Type: QED Sample Pro / poly tubing
Pump Intake Depth: / (ft BGS) 37.50 (ft BMP)
MP Description: T.O.C.
Equipment Decon. Method: Liquinox & water (x3)
Depth to Water Before Pump Installation (ft BMP): 26.90 Time: 1201
GW Disposal: GW-11 pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1220			30.44		7.80		4840		1.99		132		555		105	27.13	0
1225			29.87		7.70		4920		1.52		135		358		105	27.10	525
1230			29.59		7.71		4940		0.98		135		248		105	27.10	1050
1235			29.52		7.80		4920		0.83		133		130		105	27.10	1575
1240			29.52		7.76		4870		1.04		132		30.2		105	27.10	2100
1245			29.58		7.77		4860		1.03		131		16.7		105	27.10	2625
1250			29.61		7.76		4860		0.96		129		8.2		105	27.10	3150
1255			29.80		7.76		4900		0.93		124		0.5		105	27.10	3675
1300			29.84		7.76		4870		0.98		125		0.0		105	27.10	4200
1305			29.76		7.76		4870		0.88		126		0.0		105	27.10	4725

Sample ID: UFMW-05I-20170407
Duplicate ID: NA
QA/QC Samples/ID: NA
COC Time: 1310

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP		Area	Sampling	Set

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)
Field Decontamination: Y N
Field Filtered: Y N
COC Number:
Comments:
Sulfide = 0.08 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study
Task Manager: Arul Ayyaswami
Task No: M13
Well ID: UFMW-06S
Field Samplers: D. Keady
Recorded by: D. Keady
Date: 4-10-17
Well Depth (ft BGS): —
MP Distance AGS (ft): —
Well Depth (ft BMP): 30.02
Screened/Open Interval Top: 25.02 (ft ~~BGS~~ BMP) — (ft BMP)
Well Diameter (in): 2
PID/FID Readings Beneath Inner Cap (ppm cge akb): —
Screened/Open Interval Bottom: 30.02 (ft ~~BGS~~ BMP) — (ft BMP)
Pump and Tubing Type: QED SamplePro; polytubing
Pump Intake Depth: — (ft BGS) 27.52 (ft BMP)
MP Description: TOC
Equipment Decon. Method: 3 bucket method
Depth to Water Before Pump Installation (ft BMP): 26.69 Time: 0806
GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (mS/cm) READ	Spec Conductivity (mS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0908	X		24.73		7.38		5.70		6.80/1.93		127		550		100	26.70	0
0913	X		25.49		7.43		5.68		6.42/1.63		131		149		100	26.71	500
0918	X		25.86		7.46		5.68		6.10/1.66		131		33.6		100	26.71	1000
0923	X		26.11		7.44		5.68		5.88/1.58		132		9.1		100	26.71	1500
0928	X		26.19		7.46		5.68		5.78/1.55		133		1.0		100	26.71	2000
0933	X		26.24	✓	7.46	✓	5.67	✓	5.73/1.53	✓	134	✓	0.0	✓ (<5)	100	26.71	2500
0940		X	STABILIZATION														

DK 4-10-17

Sample ID: UFMW-06S-20170410
Duplicate ID:
QA/QC Samples/ID: —
COC Time: 0940

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area TS Sampling Suite				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)
Field Decontamination: Y N
Field Filtered: Y N
COC Number:
Comments:

Sulfide: 0.00 mg/L

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: Arul Ayyaswami	Task No: M13	**Well ID:** UFMW-06I
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 4.10.17
Well Depth (ft BGS): ~~40.21~~	TMP Distance AGS (ft): — Well Depth (ft BMP): 40.21	Screened/Open Interval Top: 35.21	(~~ft BGS~~) BMP — (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: 40.21	(~~ft BGS~~) BMP — (ft BMP)
Pump and Tubing Type: QED SamplePro	Pump Intake Depth: —	(ft BGS) 37.71 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse	Depth to Water Before Pump Installation (ft BMP):	26.62 Time: 0808	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity m (~~µ~~S/cm)		Dissolved Oxygen Horiba/YSI DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
1048	X		27.03		7.80		5.44		1.02/1.56		147		46.6		100	26.64	0
1053	X		27.18		7.74		5.45		0.44/1.58		147		23.9		100	26.66	500
1058	X		27.32		7.75		5.45		0.16/0.99		143		5.2		100	26.66	1000
1103	X		27.39		7.70		5.46		0.14/1.00		144		0.0		100	26.66	1500
1108	X		27.45	✓	7.76	✓	5.46	✓	0.00/0.98	✓	140	✓	0.0	✓ (<5)	100	26.66	2000
1115		X	STABILIZATION														

DK 4-10-17

Sample ID: UFMW-06I-20170410 **Duplicate ID:** UFMW-06I-20170410-FD **QA/QC Samples/ID:** — **COC Time:** 1115

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area TS Sampling Suite				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Sulfide: 0.01 mg/L

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

Soil Flushing IRM - Daily/Bi-Weekly GW Gauging Form

Project Name: NERT Task K01 - Soil Flushing IRM
Date: 6/19/17
Address: 510 S. 4th Street, Henderson, NV 89015
Gate Access Code: 6932
Technician: Jesse Bunkers
Weather: 100°F clear

Monitoring Wells

Well ID	Depth to Water (ft btoc)	~~Total Depth of Well~~ Time (ft btoc)	Notes (well condition, etc.)
PLOT 1 (NORTH)			
Injection Wells			
UFIW-01S	26.75	0752	★
UFIW-01I	27.06	0753	★
UFIW-01D	27.21	0754	
UFIW-02S	26.24	0756	★
UFIW-02I	26.31	0757	★
UFIW-02D	26.30	0758	
UFIW-03S	26.32	0759	★
UFIW-03I	26.39	0800	★
UFIW-03D	26.44	0801	
UFIW-04S	26.67	0803	★
UFIW-04I	26.61	0804	★
UFIW-04D	26.54	0805	★
Monitoring Wells			
UFMW-01S	28.08	0720	
UFMW-01I	28.55	0725	
UFMW-01D	28.91	0733	
UFMW-02S	27.55	0827	
UFMW-02I	28.50	0825	
UFMW-02D	28.68	0826	
UFMW-03S	dry	0743	
UFMW-03I	26.50	0745	
UFMW-03D	26.78	0744	
Extraction Wells			
E1-1	42.71	0739	
E1-2	33.85	0740	
E1-3	43.66	0741	
PLOT 2 (SOUTH)			
Injection Wells			
UFIW-05S			
UFIW-05I			
UFIW-05D			
UFIW-06S			
UFIW-06I			
UFIW-06D			
UFIW-07S			
UFIW-07I			
UFIW-07D			
UFIW-08S			
UFIW-08I			
UFIW-08D			
Monitoring Wells			
UFMW-04S	26.70	0814	
UFMW-04I	26.73	0815	
UFMW-04D	26.70	0816	
UFMW-05S	26.94	0817	
UFMW-05I	26.83	0818	
UFMW-05D	26.72	0819	
UFMW-06S	26.67	0820	
UFMW-06I	26.60	0821	
UFMW-06D	26.65	0822	
Extraction Wells			
E2-1	25.85	0807	
E2-2	26.09	0808	
E2-3	26.40	0809	
E2-4	26.58	0810	
E2-5	26.42	0811	

★ : MP = Top of coupling

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-015
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 6-19-17
Well Depth (ft BGS): —	MP Distance AGS (ft): — / Well Depth (ft BMP): 29.56	Screened/Open Interval Top: 24 (ft BGS)	— (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: 29 (ft BGS)	— (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder) ; poly tubing	Pump Intake Depth: — (ft BGS)	26.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox	Depth to Water Before Pump Installation (ft BMP): 28.08	Time: 0720	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity ~~µ~~mS/cm READ	CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	CHANGE*	Redox Potential ORP (mV) READ	CHANGE*	Turbidity (NTU) READ	CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0823	X		30.13		6.97		3.61		1.39/1.48		192		4.66		100	28.14	0
0828	X		27.97		7.10		3.57		1.77/1.54		172		1.77		100	28.22	500
0833	X		27.20		7.13		3.53		0.42/0.53		167		1.84		100	28.25	1000
0838	X		27.02		7.15		3.53		0.29/0.33		164		1.28		100	28.27	2000
0843	X		26.98		7.16		3.55		0.27/0.34		163		0.75		100	28.28	2500
0848	X		26.96	✓	7.16	✓	3.55	✓	0.26/0.32	✓	163	✓	0.48	✓	100	28.28	3000
0850		X	STABILIZATION														

DK 6-19-17

Sample ID: UFMW-015-20170619 **Duplicate ID:** — **QA/QC Samples/ID:** — **COC Time:** 0850

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area T.S. Sample Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

color: clear

Signature(s): D. K

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-01I
Field Samplers: D. Kendy		Recorded by: D. Keady	Date: 6-19-17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 39.52	Screened/Open Interval Top: 34 (ft BGS) — (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: 39 (ft BGS) — (ft BMP)
Pump and Tubing Type: dedicated ~~QED Sample Pro~~ (bladder); poly tubing		Pump Intake Depth: — (ft BGS) 36.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: dedicated pump + tubing		Depth to Water Before Pump Installation (ft BMP): 28.55 Time: 0725	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (~~µ~~mS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0925	X		31.23		7.45		4.03		0.97/3.23		154		9.39		100	28.53	0
0930	X		28.99		7.47		4.01		0.62/1.86		149		6.59		100	28.57	500
0935	X		27.97		7.48		4.01		0.32/0.97		146		4.26		100	28.59	1000
0940	X		27.91		7.48		3.99		0.20/0.43		143		2.69		100	28.60	1500
0945	X		28.08		7.49		3.99		0.25/0.38		142		1.48		100	28.60	2000
0950	X		28.35	✓	7.49	✓	3.99	✓	0.27/0.36	✓	142	✓	0.80	✓	100	28.60	2500
0955	X		28.38		7.49		4.00		0.28/0.33		142		0.69		100	28.60	3000
1000		X	STABILIZATION														

DK 6-19-17

Sample ID: UFMW-01I-20170619 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1000

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N Field Filtered: Y N COC Number:

Comments:

color: clear

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	**Well ID:** UFMW-01D
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 6.19.17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 49.25	Screened/Open Interval Top: 34 (ft BGS) — (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: 49 (ft BGS) — (ft BMP)
Pump and Tubing Type: Dedicated bladder pump + poly tubing	Pump Intake Depth: 36.5 (ft BGS) — (ft BMP)		MP Description: TOC
Equipment Decon. Method: Dedicated pump + tubing	Depth to Water Before Pump Installation (ft BMP): 28.91	Time: 0733	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity m(µS/cm)		Dissolved Oxygen DO (mg/L) Horiba/YSI		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
1023	X		34.52		7.51		5.64		2.45/3.63		145		4.93		100	28.84	0
1028	X		29.69		7.53		5.39		0.74/1.41		148		0.15		100	28.85	500
1033	X		28.93		7.55		5.35		0.50/0.91		148		0.32		100	28.85	1000
1038	X		28.82		7.56		5.33		0.39/0.72		148		0.00		100	28.85	1500
1043	X		28.68		7.55		5.33		0.34/0.63		149		0.00		100	28.85	2000
1048	X		31.15		7.56		5.15		0.31/0.54		147		0.00		100	28.85	2500
1053	X		29.94		7.54		5.37		0.30/0.50		148		0.00		100	28.85	3000
1058	X		29.91	✓	7.54	✓	5.36	✓	0.29/0.45	✓	148	✓	0.00	✓	100	28.85	3500
1100		X	STABILIZATION														

DK 6.19.17

Sample ID: UFMW-01D-20170619 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1100

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT	AP	Area T.S.	Sampling Set	

Material Codes: VOA = 40 ml glass vial; AG = Amber Glass; CG = Clear Glass; PE = polyethylene; O = Other (Specify)

Field Decontamination: Y N Field Filtered: Y N COC Number:

Comments:

color: clear

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer		Task No: M13		Well ID: UFMW-025
Field Samplers: D. Keady			Recorded by: D. Keady		Date: 6.19.17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 29.19	Screened/Open Interval Top: 24	(ft BGS) —	(ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: 29	(ft BGS) —	(ft BMP)
Pump and Tubing Type: QED SamplePro (bladder); poly tubing		Pump Intake Depth: 26.5	~~(ft BGS)~~ → —	(ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox		Depth to Water Before Pump Installation (ft BMP): 27.55	Time: 0827		GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity m~~µ~~S/cm READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1157	X		37.89		7.33		2.58		2.09		153		34.3		100	27.64	0
1202	X		32.44		7.29		2.54		1.19		161		14.8		100	27.65	500
1207	~~X~~ Stop		AIR COMPRESSOR DIED.														
1218	X		AIR COMPRESSOR WORKING AGAIN.														
1220	X		32.15		7.30		2.55		0.81		166		2.95		100	27.65	1000
1225	X		29.96		7.32		2.52		0.72		166		1.02		100	27.66	1500
1230	X		28.74		7.30		2.53		0.29		168		0.00		100	27.66	2000
1235	X		27.44		7.33		2.52		0.27		169		0.00		100	27.67	2500
1240	X		27.13	✓	7.32	✓	2.52	✓	0.25	✓	169	✓	0.00	✓	100	27.67	3000
1245		X	STABILIZATION														

DK 6.19.17

Sample ID: UFMW-025-20170619 **Duplicate ID:** — **QA/QC Samples/ID:** — **COC Time:** 1245

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT AP Area T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

color: clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-02I
Field Samplers: D. Keady		Recorded by: D Keady	Date: 6.19.17
Well Depth (ft BGS): 39	MP Distance AGS (ft): —	Well Depth (ft BMP): —	Screened/Open Interval Top: 34 (ft BGS) — (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: 39 (ft BGS) — (ft BMP)
Pump and Tubing Type: Dedicated bladder pump + poly tubing		Pump Intake Depth: — (ft BGS) 36.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: Dedicated pump + tubing		Depth to Water Before Pump Installation (ft BMP): 28.50 Time: 0825	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity M (μS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen Hor/YSI DO (mg/L) READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1324	X		44.26		7.38		4.88		4.07/6.25		147		605		100	28.56	0
1329	X		44.24		7.33		4.77		0.53/2.12		148		719		100	28.59	500
1334	X		43.27		7.36		4.78		0.50/1.08		146		830		100	28.60	1000
1339	X		44.19		7.35		4.76		0.56/0.76		146		704		100	28.62	1500
1344	X		43.72		7.34		4.75		0.65/0.54		148		461		100	28.62	2000
1349	X		43.29		7.37		4.77		0.72/0.62		149		299		100	28.63	2500
1354	X		43.31		7.36		4.76		0.77/0.66		151		163		100	28.63	3000
1359	X		44.58		7.36		4.77		0.82/0.71		152		110		100	28.63	3500
1404	X		43.84		7.37		4.77		0.86/0.73		153		90.1		100	28.63	4000
1409	X		43.21		7.37		4.77		0.87/0.77		155		58.9		100	28.63	4500
1414	X		43.08		7.38		4.75		0.89/0.79		156		39.8		100	28.63	5000
1419	X		43.67		7.37		4.77		0.87/0.80		157		36.3		100	28.63	5500
1424	X		43.11	✓	7.37	✓	4.77	✓	0.84/0.81	✓	159	✓	34.3	✓	100	28.63	6000
1430		X	STABILIZATION														

DK 6.19.17

Sample ID: UFMW-02I-20170619 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1430

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT APArea T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

color: cloudy, whitish

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-02D
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 6-20-17
Well Depth (ft BGS): 49	MP Distance AGS (ft): —	Well Depth (ft BMP): —	Screened/Open Interval Top: 44 (ft BGS) — (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: 49 (ft BGS) — (ft BMP)
Pump and Tubing Type: Dedicated bladder pump + poly tubing	Pump Intake Depth: — (ft BGS) 46.5 (ft BMP)		MP Description: TOC
Equipment Decon. Method: Dedicated pump + tubing	Depth to Water Before Pump Installation (ft BMP): 28.68	Time: 0826 (6-19-17)	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (mS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0735	X		33.45		7.65		6.99		4.24/4.68		150		38.7		100	29.10	0
0740	X		31.18		7.55		6.20		0.96/2.22		149		12.0		100	29.13	500
0745	X		30.57		7.54		5.94		0.45/2.06		149		1.13		100	29.16	1000
0750	X		30.69		7.54		5.89		0.28/1.86		149		0.00		100	29.17	1500
0755	X		30.89		7.54		5.87		0.22/1.46		149		0.00		100	29.17	2000
0800	X		30.88		7.54		5.87		0.16/0.86		148		0.00		100	29.17	2500
0805	X		31.09		7.53		5.86		0.18/0.82		149		0.00		100	29.17	3000
0810	X		31.34	✓	7.52	✓	5.86	✓	0.18/0.78	✓	149	✓	0.00	✓	100	29.17	3500
0815		X	STABILIZATION														

DK 6-20-17

Sample ID: UFMW-02D-20170620 Duplicate ID: — QA/QC Samples/ID: — COC Time: 0815

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT AP Area T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N

Field Filtered: Y N

COC Number:

Comments:

color: clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study
Task Manager: G. Roemer
Task No: M13
Well ID: UFMW-03S
Field Samplers: D. Keady
Recorded by: D. Keady
Date: 6.19.17
Well Depth (ft BGS): —
MP Distance AGS (ft): —
Well Depth (ft BMP): —
Screened/Open Interval Top: — (ft BGS) — (ft BMP)
Well Diameter (in): —
PID/FID Readings Beneath Inner Cap (ppm cge akb): —
Screened/Open Interval Bottom: — (ft BGS) — (ft BMP)
Pump and Tubing Type: —
Pump Intake Depth: — (ft BGS) — (ft BMP)
MP Description: —
Equipment Decon. Method: —
Depth to Water Before Pump Installation (ft BMP): —
Time:
GW Disposal: —

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
WELL DRY; UNABLE TO MONITOR / SAMPLE.																	

DK 6/19/17

Sample ID: —
Duplicate ID: —
QA/QC Samples/ID: —
COC Time: —

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method

DK 6/19/17

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)
Field Decontamination: Y N
Field Filtered: Y N
COC Number:
Comments:
DRY.

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G Roemer	Task No: M13	Well ID: UFMW-03I
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 6-19-17
Well Depth (ft BGS): 40	MP Distance AGS (ft): — Well Depth (ft BMP): —	Screened/Open Interval Top: 30	(ft BGS) — (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: 40	(ft BGS) — (ft BMP)
Pump and Tubing Type: Dedicated bladder pump; poly tubing	Pump Intake Depth: 35 (ft BGS) — (ft BMP)		MP Description: TOC
Equipment Decon. Method: Dedicated pump & tubing	Depth to Water Before Pump Installation (ft BMP): 26.50	Time: 0745 (6-14)	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity m (µS/cm)		Dissolved Oxygen DO (mg/L) Horiba/YSI		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0449	X		27.88		7.54		3.39		12.21/10.31		116		191		100	26.53	0
0454	X		25.33		7.55		3.43		10.15/9.12		124		54.1		100	26.55	500
0459	X		24.61		7.58		3.62		2.22/4.34		126		18.7		100	26.54	1000
0504	X		24.01		7.60		3.71		1.56/2.02		125		9.25		100	26.56	1500
0509	X		23.82	✓	7.62	✓	3.74	✓	1.47/1.98	✓	125	✓	4.07	✓	100	26.56	2000
0514	X		23.51		7.61		3.74		1.32/1.95		126		1.91		100	26.56	2500
0520		X	STABILIZATION														

DK 6-14-17

Sample ID: UFMW-03I-20170620 Duplicate ID: — QA/QC Samples/ID: — COC Time: 0520

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT AP Area F.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

color: cloudy/clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study
Task Manager: G. Roemer
Task No: M13
Well ID: UPMW-03D
Field Samplers: D. Kendy
Recorded by: D. Kendy
Date: 6·20·17
Well Depth (ft BGS): 50
MP Distance AGS (ft): —
Well Depth (ft BMP): —
Screened/Open Interval Top: 45 (ft BGS) — (ft BMP)
Well Diameter (in): 2
PID/FID Readings Beneath Inner Cap (ppm cge akb): —
Screened/Open Interval Bottom: 50 (ft BGS) — (ft BMP)
Pump and Tubing Type: Dedicated bladder pump; poly tubing
Pump Intake Depth: 47.5 (ft BGS) — (ft BMP)
MP Description: TOC
Equipment Decon. Method: Dedicated pump & tubing
Depth to Water Before Pump Installation (ft BMP): 26.79
Time: 0744 6·19·1
GW Disposal: GW/Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity M(μS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen Horiba U52 DO (mg/L) READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0558	X		24.99		7.74		4.80		1.66/1.88		150		9.36		100	27.15	0
0603	X		24.18		7.75		4.78		0.48/1.02		151		1.78		100	27.15	500
0608	X		24.15		7.75		4.78		0.19/0.41		151		0.33		100	27.15	1000
0613	STOP		ON HOLD TO TALK TO LOGISTICAL SOLUTIONS														\
0637	X		RESUMED PURGING														\
0642	X		26.99		7.70		4.80		1.20/1.43		142		0.04		100	27.05	1500
0647	X		26.03		7.73		4.82		0.35/0.61		142		0.00		100	27.12	2000
0652	X		25.86	✓	7.73	✓	4.79	✓	0.18/0.54	✓	143	✓	0.00	✓	100	27.15	2500
0700		X	STABILIZATION														

Dk 6·20·17

Sample ID: UPMW-03D-20170620
Duplicate ID: —
QA/QC Samples/ID: —
COC Time:

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT AP Area T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)
Field Decontamination: Y N
Field Filtered: Y N
COC Number:
Comments:
color : clear

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-04S
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 6.20.17
Well Depth (ft BGS): 29	MP Distance AGS (ft): — / Well Depth (ft BMP): —	Screened/Open Interval Top: 24 (ft BGS)	— (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: 29 (ft BGS)	— (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder); poly tubing	Pump Intake Depth: 26.5 (ft BGS) — (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox	Depth to Water Before Pump Installation (ft BMP): 26.70 Time: 0814 (6-19-17)		GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity m ~~µ~~S/cm READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0933	X		31.63		7.50		4.67		1.67/1.81		149		23.6		100	26.74	0
0938	X		28.98		7.44		4.51		0.69/1.02		156		9.36		100	26.80	500
0943	X		28.14		7.44		4.37		0.41/0.73		158		3.58		100	26.86	1000
0948	X		27.86		7.44		4.28		0.28/0.51		159		1.48		100	26.92	1500
0953	X		27.71	✓	7.44	✓	4.24	✓	0.26/0.49	✓	159	✓	0.00	✓	100	26.94	2000
0958	X		27.63		7.43		4.22		0.24/0.46		160		0.00		100	26.95	2500
1000		X	STABILIZATION														

DK 6.20.17

Sample ID: UFMW-04S-20170620 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1000

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT AP Area T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N Field Filtered: Y N COC Number:

Comments:

Color: clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	**Well ID:** UFMW-04I
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 6·20·17
Well Depth (ft BGS): 39	MP Distance AGS (ft): — / Well Depth (ft BMP): —	Screened/Open Interval Top: 34 (ft BGS)	— (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: 39 (ft BGS)	— (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder); poly tubing	Pump Intake Depth: 36.5	(ft BGS) — (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox	Depth to Water Before Pump Installation (ft BMP): 26.73	Time: 0815 (6/19/17)	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity mS/cm READ	Spec Cond. CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1031	X		32.29		7.57		4.48		1.75/1.91		159		429		100	26.84	0
1036	X		29.84		7.61		4.68		0.73/1.02		161		425		100	26.85	500
1041	X		29.27		7.63		4.73		0.35/0.81		160		298		100	26.85	1000
1046	X		29.01		7.64		4.74		0.19/0.63		160		175		100	26.85	1500
1051	X		28.97		7.64		4.73		0.17/0.41		159		114		100	26.85	2000
1056	X		28.82		7.64		4.71		0.16/0.40		158		75.3		100	26.86	2500
1101	X		29.02		7.64		4.68		0.14/0.37		157		47.9		100	26.86	3000
1106	X		29.02		7.63		4.67		0.12/0.36		157		26.8		100	26.86	3500
1111	X		29.07		7.62		4.64		0.11/0.35		157		16.2		100	26.86	4000
1116	X		29.00		7.62		4.63		0.09/0.31		155		10.3		100	26.86	4500
1121	X		29.20		7.63		4.60		0.08/0.29		153		7.5		100	26.86	5000
1126	X		29.31	✓	7.63	✓	4.61	✓	0.06/0.27	✓	153	✓	4.6	✓	100	26.86	5500
1130		X	STABILIZATION														

DK 6·20·17

Sample ID: UFMW-04I-20170620 **Duplicate ID:** UFMW-04I-20170620-FD **QA/QC Samples/ID:** — **COC Time:** 1130

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT AP Area TS. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

color: cloudy, clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-04D
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 6-21-17
Well Depth (ft BGS): 50	MP Distance AGS (ft): — Well Depth (ft BMP): —	Screened/Open Interval Top: 45	(ft BGS) — (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: 50	(ft BGS) — (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder); poly tubing	Pump Intake Depth: 47.5	(ft BGS) — (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox	Depth to Water Before Pump Installation (ft BMP): 26.70	Time: 0816 ([illegible]	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0450	X		31.13		7.51		5.33		3.32/2.13		117		>1000		100	26.74	0
0455	X		28.93		7.67		5.35		2.67/1.91		115		465		100	26.83	500
0500	X		27.89		7.70		5.29		2.36/1.64		116		240		100	26.85	1000
0505	X		27.49		7.71		5.27		1.99/1.23		116		124		100	26.86	1500
0510	X		27.27		7.71		5.24		1.79/1.31		116		83.7		100	26.86	2000
0515	X		27.15		7.71		5.22		1.54/1.17		115		38.9		100	26.86	2500
0520	X		27.16		7.70		5.21		1.45/1.14		115		29.4		100	26.86	3000
0525	X		27.06		7.70		5.20		1.20/1.11		114		21.4		100	26.86	3500
0530	X		26.89		7.69		5.19		1.39/1.10		114		11.1		100	26.86	4000
0535	X		26.94		7.70		5.18		1.31/1.09		113		7.41		100	26.86	4500
0540	X		26.96	✓	7.70	✓	5.17	✓	1.29/1.08	✓	113	✓	4.98	✓	100	26.86	5000
0545		X	STABILIZATION														

DK 6-21-17

Sample ID: UFMW-04D-20170621 Duplicate ID: — QA/QC Samples/ID: — COC Time: 0545

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT AP Area T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N Field Filtered: Y N COC Number:

Comments:

Color: Cloudy/clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study | Task Manager: G. Roemer | Task No: M13 | Well ID: UFMW-055

Field Samplers: D. Keady | Recorded by: D. Keady | Date: 6.21.17

Well Depth (ft BGS): 30 | MP Distance AGS (ft): — | Well Depth (ft BMP): — | Screened/Open Interval Top: 25 (ft BGS) — (ft BMP)

Well Diameter (in): 2 | PID/FID Readings Beneath Inner Cap (ppm cge akb): — | Screened/Open Interval Bottom: 30 (ft BGS) — (ft BMP)

Pump and Tubing Type: QED Sample Pro (bladder); poly tubing | Pump Intake Depth: 27.5 (ft BGS) — (ft BMP) | MP Description: TOC

Equipment Decon. Method: 3 bucket rinse w/ Liquinox | Depth to Water Before Pump Installation (ft BMP): 26.94 Time: 0817 (6/16) | GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity m (dS/cm) READ	Spec Cond. CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0634	X		27.33		7.19		7.41		2.00/1.27		161		294		100	26.99	0
0639	X		26.97		7.23		7.22		0.52/1.14		162		141		100	27.09	500
0644	X		26.86		7.23		7.09		0.31/1.09		162		56.7		100	27.14	1000
0649	X		26.91		7.22		7.05		0.35/1.09		162		28.9		100	27.20	1500
0654	X		26.94		7.22		7.03		0.32/1.05		161		16.2		100	27.24	2000
0659	X		26.95		7.22		6.99		0.27/1.09		160		7.3		100	27.27	2500
0704	X		27.03	✓	7.23	✓	6.93	✓	0.28/1.07	✓	159	✓	3.6	✓	100	27.30	3000
0710		X	STABILIZATION														

DK 6-21-17

Sample ID: UFMW-055-20170621 | Duplicate ID: — | QA/QC Samples/ID: — | COC Time: 0710

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT AP Area T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG = Amber Glass; CG = Clear Glass; PE = polyethylene; O = Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Color: Clear

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-05I
Field Samplers: D. Kealy		Recorded by: D. Kealy	Date: 6.21.17
Well Depth (ft BGS): 40	MP Distance AGS (ft): — Well Depth (ft BMP): —	Screened/Open Interval Top: 35	(ft BGS) — (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: 40	(ft BGS) — (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder); poly tubing	Pump Intake Depth: 37.5 (ft BGS) — (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox	Depth to Water Before Pump Installation (ft BMP): 26.83	Time: 0818/6.19.17	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0739	X		27.58		7.66		5.08		1.53/1.91		153		662		100	27.08	0
0744	X		27.93		7.68		5.10		0.42/1.70		152		409		100	27.00	500
0749	X		27.94		7.68		5.10		0.28/1.40		151		273		100	27.00	1000
0754	X		27.94		7.67		5.09		0.12/1.21		150		133		100	27.00	~~2~~ 1500
0759	X		27.97		7.68		5.08		0.09/1.11		150		103		100	27.00	2000
0804	X		27.99		7.68		5.08		0.13/1.01		149		55.5		100	27.00	2500
0809	X		28.03		7.68		5.08		0.11/0.97		148		28.8		100	27.00	3000
0814	X		28.17		7.67		5.07		0.10/0.97		148		27.0		100	27.00	3500
0819	X		28.15		7.66		5.06		0.09/0.91		147		14.5		100	27.00	4000
0824	X		28.23	✓	7.64	✓	5.04		0.08/0.87		146		9.29		100	27.00	4500
0829	X		28.34		7.65		5.03	✓	0.07/0.85	✓	146	✓	4.49	✓	100	27.00	5000
0835		X	STABILIZATION														

DK 6.21.17

Sample ID: UFMW-05I-20170621 Duplicate ID: — QA/QC Samples/ID: — COC Time: 0835

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT AP Area T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N Field Filtered: Y N COC Number:

Comments:

color: clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer		Task No: M13		Well ID: VFMW-05D
Field Samplers: D. Keady			Recorded by: D. Keady		Date: 6.21.17
Well Depth (ft BGS): 50	MP Distance AGS (ft): —	Well Depth (ft BMP): —	Screened/Open Interval Top: 45	(ft BGS) —	(ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: 50	(ft BGS) —	(ft BMP)
Pump and Tubing Type: QED SamplePro (bladder); poly tubing		Pump Intake Depth: 47.5	(ft BGS) —	(ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox		Depth to Water Before Pump Installation (ft BMP): 26.72	Time: 0817 (6.19.17		GW Disposal: GWTP Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity mS/cm (~~µS/cm~~) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Hach/YSI READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0910	X		33.85		7.44		6.27		1.44/1.61		142		216		100	26.86	0
0915	X		31.01		7.49		6.58		0.47/1.41		124		198		100	26.87	500
0920	X		29.96		7.52		6.66		0.17/1.22		115		124		100	26.87	1000
0925	X		29.72		7.54		6.68		0.09/1.09		111		77.2		100	26.87	1500
0930	X		29.61		7.56		6.69		0.07/1.01		110		45.6		100	26.87	2000
0935	X		29.66		7.57		6.67		0.02/0.91		111		26.2		100	26.87	2500
0940	X		29.64		7.57		6.65		0.01/0.88		111		19.2		100	26.87	3000
0945	X		29.61		7.58		6.64		0.00/0.86		112		13.0		100	26.87	3500
0950	X		29.75		7.57		6.63		0.00/0.84		113		7.23		100	26.87	4000
0955	X		30.00	✓	7.57	✓	6.61	✓	0.00/0.82	✓	113	✓	4.75	✓	100	26.87	4500
1005		X	STABILIZATION														

Sample ID: VFMW-05D-20170621 Duplicate ID: — QA/QC Samples/ID: MS/MSD COC Time: 1005

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT AP Area T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

color = cloudy / clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study | Task Manager: G. Roemer | Task No: M13 | Well ID: UFMW-065
Field Samplers: D. Keady | Recorded by: D. Keady | Date: 6.21.17
Well Depth (ft BGS): 30 | MP Distance AGS (ft): — | Well Depth (ft BMP): — | Screened/Open Interval Top: 25 (ft BGS) — (ft BMP)
Well Diameter (in): 2 | PID/FID Readings Beneath Inner Cap (ppm cge akb): — | Screened/Open Interval Bottom: 30 (ft BGS) — (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder) / poly tubing | Pump Intake Depth: 27.5 (ft BGS) — (ft BMP) | MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox | Depth to Water Before Pump Installation (ft BMP): 26.67 | Time: 0920(19-ft) | GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity m (uS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1101	X		37.59		7.22		5.57		1.41/1.98		135		624		100	26.75	0
1106	X		32.67		7.23		5.77		0.51/1.72		142		535		100	26.78	500
1111	X		31.83		7.25		5.76		0.32/1.60		144		249		100	26.80	1000
1116	X		31.39		7.27		5.77		0.19/1.52		143		90.6		100	26.80	1500
1121	X		31.14		7.30		5.77		0.08/1.43		143		54.6		100	26.80	2000
1126	X		31.10		7.30		5.77		0.02/1.36		142		24.6		100	26.80	2500
1131	X		31.09		7.30		5.77		0.00/1.33		142		17.7		100	26.80	3000
1136	X		31.22		7.31		5.77		0.00/1.30		141		12.9		100	26.80	3500
1141	X		30.94		7.30		5.78		0.00/1.28		142		7.16		100	26.80	4000
1146	X		30.88		7.30		5.77		0.00/1.25		141		3.23		100	26.80	4500
1150		X	STABILIZATION														

DK 6-21-17

Sample ID: UFMW-065-20170621 | Duplicate ID: — | QA/QC Samples/ID: — | COC Time: 1150

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT AP Area T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)
Field Decontamination: Y N | Field Filtered: Y N | COC Number:
Comments:
color: cloudy / clear

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-06I
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 6·22·17
Well Depth (ft BGS): 40	MP Distance AGS (ft): —	Well Depth (ft BMP): —	Screened/Open Interval Top: 35 (ft BGS) — (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: 40 (ft BGS) — (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder); poly tubing		Pump Intake Depth: 37.5 (ft BGS) — (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox		Depth to Water Before Pump Installation (ft BMP): 26.60 Time: 0821 (6·19·17)	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity mS (µS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0631	X		31.46		7.43		5.46		1.46/1.51		122		113		100	26.72	0
0636	X		29.65		7.46		5.53		0.54/1.32		126		79.4		100	26.73	500
0641	X		29.10		7.51		5.53		0.27/1.18		126		65.9		100	26.73	1000
0646	X		28.73		7.52		5.50		0.17/1.10		127		45.7		100	26.73	1500
0651	X		28.49		7.53		5.48		0.10/1.03		128		40.2		100	26.73	2000
0656	X		28.30		7.54		5.48		0.06/0.98		129		30.3		100	26.73	2500
0701	X		28.75		7.54		5.48		0.03/0.94		128		23.0		100	26.73	3000
0706	X		28.50		7.56		5.52		0.01/0.97		127		17.3		100	26.73	3500
0711	X		28.21		7.56		5.53		0.00/0.91		128		12.1		100	26.73	4000
0716	X		28.20	✓	7.56	✓	5.51	✓	0.00/0.89	✓	129	✓	8.40	✓	100	26.73	4500
0721	X		28.09		7.57		5.51		0.00/0.88		130		4.73		100	26.73	5000
0730		X	STABILIZATION														

DK 6·22·17

Sample ID: UFMW-06I-20170622 Duplicate ID: — QA/QC Samples/ID: — COC Time: 0730

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT AP Area T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Color: Clear

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-06D
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 6.22.17
Well Depth (ft BGS): 50	MP Distance AGS (ft): — Well Depth (ft BMP): —	Screened/Open Interval Top: 45	(ft BGS) — (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: 50	(ft BGS) — (ft BMP)
Pump and Tubing Type: QED Sample Pro (bladder); poly tubing	Pump Intake Depth: 47.5 (ft BGS) — (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox	Depth to Water Before Pump Installation (ft BMP): 26.65 Time: 0822 (6/14/17)		GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity mS (µS/cm)		Dissolved Oxygen DO (mg/L) Horiba/YSI		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0803	X		30.15		7.65		6.59		1.41/1.57		150		>1000		100	26.99	0
0808	X		28.62		7.69		6.77		0.59/1.40		149		>1000		100	27.05	500
0813	X		28.16		7.72		6.75		0.29/1.31		147		832		100	27.06	1000
0818	X		28.04		7.72		6.65		0.17/1.25		145		756		100	27.06	1500
0823	X		27.91		7.73		6.58		0.07/1.14		143		535		100	27.06	2000
0828	X		27.82		7.73		6.54		0.03/1.09		141		376		100	27.06	2500
0833	X		27.76		7.73		6.51		0.01/1.00		140		322		100	27.06	3000
0838	X		27.77		7.73		6.49		0.00/0.99		138		266		100	27.06	3500
0843	X		27.75		7.74		6.49		0.00/0.96		137		188		100	27.06	4000
0848	X		27.49		7.74		6.48		0.00/0.94		136		169		100	27.06	4500
0853	X		27.36		7.74		6.48		0.00/0.92		135		153		100	27.06	5000
0858	X		27.27	✓	7.74	✓	6.47	✓	0.00/0.90	✓	134	✓	141	✓	100	27.06	5500
0903	X		27.31		7.74		6.47		0.00/0.89		134		129		100	27.06	6000
0910		X	STABILIZATION														

DK 6.22.17

Sample ID: UFMW-06D-20170622 Duplicate ID: — QA/QC Samples/ID: — COC Time: 0910

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
NERT AP Area T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Color: cloudy/clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point

C - Centigrade
COC - Chain of Custody

GS - Ground Surface
ID - Identification

mg/L - milligram/Liter
mV - milli Volts

min - Minute
ml - milliliter

MP - Measuring Point
NTU - Nephelometric Units

QA - Quality Assurance
QC - Quality Control

Soil Flushing IRM - Daily/Bi-Weekly GW Gauging Form

Project Name: NERT Task K01 - Soil Flushing IRM
Date: 8/14/17
Address: 510 S. 4th Street, Henderson, NV 89015
Gate Access Code: 6932
Technician: Jacob Souza
Weather: 94°F

Monitoring Wells

Well ID	Depth to Water (ft btoc)	Total Depth of Well (ft btoc)	Notes (well condition, etc.)
PLOT 1 (NORTH)			
Injection Wells			
UFIW-01S	27.02		1155
UFIW-01I	27.19		1156
UFIW-01D	27.60		1157
UFIW-02S	26.88		1159
UFIW-02I	26.92		1201
UFIW-02D	27.09		1202
UFIW-03S	26.95		1204
UFIW-03I	27.04		1205
UFIW-03D	27.34		1206
UFIW-04S	27.30		1208
UFIW-04I	27.30		1209
UFIW-04D	27.45		1210
Monitoring Wells			
UFMW-01S	28.24		1144
UFMW-01I	27.86		1145
UFMW-01D	27.99		1146
UFMW-02S	DRY		1148
UFMW-02I	28.96		1149
UFMW-02D	28.93		1150
UFMW-03S	DRY		1152
UFMW-03I	27.54		1153
UFMW-03D	27.67		1154
Extraction Wells			
E1-1	27.21		1100
E1-2	38.69		1102
E1-3	41.39		1104
PLOT 2 (SOUTH)			
Injection Wells			
UFIW-05S			
UFIW-05I			
UFIW-05D			
UFIW-06S			
UFIW-06I			
UFIW-06D			
UFIW-07S			
UFIW-07I			
UFIW-07D			
UFIW-08S			
UFIW-08I			
UFIW-08D			
Monitoring Wells			
UFMW-04S	26.57		1217
UFMW-04I	26.55		1218
UFMW-04D	26.49		1220
UFMW-05S	26.94		1222
UFMW-05I	26.77		1223
UFMW-05D	26.59		1224
UFMW-06S	26.72		1226
UFMW-06I	26.63		1227
UFMW-06D	26.65		1228
Extraction Wells			
E2-1	27.61		1031
E2-2	25.71		1033
E2-3	28.75		1029
E2-4	26.34		1035
E2-5	38.67		1027

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	**Well ID: UFMW-01S**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 8/17/17
Well Depth (ft BGS):	MP Distance AGS (ft): Well Depth (ft BMP): 29.56	Screened/Open Interval Top:	(ft BGS) 24 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):	Screened/Open Interval Bottom:	(ft BGS) 29 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing	Pump Intake Depth:	(ft BGS) 26.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 28.21	Time: 0616	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0425	X		29.10		6.97		4.38		1.21		142		52.0		Hand Bail	28.21	
																29.55	~0.5L
			Hand Bail Dry allow recharge prior to collecting sample.														
0500		X	Collect sample UFMW-015-20170817														

Sample ID: UFMW-015-20170817 **Duplicate ID:** N/A **QA/QC Samples/ID:** N/A **COC Time:** 0500

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N | Field Filtered: [✓ Y] N | COC Number:

Comments:
A= 1,942
B= 6,746

Groundwater Color is clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-01I
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 8/16/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 39.52	Screened/Open Interval Top: (ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 39 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing		Pump Intake Depth: (ft BGS) 36.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 27.99 Time: 0618	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
1045	X		23.57		7.33		3.46		1.82		93		19.5		200	27.99	0
1050	X		23.51		7.30		3.46		0.39		87		6.1		200	28.13	1L
1055	X		23.53		7.15		3.48		0.00		82		4.1		200	28.15	2L
1100	X		23.62		7.15		3.48		0.00		71		3.7		200	28.09	3L
1105	X		23.60		7.15		3.49		0.09		65		3.6		200	28.08	4L
1119	X		23.47		7.15		3.50		0.00		59		3.6		200	28.09	5L
1115	X		23.40		7.26		3.50		0.00		45		2.9		200	28.08	6L
1120	X		23.33		7.25		3.53		0.09		43		2.3		200	28.10	7L
1125	X		23.32		7.24		3.55		0.09		42		2.1		200	28.08	8L
1130	X		23.31		7.23		3.55		0.00		41		1.9		200	28.10	9L
1130		X	Parameters Stabilized														
			Collect sample UFMW-01I-20170816														

Sample ID: UFMW-01I-20170816 Duplicate ID: N/A QA/QC Samples/ID: Level 4 QC COC Time: 1130

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: [✓ Y] N COC Number:

Comments:

A= 2.232
B= 4.998

Groundwater Color is clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point

C - Centigrade
COC - Chain of Custody

GS - Ground Surface
ID - Identification

mg/L - milligram/Liter
mV - milli Volts

min - Minute
ml - milliliter

MP - Measuring Point
NTU - Nephelometric Units

QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study		Task Manager: G. Roemer		Task No: M13	**Well ID: UFMW-01D**
Field Samplers: Jeff Richeson				Recorded by: Jeff Richeson	Date: 8/16/17
Well Depth (ft BGS):	MP Distance AGS (ft):		Well Depth (ft BMP): 49.25	Screened/Open Interval Top:	(ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):			Screened/Open Interval Bottom:	(ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing			Pump Intake Depth:	(ft BGS) 42.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox			Depth to Water Before Pump Installation (ft BMP): 27.52	Time: 0619	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0950	X		25.94		7.44		5.04		6.21		123		80.4		200	27.52	0
0955	X		25.49		7.39		5.08		4.73		119		5.2		200	27.70	1L
1000	X		25.30		7.35		5.09		3.65		97		1.0		200	27.73	2L
1005	X		25.24		7.29		5.11		2.11		84		0.3		200	27.72	3L
1010	X		25.28		7.21		5.12		1.30		79		0.1		200	27.70	4L
1015	X		25.27		7.20		5.14		0.81		72		0.2		200	27.72	5L
1020	X		25.23		7.20		5.16		0.79		69		0.1		200	27.73	6L
1025	X		25.23		7.19		5.18		0.74		65		0.1		200	27.72	7L
1030	X		25.29		7.23		5.29		0.69		61		0.1		200	27.71	8L

Sample ID: UFMW-01D-20170816

Duplicate ID: N/A

QA/QC Samples/ID: N/A

COC Time: 1030

Sample Container			Preservative	Intended Analysis and/or Method
Number	Material Code	Volume		
AP Area Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N

Field Filtered: [✓ Y] N

COC Number:

Comments: A = 1,294
B = 4,090

Groundwater Color is Clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	**Well ID: UFMW-02S**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 8/17/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 29.19	Screened/Open Interval Top: (ft BGS) 24 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 29 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing		Pump Intake Depth: (ft BGS) 26.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 29.19 Time: 0622	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			Well				Dry			No		Sample				Collected	

JR
8/17/17

Sample ID: N/A **Duplicate ID:** N/A **QA/QC Samples/ID:** N/A **COC Time:** N/A

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments: Well Dry

Groundwater Color is

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-02I
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 8/17/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 39	Screened/Open Interval Top: (ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 39 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing		Pump Intake Depth: (ft BGS) 36.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 27.83 Time: 0624	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
1015	X		24.67		7.49		4.64		1.58		123		509		200	29.83	0 L
1020	X		24.53		7.46		4.88		0.54		120		255		200	29.97	1 L
1025	X		24.50		7.44		4.79		0.28		115		14.0		200	29.99	2 L
1030	X		24.49		7.37		4.75		0.00		104		5.7		200	29.98	3 L
1035	X		24.48		7.33		4.75		0.00		98		1.4		200	29.98	4 L
1040	X		24.48		7.31		4.74		0.00		93		0.9		200	29.99	5 L
1045	X		24.52		7.39		4.74		0.00		90		0.7		200	30.00	6 L

Sample ID: UFMW-02I-20170817 Duplicate ID: N/A QA/QC Samples/ID: N/A COC Time: 1045

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method

AP Area Treatability Study Sampling Bottle Set

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: [✓ Y] N COC Number:

Comments: A= 1.112 B= 7.779

Groundwater Color is Clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	**Well ID: UFMW-02D**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 8/17/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 49	Screened/Open Interval Top: (ft BGS) 44 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing		Pump Intake Depth: (ft BGS) 46.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 29.89 Time: 0629	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0835	X		24.62		7.30		5.74		1.11		127		34.6		200	29.89	0L
0840	X		25.43		7.34		5.72		0.25		98		22.2		200	29.98	1L
0845	X		25.86		7.28		5.65		0.00		101		0.9		200	30.04	2L
0850	X		25.85		7.25		5.65		0.00		100		0.5		200	30.02	3L
0855	X		25.79		7.20		5.63		0.00		92		0.0		200	30.01	4L
0900	X		25.79		7.27		5.62		0.09		83		0.0		200	29.99	5L
0905	X		25.78		7.33		5.61		0.00		74		0.0		200	29.97	6L
0910	X		25.80		7.31		5.60		0.00		71		0.0		200	29.98	7L
0915	X		25.81		7.31		5.59		0.00		68		0.0		200	29.98	8L
0920	X		25.81		7.30		5.59		0.00		66		0.0		200	29.97	9L
0920		X	parameters stabilized														
			Collect sample UFMW-02D-20170817														

Sample ID: UFMW-02D-20170817 Duplicate ID: N/A QA/QC Samples/ID: N/A COC Time: 0920

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: [✓ Y] N COC Number:

Comments: A= 1.004
B= 5.422

Groundwater Color is clear

Signature(s): J R

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-03S
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date:
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 26.03	
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		
Screened/Open Interval Top:	(ft BGS)	24	(ft BMP)
Screened/Open Interval Bottom:	(ft BGS)	29	(ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing	Pump Intake Depth: (ft BGS) (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 26.02	Time:	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			

Well Dry No Sample Collected

Total Depth = 26.03
DTW = 26.02

Sample ID: N/A

Duplicate ID: N/A

QA/QC Samples/ID: N/A

COC Time: N/A

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N

Field Filtered: Y N

COC Number:

Comments:

Groundwater Color is Dry

Signature(s): R R

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-03I
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 8/17/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 40	Screened/Open Interval Top: (ft BGS) 30 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 40 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing		Pump Intake Depth: (ft BGS) 35 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 27.40 Time: 0629	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0655	X		20.67		7.30		4.03		0.00		93		17.2		200	27.40	0L
0700	X		21.01		7.29		4.03		0.00		74		4.4		200	27.63	1L
0705	X		21.37		7.28		4.04		0.00		61		3.7		200	27.60	2L
0710	X		21.39		7.29		4.04		0.00		54		2.2		200	27.61	3L
0715	X		21.45		7.29		4.04		0.00		46		1.4		200	27.58	4L
0720	X		21.46		7.29		4.03		0.00		42		1.4		200	27.57	5L
0725	X		21.41		7.33		4.03		0.00		38		1.4		200	27.56	6L
0730	X		21.37		7.32		4.02		0.00		38		1.3		200	27.57	7L
0730		X	Parameters Stabilized Collect sample UFMW-03I-20170817 + UFMW-03I-20170817-FD														

Sample ID: UFMW-03I-20170817 Duplicate ID: UFMW-03I-20170817-FD QA/QC Samples/ID: N/A COC Time:

Sample Container

Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
	AP Area Treatability Study Sampling Bottle Set			

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N | Field Filtered: [✓ Y] N | COC Number:

Comments: A = 0.983
B = 7.722

Groundwater Color is Clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: AP Area Treatability Study		Task Manager: G. Roemer	Task No: M13	**Well ID: UFMW-03D**
Field Samplers: Jeff Richeson			Recorded by: Jeff Richeson	Date: 8/17/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 50	Screened/Open Interval Top:	(ft BGS) 45 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom:	(ft BGS) 50 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing		Pump Intake Depth:	(ft BGS) 47.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 27.49	Time: 0630	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0555	X		21.97		7.54		4.77		1.56		119		10.8		200	27.49	0
0600	X		23.05		7.37		4.81		0.26		114		0.8		200	27.68	1L
0605	X		23.15		7.35		4.81		0.06		110		0.6		200	27.70	2L
0610	X		23.19		7.32		4.81		0.00		103		0.5		200	27.67	3L
0615	X		23.21		7.30		4.84		0.00		99		0.3		200	27.69	4L
0620	X		23.25		7.29		4.87		0.00		90		0.4		200	27.70	5L
0625	X		23.27		7.29		4.90		0.09		89		0.3		200	27.70	6L
0630	X		23.26		7.29		4.93		0.00		86		0.2		200	27.68	7L
0635	X		23.26		7.30		4.95		0.00		84		0.3		200	27.67	8L
0635		X	Parameters Stabilized Collect Sample UFMW-03D-20170817														

Sample ID: UFMW-03D-20170817 Duplicate ID: N/A QA/QC Samples/ID: N/A COC Time: 0635

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N | Field Filtered: [✓ Y] N | COC Number:

Comments:
A = 2.135
B = 8.418

Groundwater Color is Clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer		Task No: M13	Well ID: UFMW-04S
Field Samplers: Jeff Richeson			Recorded by: Jeff Richeson	Date: 8/16/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 29	Screened/Open Interval Top:	(ft BGS) 24 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom:	(ft BGS) 29 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing		Pump Intake Depth:	(ft BGS) 27.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 26.79	Time: 0611	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0825	X		27.45		7.35		4.88		1.50		160		49.9		100	26.79	0
0830	X		27.40		7.39		4.83		0.89		163		32.7		100	26.89	500
0835	X		27.30		7.27		4.66		0.22		150		0.00		100	26.92	1L
0840	X		27.20		7.24		4.65		0.21		151		0.00		100	26.94	1.5L
0845	X		27.09		7.22		4.62		0.20		152		0.90		100	26.94	2L
0850	X		27.00		7.20		4.60		0.18		150		0.00		100	26.94	2.5L
0850		X	parameters stabilized														
			Collect sample UFMW-04S-20170816														

Sample ID: UFMW-04S-20170816 Duplicate ID: N/A QA/QC Samples/ID: N/A COC Time: 0850

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: [✓ Y] N COC Number:

Comments:

A = 1,113

B = 6,675

Groundwater Color is Clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer		Task No: M13	**Well ID: UFMW-04I**
Field Samplers: Jeff Richeson			Recorded by: Jeff Richeson	Date: 8/16/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 39	Screened/Open Interval Top:	(ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom:	(ft BGS) 39 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing		Pump Intake Depth:	(ft BGS) 37.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 26.81	Time: 0612	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0740	X		26.70		7.44		4.31		1.77		130		480		200	26.81	0
0745	X		26.69		7.42		4.55		0.72		119		154		200	27.01	1L
0750	X		26.68		7.40		4.57		0.21		102		12.4		200	27.00	2L
0755	X		26.70		7.37		4.59		0.00		85		3.6		200	27.01	3L
0800	X		26.70		7.24		4.63		0.00		83		3.3		200	27.02	4L
0805	X		26.69		7.23		4.63		0.00		78		3.0		200	27.03	5L
0810	X		26.65		7.28		4.66		0.00		73		2.8		200	27.02	6L
0815	X		26.65		7.32		4.67		0.00		68		2.5		200	27.03	7L
0815		X	Parameters achieved stabilization														
			Collect sample UFMW-04I-20170816														

Sample ID: UFMW-04I-20170816 Duplicate ID: QA/QC Samples/ID: COC Time: 0815

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N | Field Filtered: [✓ Y] N | COC Number:

Comments:

A= 1,003
B= 8,941

Groundwater Color is clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	**Well ID: UFMW-04D**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 8/16/17
Well Depth (ft BGS):	MP Distance AGS (ft): Well Depth (ft BMP): 50	Screened/Open Interval Top:	(ft BGS) 45 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):	Screened/Open Interval Bottom:	(ft BGS) 50 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing	Pump Intake Depth:	(ft BGS) 47.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 26.78	Time: 0613	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0630	X		26.40		7.17		5.06		1.39		154		241		200	26.78	0
0635	X		26.61		7.23		5.19		0.16		138		6.0		200	26.99	1L
0640	X		26.64		7.24		5.11		0.04		130		3.6		200	27.03	2L
0645	X		26.66		7.26		5.11		0.00		115		2.7		200	27.02	3L
0650	X		26.69		7.45		5.12		0.00		86		2.2		200	27.00	4L
0655	X		26.68		7.44		5.12		0.00		82		1.9		200	27.02	5L
0700	X		26.67		7.42		5.12		0.00		79		1.7		200	27.03	6L
0705	X		26.69		7.42		5.12		0.09		75		1.8		200	27.02	7L
0705		X	parameters achieved stabilization														
			collect sample UFMW-04D-20170816														

Sample ID: UFMW-04D-20170816 Duplicate ID: N/A QA/QC Samples/ID: N/A COC Time:

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: [✓ Y] N COC Number:

Comments: A = 1.342
B = 5.770

Groundwater Color is Clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	**Well ID: UFMW-05S**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date:
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 30	Screened/Open Interval Top: (ft BGS) 25 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 30 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing		Pump Intake Depth: (ft BGS) 27.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 27.19 Time: 0605	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0530	X		27.40		7.17		6.95		1.45		150		156		100	27.19	0L
0535	X		27.30		7.18		6.90		0.75		148		101		100	27.25	500
0540	X		27.27		7.18		6.80		0.40		146		75.3		100	27.30	1L
0545	X		27.20		7.19		6.75		0.35		145		8.4		100	27.32	1.5L
0550	X		27.17		7.19		6.72		0.33		144		7.2		100	27.34	2L
0555	X		27.14		7.20		6.72		0.31		145		6.8		100	27.35	2.5L
0600	X		27.13		7.21		6.72		0.30		145		6.4		100	27.35	3L
0600		X	parameters achieved stabilization														
			Collect Sample UFMW-05S-20170816														

Sample ID: UFMW-05S-20170816 Duplicate ID: N/A QA/QC Samples/ID: N/A COC Time: 0600

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered [✓ Y] N COC Number:

Comments: A = 0.980
B = 2.347

Groundwater Color is Clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	**Well ID: UFMW-05I**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 8/16/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 40	Screened/Open Interval Top: (ft BGS) 35 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 40 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing	Pump Intake Depth: (ft BGS) 37.5 (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 27.07 Time: 0606		GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0420	X		26,67		7,36		5.12		1,29		36		230		200	27,07	0
0425	X		26.79		7,35		5.15		0.71		13		74.9		200	27,19	1L
0430	X		26.73		7,24		5,09		2.34		11		5.9		200	27,25	2L
0435	X		26,71		7,21		5,08		0,26		12		3,6		200	27,29	3L
0440	X		26,75		7,20		5.09		0,17		13		3.0		200	27,31	4L
0445	X		26.79		7.18		5,19		0.03		12		3,4		200	27,32	5L
0450	X		26,81		7.18		5,09		0.02		11		3.6		200	27,31	6L
0455	X		26.79		7,19		5,08		0,01		11		3,3		200	27,32	7L
0500	X		26,77		7,18		5.08		0.00		12		2,9		200	27,33	8L
0500		X	parameters stabilized (3 consecutive readings) collect sample UFMW-05I-20170816														

Sample ID: UFMW-05I-20170816 Duplicate ID: N/A QA/QC Samples/ID: N/A COC Time: 0500

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: [✓ Y] N COC Number:

Comments: A= 0,616 B= 4,420

Groundwater Color is clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-05D
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date:
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 50	Screened/Open Interval Top: (ft BGS) 45 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 50 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing		Pump Intake Depth: (ft BGS) 47.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 26.86 Time: 0607	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1255	X		28.01		7.23		6.17		1.70		154		82.0		200	26.86	0
1300	X		27.64		7.21		6.55		0.25		155		8.9		200	27.05	1L
1305	X		27.56		7.18		6.54		0.05		150		1.5		200	27.10	2L
1310	X		27.48		7.17		6.52		0.00		138		0.9		200	27.12	3L
1315	X		27.51		7.15		6.52		0.00		130		0.5		200	27.12	4L
1320	X		27.51		7.16		6.48		0.00		124		0.4		200	27.13	5L
1325	X		27.49		7.20		6.47		0.00		116		0.5		200	27.13	6L
1325		X	parameters stabilized (3 consecutive Readings)														
			collect sample UFMW-05D-20170815														

Sample ID: UFMW-05D-20170815 Duplicate ID: N/A

QA/QC Samples/ID: N/A

COC Time: 1325

Sample Container

Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N

Field Filtered: [✓ Y] N

COC Number:

Comments: A= 0.745

B= 2.316

Groundwater Color is Clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-06S
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 8/15/17
Well Depth (ft BGS):	MP Distance AGS (ft): Well Depth (ft BMP): 30	Screened/Open Interval Top:	(ft BGS) 25 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge aka):	Screened/Open Interval Bottom:	(ft BGS) 30 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing	Pump Intake Depth:	(ft BGS) 27.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 26.87	Time:	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
1115	X		31.67		6.92		5.46		1.75		235		0.0		100	26.87	0
1120	X		29.94		6.91		5.49		0.80		217		516		100	27.03	500
1125	X		29.46		6.91		5.47		0.57		205		205		100	27.12	1L
1130	X		29.17		6.91		5.48		0.27		193		89.7		100	27.12	1.5L
1135	X		29.12		6.92		5.48		0.14		185		61.5		100	27.12	2L
1140	X		29.07		6.95		5.47		0.03		181		43.1		100	27.11	2.5L
1145	X		29.07		6.99		5.47		0.09		181		36.4		100	27.11	3L
1150	X		29.05		7.02		5.45		0.00		182		28.3		100	27.11	3.5L
1155	X		29.09		7.05		5.46		0.00		182		25.9		100	27.12	4L
1200	X		29.11		7.06		5.46		0.00		183		24.6		100	27.12	4.5L
1205	X		29.11		7.07				0.00		182		23.1		100	27.12	5L
1205		X	Parameters Stabilized (3 Consecutive Readings)														
			Collect sample UFMW-06S-20170815														

Sample ID: UFMW-06S-20170815 Duplicate ID: N/A QA/QC Samples/ID: N/A COC Time: 1205

Sample Container			Preservative	Intended Analysis and/or Method
Number	Material Code	Volume		
AP Area Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N | Field Filtered: [✓ Y] N | COC Number:

Comments: A= 1.139 B= 0.879

Groundwater Color is clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-06I
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 8/15/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 40	Screened/Open Interval Top: (ft BGS) 35 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 40 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing		Pump Intake Depth: (ft BGS) 37.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 26.89 Time: 0557	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0915	X		27.26		6.98		5.78		1.50		283		15.3		200	26.89	0
0920	X		26.88		7.22		5.67		1.00		241		0.6		200	27.02	1L
0925	X		26.79		7.24		5.67		0.74		220		0.0		200	27.04	2L
0930	X		26.91		7.25		5.69		0.62		200		0.0		200	27.04	3L
0935	X		26.35		7.23		5.74		0.57		195		0.0		200	27.03	4L
0940	X		26.25		7.18		5.73		0.54		190		0.0		200	27.05	5L
0945	X		26.65		7.18		5.71		0.51		185		0.0		200	27.06	6L
0945		X	parameters stabilized (3 consecutive readings)														
			collect sample UFMW-06I-20170815 + UFMW-06I-20170815-FD														

Sample ID: UFMW-06I-20170815 Duplicate ID: UFMW-06I-20170815-FD QA/QC Samples/ID: N/A COC Time: 0945

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: [✓ Y] N COC Number:

Comments:

A = 2.175
B = 4.069

Groundwater Color is clear

Signature(s): JR

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	**Well ID: UFMW-06D**
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 8/15/17
Well Depth (ft BGS):	MP Distance AGS (ft):	Well Depth (ft BMP): 50	Screened/Open Interval Top: (ft BGS) 45 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb):		Screened/Open Interval Bottom: (ft BGS) 50 (ft BMP)
Pump and Tubing Type: QED Sample Pro with Poly Tubing		Pump Intake Depth: (ft BGS) 47.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox		Depth to Water Before Pump Installation (ft BMP): 27.23 Time: 0600	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0755	X		27.80		7.22		6.39		1.52		183		170		200	27.23	0
0800	X		27.08		7.26		6.45		0.70		180		17.5		200	27.39	1L
0805	X		26.98		7.28		6.47		0.72		178		5.3		200	27.40	2L
0810	X		26.71		7.27		6.50		0.70		177		1.9		200	27.38	3L
0815	X		26.61		7.27		6.52		0.71		178		1.1		200	27.39	4L
0815		X	Parameters achieved stabilization, collect sample UFMW-06D-20170815														

Sample ID: UFMW-06D-20170815 Duplicate ID: QA/QC Samples/ID: MS/MSD COC Time: 0815

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area Treatability Study Sampling Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N | Field Filtered: [✓ Y] N | COC Number:

Comments: Rhodamine (A) = 1.031

Groundwater Color is clear Flourescein (B) = 0.923

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

Soil Flushing IRM - Daily/Bi-Weekly GW Gauging Form

Project Name: NERT Task K01 - Soil Flushing IRM

Date: 10/2/17

Address: 510 S. 4th Street, Henderson, NV 89015

Gate Access Code: 6932

Technician: K. Hansen

Weather: Sunny & 75°

Monitoring Wells

Well ID	Depth to Water (ft btoc)	Total Depth of Well (ft btoc)	Notes (well condition, etc.)
PLOT 1 (NORTH)			
Injection Wells			
UFIW-01S			
UFIW-01I			
UFIW-01D			
UFIW-02S			
UFIW-02I			
UFIW-02D			
UFIW-03S			
UFIW-03I			
UFIW-03D			
UFIW-04S			
UFIW-04I			
UFIW-04D			
Monitoring Wells			
UFMW-01S	Dry	1105	
UFMW-01I	29.38	1106	
UFMW-01D	29.53	1107	
UFMW-02S	Dry	1110	
UFMW-02I	30.21	1111	
UFMW-02D	30.24	1117	
UFMW-03S	Dry	1114	
UFMW-03I	28.73	1115	
UFMW-03D	28.77	1116	
Extraction Wells			
E1-1	29.68	0825	
E1-2	41.22	0828	
E1-3	39.50	0832	
PLOT 2 (SOUTH)			
Injection Wells			
UFIW-05S			
UFIW-05I			
UFIW-05D			
UFIW-06S			
UFIW-06I			
UFIW-06D			
UFIW-07S			
UFIW-07I			
UFIW-07D			
UFIW-08S			
UFIW-08I			
UFIW-08D			
Monitoring Wells			
UFMW-04S	28.37	1053	
UFMW-04I	28.49	1054	
UFMW-04D	28.57	1055	
UFMW-05S	29.01	1056	
UFMW-05I	28.90	1057	
UFMW-05D	28.70	1058	
UFMW-06S	28.38	1059	
UFMW-06I	28.46	1100	
UFMW-06D	28.75	1101	
Extraction Wells			
E2-1	42.57	0924	
E2-2	40.70	0945	
E2-3	39.74	0954	
E2-4	40.36	1007	
E2-5	43.44	1017	

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roerner	Task No: M13	Well ID: UFMW-015
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 10/6/17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 29	Screened/Open Interval Top: — (ft BGS) 24 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 29 (ft BMP)
Pump and Tubing Type: —		Pump Intake Depth: — (ft BGS) — (ft BMP)	MP Description: TOC
Equipment Decon. Method: —		Depth to Water Before Pump Installation (ft BMP): DRY Time: 1105 (10/16)	GW Disposal: —

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)

WELL OBSERVED TO BE DRY; UNABLE TO SAMPLE.

DK 10/6/17

Sample ID: —

Duplicate ID: —

QA/QC Samples/ID: —

COC Time: —

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Well dry.

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-01I
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 10/6/17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 39	Screened/Open Interval Top: — (ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 39 (ft BMP)
Pump and Tubing Type: QED Bladder and poly tubing		Pump Intake Depth: — (ft BGS) 36.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox		Depth to Water Before Pump Installation (ft BMP): 29.39 Time: [illegible]	GW Disposal: GW-11 pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity m(~~µ~~S/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	Dissolved Oxygen CHANGE*	Redox Potential ORP (mV) READ	Redox Potential CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0714	X		22.63		7.12		2.98		0.00/0.55		208		3.3		200	29.97	
0719	X		22.90		7.34		2.98		0.00/0.32		169		0.0		200	29.97	
0724	X		22.94		7.37		2.98		0.00/0.29		145		0.0		200	29.97	
0729	X		22.98		7.38		2.98		0.00/0.27		130		0.0		200	29.97	
0734	X		22.93		7.39		2.98		0.00/0.25		120		0.0		200	29.97	
0739	X		22.95	✓	7.40	✓	2.98	✓	0.00/0.24	✓	110	✓	0.0	✓	200	29.97	
0745		X	STABILIZATION														

DK 10/6/17

Sample ID: UFMW-01I-20171006 **Duplicate ID:** — **QA/QC Samples/ID:** — **COC Time:** 0745

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments: groundwater color : clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-01D
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 10/5/17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 49	Screened/Open Interval Top: — (ft BGS) 44 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Bladder Pump w/ poly tubing		Pump Intake Depth: — (ft BGS) 46.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox		Depth to Water Before Pump Installation (ft BMP): 29.53 Time: 1107 10/2/17	GW Disposal: GW-11

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity ~~µ~~m S/cm		Dissolved Oxygen DO (mg/L) Horiba/YSI		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
1419	X		26.84		7.42		4.55		1.26/0.26		164		273		200	30.15	0
1424	X		26.02		7.43		4.57		0.30/0.22		162		116		200	30.12	1000
1429	X		25.65		7.44		4.57		0.10/0.19		159		38.2		200	30.10	2000
1434	X		25.52		7.44		4.57		0.01/0.19		158		18.6		200	30.10	3000
1439	X		25.42	✓	7.44	✓	4.58	✓	0.00/0.18	✓	156	✓	6.4	✓(<5)	200	30.10	4000
1444	X		25.31		7.44		4.58		0.00/0.18		154		0.0		200	30.10	5000
1450		X	STABILIZATION														

DK 10/5/17

Sample ID: UFMW-01D-20171005   Duplicate ID: —   QA/QC Samples/ID: —   COC Time: 1450

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N   Field Filtered: Y N   COC Number:

Comments:

groundwater color: clear

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: MB	**Well ID:** UAMW-025
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 10/6/17
Well Depth (ft BGS): —	MP Distance AGS (ft): — / Well Depth (ft BMP): 29	Screened/Open Interval Top: —	(ft BGS) 24 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: —	(ft BGS) 29 (ft BMP)
Pump and Tubing Type: —	Pump Intake Depth: — (ft BGS)	— (ft BMP)	MP Description: TOC
Equipment Decon. Method: —	Depth to Water Before Pump Installation (ft BMP): DRY	Time: 1110 10/2/17	GW Disposal: —

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)

WELL OBSERVED TO BE DRY; UNABLE TO SAMPLE

DK 10/4/17

Sample ID: — **Duplicate ID:** — **QA/QC Samples/ID:** — **COC Time:** —

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

Well dry.

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-02I
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 10/6/17
Well Depth (ft BGS): —	MP Distance AGS (ft): — / Well Depth (ft BMP): 39	Screened/Open Interval Top: — (ft BGS)	34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: — (ft BGS)	37 (ft BMP)
Pump and Tubing Type: QED Bladder Pump and poly tubing	Pump Intake Depth: — (ft BGS)	36.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox	Depth to Water Before Pump Installation (ft BMP): 30.21	Time: 1111 10/2/17	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity mS/cm (µS/cm)		Dissolved Oxygen DO (mg/L) Horiba/YSI		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0920	X		23.93		7.50		3.94		0.84/0.30		172		711		200	30.90	0
0925	X		23.88		7.51		4.01		0.07/0.24		178		178		200	30.91	1000
0930	X		23.87		7.52		4.03		0.00/0.24		164		79.5		200	30.92	2000
0935	X		23.87		7.52		4.06		0.00/0.22		161		36.8		200	30.94	3000
0940	X		23.85	✓	7.52	✓	4.07	✓	0.00/0.20	✓	158	✓	5.6		200	30.95	4000
0945	X		23.86		7.52		4.08		0.00/0.19		156		0.0	✓ (<5)	200	30.95	5000
0950		X	STABILIZATION														

DK 10/6/17

Sample ID: UFMW-02I-20171006 Duplicate ID: —

QA/QC Samples/ID: —

COC Time: 0950

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N

Field Filtered: Y N

COC Number:

Comments: groundwater color : Clear

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer		Task No: M13	Well ID: UFMW-02D
Field Samplers: D. Keady			Recorded by: D. Keady	Date: 10/6/17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 99	Screened/Open Interval Top: —	(ft BGS) 44 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: —	(ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Bladder Pump and poly tubing		Pump Intake Depth: —	(ft BGS) 46.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox		Depth to Water Before Pump Installation (ft BMP): 30.24	Time: 1112 (10/2/17)	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity mS (µS/cm)		Dissolved Oxygen DO (mg/L) Horiba/YSI		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0822	X		24.11		7.47		5.17		0.87/0.23		181		256		200	31.09	0
0827	X		24.40		7.49		5.17		0.14/0.27		174		75.4		200	31.01	1000
0832	X		24.45		7.49		5.18		0.00/0.27		170		8.8		200	30.98	2000
0837	X		24.50	✓	7.50	✓	5.18	✓	0.00/0.25		166		0.0		200	30.92	3000
0842	X		24.56		7.50		5.18		0.00/0.23	✓	162	✓	0.0	✓ (CT)	200	30.92	4000
0845		X	STABILIZATION														

DK 10/6/17

Sample ID: CTMW-02D-20171006 Duplicate ID: — QA/QC Samples/ID: — COC Time: 0845

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area T-S			Sampling Set	

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

groundwater Color : clear

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRATECH

AP Area

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: ~~In-Situ Chromium~~ Treatability Study
Task Manager: ~~Anul Ayyaswami~~ G. Roemer
Task No: ~~M12~~ M13
Well ID: ~~CTMW-60D~~ UFMW-035
Field Samplers: ~~Jeff Richeson~~ D. Keady
Recorded by: ~~Jeff Richeson~~ D Keady
Date: 10/6/17
Well Depth (ft BGS): —
MP Distance AGS (ft): —
Well Depth (ft BMP): ~~54.25~~ 26
Screened/Open Interval Top: — (ft BGS) 21 ~~34~~ (ft BMP)
Well Diameter (in): 2
PID/FID Readings Beneath Inner Cap (ppm cge akb): —
Screened/Open Interval Bottom: — (ft BGS) 26 ~~54~~ (ft BMP)
Pump and Tubing Type: ~~QED Sample Pro (bladder) with poly tubing~~
Pump Intake Depth: — (ft BGS) ~~44~~ (ft BMP)
MP Description: TOC
Equipment Decon. Method: ~~3 Bucket Rinse with Liquinox~~
Depth to Water Before Pump Installation (ft BMP): DRY
Time: 1114 (10/2/17)
GW Disposal: ~~GW-11 Pond~~

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L)		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
WELL OBSERVED TO BE DRY; UNABLE TO SAMPLE.																	

DK 10/6/17

Sample ID: —
Duplicate ID: —
QA/QC Samples/ID: —
COC Time: —

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
~~In-Situ Chromium Treatability Study Sampling Bottle Set~~				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)
Field Decontamination: Y N
Field Filtered: Y N
COC Number:
Comments:
~~Ferrous Iron~~
~~Sulfide~~
~~Groundwater Color is~~
Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area T.S.	Task Manager: ~~Arul Ayyaswami~~ Griesner		Task No: M13	Well ID: UFMW-03I
Field Samplers: Jeff Richeson			Recorded by: Jeff Richeson	Date: 10/6/17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 40	Screened/Open Interval Top: — (ft BGS)	30 (ft BMP)
Well Diameter (in): 2"	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS)	40 (ft BMP)
Pump and Tubing Type: QED Bladder w/ poly tubing		Pump Intake Depth: — (ft BGS)	35 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket rinse		Depth to Water Before Pump Installation (ft BMP): 28.70	Time: 0825	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L) Ho: 7.04/7.97		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0830	X		21.70		7.29		3.89		2.79/4.02		101		231		200	28.70	0
0835	X		21.12		7.22		3.89		1.56/3.24		101		53.4		200	28.81	1L
0840	X		20.99		7.22		3.89		1.52/2.56		100		9.2		200	28.74	2L
0845	X		20.98		7.22		3.89		1.55/2.89		100		0.0		200	28.72	3L
0850	X		20.97	✓	7.21	✓	3.90	✓	1.60/3.05	✓	100		0.0	✓	200	28.74	4L
0855	X		20.92		7.21		3.90		1.59/3.06		100	✓	0.0		200	28.73	5L

JR 10/6/17

Sample ID: UFMW-03I-20171006 Duplicate ID: N/A QA/QC Samples/ID: N/A COC Time: 0855

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP	Area	T.S.	Bottle	Set

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N

Field Filtered: [✓ Y] N

COC Number:

Comments: GW color is clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area T.S.	Task Manager: ~~Arul Ayyaswami~~ G Roemer	Task No: M13	Well ID: UFMW-03D
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 10/6/17
Well Depth (ft BGS): —	MP Distance AGS (ft): — / Well Depth (ft BMP): 50	Screened/Open Interval Top: — (ft BGS)	45 (ft BMP)
Well Diameter (in): 2"	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: — (ft BGS)	50 (ft BMP)
Pump and Tubing Type: QED Bladder w/ poly tubing	Pump Intake Depth: — (ft BGS)	47.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket rinse	Depth to Water Before Pump Installation (ft BMP): 28.77	Time: 0710	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen DO (mg/L) Horiba/YSI		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
0725	X		20.69		7.32		4.39		4.23/5.46		79		39.8		200	28.77	0
0730	X		20.10		7.39		4.37		4.24/5.31		83		41.3		200	29.01	1L
0735	X		20.13		7.38		4.37		3.79/5.45		85		47.4		200	29.03	2L
0740	X		20.19		7.39		4.37		3.59/5.48		86		44.7		200	29.02	3L
0745	X		20.28		7.40		4.37		3.44/5.59		87		40.5		200	29.03	4L
0750	X	X	20.39	✓	7.41	✓	4.37	✓	3.19/5.31	✓	88	✓	37.7	✓	200	29.01	5L

JR 10/6/17

Sample ID: UFMW-03D-20171006 Duplicate ID: N/A QA/QC Samples/ID: N/A COC Time: 0750

Sample Container				
Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
	AP	Area	T.S.	Bottle Set

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: [✓ Y] N COC Number:

Comments:

GW color is Clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-045
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 10/5/17
Well Depth (ft BGS): —	MP Distance AGS (ft): — / Well Depth (ft BMP): 29	Screened/Open Interval Top: — (ft BGS)	24 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: — (ft BGS)	29 (ft BMP)
Pump and Tubing Type: QED Bladder Pump and polytubing	Pump Intake Depth: — (ft BGS)	26.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox	Depth to Water Before Pump Installation (ft BMP): 28.57	Time: 1013 (10/4/17)	IDW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity mS/cm READ	CHANGE*	Dissolved Oxygen DO (mg/L) Horiba READ	CHANGE*	Redox Potential ORP (mV) READ	CHANGE*	Turbidity (NTU) READ	CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0939	X		25.71		7.30		4.44		0.94		162		0.0		100	NM	0
0944	X		26.41		7.27		4.26		0.42		157		0.0		100	NM	500
0949	X		26.99		7.27		4.19		[illegible]		154		0.0		100	NM	1000
954	X		26.67		7.30		4.24		0.21		158		0.0		100	NM	1500
0959	X		26.52	✓	7.30	✓	4.25	✓	0.19	✓	161	✓	0.0	✓	100	NM	2000
1000		X	STABILIZATION														

DK 10/5/17

Sample ID: UFMW-045-20171005 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1000

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area TS Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:
groundwater color : Clear

Signature(s): DCK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-04I
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 10/5/17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 39	Screened/Open Interval Top: — (ft BGS) 34 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 39 (ft BMP)
Pump and Tubing Type: QED Bladder pump and poly tubing		Pump Intake Depth: — (ft BGS) 36.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox		Depth to Water Before Pump Installation (ft BMP): 28.49 Time: 1054 (1072)	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity m ~~(µ~~S/cm) READ	Spec Cond. CHANGE*	Dissolved Oxygen DO (mg/L) READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0825	X		24.63		7.29		3.96		1.02/0.24		171		35.4		200	28.60	0
0830	X		25.91		7.29		3.99		0.23/0.16		164		0.0		200	28.60	1000
0835	X		26.22		7.30		4.01		0.00/0.12		158		0.0		200	28.60	2000
0840	X		26.27	✓	7.30	✓	4.02	✓	0.00/0.11	✓	156	✓	0.0	✓	200	28.60	3000
0845	X		26.37		7.31		4.02		0.00/0.10		153		0.0		200	28.60	4000
0850		X	STABILIZATION														

DC 10/5/17

Sample ID: UFMW-04I-20171005 Duplicate ID: — QA/QC Samples/ID: — COC Time: 0850

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments: groundwater color: Clear

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-04D
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 10/5/17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 49	Screened/Open Interval Top: — (ft BGS) 44 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 49 (ft BMP)
Pump and Tubing Type: QED Bladder pump and poly tubing		Pump Intake Depth: — (ft BGS) 46.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox		Depth to Water Before Pump Installation (ft BMP): 28.57 Time: 1015 (10/2/17)	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity m(µS/cm) READ	Spec Conductivity CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0719	X		22.49		6.77		4.99		0.56/0.23		231		730		200	28.83	0
0724	X		23.76		7.32		4.95		0.01/0.20		201		98.0		200	28.84	1000
0729	X		24.02		7.38		4.92		0.00/0.18		189		18.2		200	28.84	2000
0734	X		24.26		7.40		4.92		0.00/0.17		180		0.0		200	28.84	3000
0739	X		24.43	✓	7.41	✓	4.92	✓	0.00/0.17	✓	173	✓	0.0	✓ (<5)	200	28.84	4000
0745		X	STABILIZATION														

DK 10/5/17

Sample ID: UFMW-04D-20171005 Duplicate ID: UFMW-04D-20171005-FD QA/QC Samples/ID: — COC Time: 0745

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments:

groundwater color = clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area T.S.	Task Manager: ~~Arul Ayyaswami~~ G. Roemer	Task No: M13	Well ID: UFMW-05S
Field Samplers: Jeff Richeson		Recorded by: J. Richeson	Date: 10/5/17
Well Depth (ft BGS): —	MP Distance AGS (ft): — / Well Depth (ft BMP): 30	Screened/Open Interval Top: — (ft BGS)	25 (ft BMP)
Well Diameter (in): 2"	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: — (ft BGS)	30 (ft BMP)
Pump and Tubing Type: QED Bladder w/ poly Tubing	Pump Intake Depth: — (ft BGS)	27.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket Rinse	Depth to Water Before Pump Installation (ft BMP): 29.10	Time: 0915	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (uS/cm) READ	Spec Cond. CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0930	X		22.15		6.21		9.84		4.70/2.46		174		83.1		200	29.10	0
0935	X		23.65		5.84		9.53		3.50/2.16		192		74.0		200	29.25	1L
0940	X		24.27		5.66		9.30		3.35/1.89		199		71.1		200	29.31	2L
0945	X		24.45		5.61		9.22		3.19/1.83		202		73.7		200	29.33	3L
0950	X		24.78		5.55		9.14		3.04/1.70		204		71.8		200	29.30	4L
0955	X	X	25.08	✓	5.58	✓	9.02	✓	2.98/1.63	✓	206	✓	68.4	✓	200	29.32	5L

JR 10/5/17

Sample ID: UFMW-05S-20171005
Duplicate ID: N/A
QA/QC Samples/ID: N/A
COC Time: 0955

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
	AP	Area	T.S.	Bottle Set

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N | Field Filtered: [✓ Y] N | COC Number:

Comments:

GW color is clear (silty/murky)

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-05I
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 10/4/17
Well Depth (ft BGS): —	MP Distance AGS (ft): — / Well Depth (ft BMP): 40	Screened/Open Interval Top: — (ft BGS)	35 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —	Screened/Open Interval Bottom: — (ft BGS)	40 (ft BMP)
Pump and Tubing Type: QED Bladder pump and poly tubing	Pump Intake Depth: — (ft BGS)	37.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ Liquinox	Depth to Water Before Pump Installation (ft BMP): 28.90	Time: 1057 10/2/17	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity mS/cm READ	Spec Conductivity mS/cm CHANGE*	Dissolved Oxygen DO (mg/L) Horiba/YSI READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1349	X		27.77		7.09		5.29		0.94/0.82		125		228		200	29.12	0
1354	X		27.68		7.10		5.33		0.60/0.62		117		73.5		200	29.13	1000
1359	X		27.63		7.12		5.34		0.59/0.58		112		36.3		200	29.13	2000
1404	X		27.63		7.12		5.35		0.59/0.57		110		24.2		200	29.13	3000
1409	X		27.59	✓	7.12		5.36		0.49/0.53		109		11.7		200	29.13	4000
1414	X		27.50		7.13	✓	5.39	✓	0.48/0.51	✓	109	✓	3.8	✓ (<5)	200	29.13	5000
1420		X	STABILIZATION														

DK

Sample ID: UFMW-05I-20171004

Duplicate ID: —

QA/QC Samples/ID: —

COC Time: 1420

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N

Field Filtered: Y N

COC Number:

Comments: groundwater color: clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

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LOW FLOW GROUNDWATER SAMPLING LOG

NERT, Henderson, NV Project

Task Name: AP Area Treatability Study	Task Manager: G. Roemer	Task No: M13	Well ID: UFMW-05D
Field Samplers: D. Keady		Recorded by: D. Keady	Date: 10/4/17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 50	Screened/Open Interval Top: — (ft BGS) 45 (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 50 (ft BMP)
Pump and Tubing Type: QED Bladder pump and poly tubing		Pump Intake Depth: — (ft BGS) 47.5 (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 bucket rinse w/ liq. linox		Depth to Water Before Pump Installation (ft BMP): 28.70 Time: 1058/10/4/17	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity mS/cm (µS/cm)		Dissolved Oxygen DO (mg/L) Horiba/YSI		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
1234	X		28.52		7.16		5.86		1.00/0.64		114		287		200	28.93	0
1239	X		27.75		7.16		5.89		0.87/0.47		112		148		200	28.95	1000
1244	X		27.55		7.15		5.91		0.99/0.38		111		80.5		200	28.96	2000
1249	X		27.44		7.15		5.93		0.88/0.23		111		54.9		200	28.96	3000
1254	X		27.48		7.15		5.89		0.86/0.24		112		34.7		200	28.96	4000
1259	X		27.44		7.15		5.87		0.82/0.25		112		24.9		200	28.96	5000
1304	X		27.39		7.15		5.89		0.85/0.27		114		15.8		200	28.96	6000
1309	X		27.40		7.15		5.90		0.84/0.28		114		8.7		200	28.96	7000
1314	X		27.38	✓	7.14	✓	5.90	✓	0.81/0.30	✓	115	✓	4.3	✓ (<5)	200	28.96	8000
1320		X	STABILIZATION														

DK 10/4/17

Sample ID: UFMW-05D-20171004 Duplicate ID: — QA/QC Samples/ID: — COC Time: 1320

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area T.S. Sampling Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: Y N | Field Filtered: Y N | COC Number:

Comments: groundwater color : clear

Signature(s): DK

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:
± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

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NERT, Henderson, NV Project

Task Name: AP Area T.S.	Task Manager: ~~Arul Attashian~~ [illegible]		Task No: M13		Well ID: UFMW-065
Field Samplers: Jeff Richeson			Recorded by: J. Richeson		Date: 10/5/17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): 30	Screened/Open Interval Top: —	(ft BGS) 25 (ft BMP)	
Well Diameter (in): 2"	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: —	(ft BGS) 30 (ft BMP)	
Pump and Tubing Type: RED bladder w/ poly tubing		Pump Intake Depth: —	(ft BGS) 27.5 (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 bucket rinse		Depth to Water Before Pump Installation (ft BMP): 28.38	Time: 1059/10/2/17		GW Disposal: GW-11 pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. (°C) CHANGE*	pH (pH Units) READ	pH (pH Units) CHANGE*	Spec Conductivity (uS/cm) READ	Spec Conductivity (uS/cm) CHANGE*	Dissolved Oxygen DO (mg/L) [illegible] READ	Dissolved Oxygen DO (mg/L) CHANGE*	Redox Potential ORP (mV) READ	Redox Potential ORP (mV) CHANGE*	Turbidity (NTU) READ	Turbidity (NTU) CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
0725	X		22.53		6.71		6.53		4.01/7.87		143		465		200	28.45	0
0730	X		23.13		6.13		6.44		1.75/2.42		157		182		200	28.56	1L
0735	X		23.50		6.07		6.39		1.51/2.29		158		98.0		200	28.58	2L
0740	X		23.81		6.02		6.36		1.34/2.18		160		54.1		200	28.56	3L
0745	X		23.99		5.98		6.36		1.33/2.11		161		56.3		200	28.58	4L
0750	X		23.99	✓	5.94	✓	6.34	✓	1.28/2.04		163	✓	58.2	✓	200	28.58	5L
0755	X	X	23.97		5.93		6.34		1.24/1.99	✓	164		60.3		200	28.57	6L

DK 10/5/17

Sample ID: UFMW-065-20171005 Duplicate ID: N/A

QA/QC Samples/ID: MS/MSD UFMW-065-20171005 COC Time: 0755

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
AP Area T.S. Bottle Set				

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: [✓ Y] N COC Number:

Comments:

GW color is Clear (silty)

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

Ap Area

LOW FLOW GROUNDWATER SAMPLING LOG

Page _1_ of _1_

NERT, Henderson, NV Project

Task Name: ~~In-Situ Chromium~~ Treatability Study	Task Manager: ~~Arul Ayyaswami~~ G. Roemer	Task No: ~~M12~~ M13	Well ID: ~~OTMW-05D~~ UFMW-06I
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 10/4/17
Well Depth (ft BGS): —	MP Distance AGS (ft): —	Well Depth (ft BMP): ~~36~~ 40	
Screened/Open Interval Top: —	(ft BGS) 35	~~X~~ (ft BMP)	
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		
Screened/Open Interval Bottom: —	(ft BGS) 40	~~X~~ (ft BMP)	
Pump and Tubing Type: QED Sample Pro (bladder) with poly tubing	Pump Intake Depth: — (ft BGS) 37.5	~~44~~ (ft BMP)	MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 28.46	Time: 1101	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C) READ	Temp. CHANGE*	pH (pH Units) READ	pH CHANGE*	Spec Conductivity (uS/cm) READ	Spec Cond. CHANGE*	Dissolved Oxygen DO (mg/L) Horr.ba/YSI READ	DO CHANGE*	Redox Potential ORP (mV) READ	ORP CHANGE*	Turbidity (NTU) READ	Turbidity CHANGE*	Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
1405	X		27.83		7.15		6.24		1.51/0.93		88		81.4		200	25.50	0
1410	X		26.78		7.19		6.57		0.58/0.74		83		25.3		200	28.69	1L
1415	X		26.54		7.27		6.65		0.54/0.68		76		18.9		200	28.70	2L
1420	X		25.86		7.27		6.72		0.43/0.64		74		3.0		200	28.70	3L
1425	X		25.78		7.26		6.74		0.41/0.63		74		0.1		200	28.70	4L
1430	X		25.67		7.26		6.76		0.38/0.61		72		0.0		200	28.70	5L
1435	X		25.59	✓	7.24	✓	6.80	✓	0.39/0.61	✓	71	✓	0.0	✓	200	28.69	6L

JR 10/4/17

Sample ID: UFMW-06I-20171004 **Duplicate ID:** N/A **QA/QC Samples/ID:** N/A **COC Time:** 1435

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
~~In-Situ Chromium~~ Treatability Study Sampling Bottle Set				
Ap	Area			

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N Field Filtered: [✓ Y] N COC Number:

Comments:

~~Ferrous Iron~~ N/A

~~Sulfide~~

Groundwater color is clear

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH; ± 3% for Specific Conductivity and Temperature; ± 10 mv for Redox Potential; ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface
BMP - Below Measuring Point
C - Centigrade
COC - Chain of Custody
GS - Ground Surface
ID - Identification
mg/L - milligram/Liter
mV - milli Volts
min - Minute
ml - milliliter
MP - Measuring Point
NTU - Nephelometric Units
QA - Quality Assurance
QC - Quality Control

TETRA TECH

LOW FLOW GROUNDWATER SAMPLING LOG

Page 1 of 1

NERT, Henderson, NV Project

Task Name: ~~[illegible]~~ Treatability Study AP Area	Task Manager: ~~Arul Ayyaswami~~ G. Roemer	Task No: ~~M12~~ M13	Well ID: ~~[illegible]~~ UFMW-06D
Field Samplers: Jeff Richeson		Recorded by: Jeff Richeson	Date: 10/4/17
Well Depth (ft BGS): [illegible]	MP Distance AGS (ft): —	Well Depth (ft BMP): ~~23.78~~ 50	Screened/Open Interval Top: — (ft BGS) 45 ~~[illegible]~~ (ft BMP)
Well Diameter (in): 2	PID/FID Readings Beneath Inner Cap (ppm cge akb): —		Screened/Open Interval Bottom: — (ft BGS) 50 ~~[illegible]~~ (ft BMP)
Pump and Tubing Type: ~~Mega Monsoon Pump~~ with Poly Tubing – Bladder Pump	Pump Intake Depth: 47.5 (ft BGS) ~~[illegible]~~ (ft BMP)		MP Description: TOC
Equipment Decon. Method: 3 Bucket Rinse with Liquinox	Depth to Water Before Pump Installation (ft BMP): 28.75	Time: 1100	GW Disposal: GW-11 Pond

Time	PURGING	SAMPLING	Temp. (°C)		pH (pH Units)		Spec Conductivity (uS/cm)		Dissolved Oxygen ~~DO~~ (mg/L) Horiba/YSI		Redox Potential ORP (mV)		Turbidity (NTU)		Purge Rate (ml/min)	Depth to Water (ft BMP)	Cum. Vol. Purged (ml)
			READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*	READ	CHANGE*			
1235	X		26.97		7.52		5.92		1.98/1.54		61		801		200	28.87	0
1240	X		26.97		7.33		5.90		1.14/0.95		73		340		200	29.10	1L
1245	X		26.80		7.31		5.91		0.79/0.81		73		194		200	29.11	2L
1250	X		26.78		7.36		5.91		0.70/0.75		68		111		200	29.10	3L
1255	X		26.80		7.44		5.93		0.59/0.69		62		70.0		200	29.08	4L
1300	X		26.85		7.49		5.94		0.56/0.67		60		63.1		200	29.10	5L
1305	X		26.86		7.50		5.96		0.59/0.68		57		28.2		200	29.08	6L
1310	X		26.76		7.52		5.97		0.48/0.64		54		18.6		200	29.10	7L
1315	X		26.77		7.52		5.97		0.44/0.62		51		13.2		200	29.07	8L
1320	X		26.73		7.52		5.97		0.41/0.62		50		9.9		200	29.07	9L
1325	X		26.72		7.51		5.97		0.42/0.63		49		9.7		200	29.09	10L
1330	X		26.76	✓	7.51	✓	5.97	✓	0.44/0.62	✓	49	✓	9.0	✓	200	29.10	11L

JR 10/4/17

Sample ID: UFMW-06D-20171004

Duplicate ID: —

QA/QC Samples/ID: N/A

COC Time: 1330

Sample Container Number	Material Code	Volume	Preservative	Intended Analysis and/or Method
~~In-Situ Chromium~~ Treatability Study Sampling Bottle Set				
AP	Area			

Material Codes: VOA = 40 ml glass vial; AG =Amber Glass; CG =Clear Glass; PE=polyethylene; O=Other (Specify)

Field Decontamination: [✓ Y] N

Field Filtered: [✓ Y] N

COC Number:

Comments:

~~Ferrous Iron =~~

~~Sulfide =~~

Groundwater color is ~~[illegible]~~ Clear.

Signature(s):

*INDICATOR PARAMETERS HAVE STABLIZED WHEN 3 CONSECUTIVE READINGS ARE WITHIN:

± 0.1 for pH: ± 3% for Specific Conductivity and Temperature: ± 10 mv for Redox Potential: ± 10% for Dissolved Oxygen and Turbidity

BGS - Below Ground Surface	C - Centigrade	GS - Ground Surface	mg/L - milligram/Liter	min - Minute	MP - Measuring Point	QA - Quality Assurance
BMP - Below Measuring Point	COC - Chain of Custody	ID - Identification	mV - milli Volts	ml - milliliter	NTU - Nephelometric Units	QC - Quality Control

Appendix F
Permits

NEVADA DIVISION OF
ENVIRONMENTAL
PROTECTION

STATE OF NEVADA
Department of Conservation & Natural Resources
Brian Sandoval, Governor
Leo M. Drozdoff, P.E., Director
David Emme, Administrator

August 16, 2016

Andrew W. Steinberg
Nevada Environmental Response Trust
35 E. Wacker Drive, Suite 1550
Chicago, IL 60601

RE: Long-Term UIC General Permit GU07RL-51056
Nevada Environmental Response Trust Site, Henderson NV – Soil Flushing

Mr. Steinberg:

The Bureau of Water Pollution Control (BWPC) has reviewed your Notice of Intent (NOI) for inclusion under the long-term remediation underground injection control (UIC) General Permit GU07RL. Based on the NOI, authorization for inclusion under the permit is granted and your ID number is 51056. You had submitted a Notice of Intent for a short-term general permit for pilot testing, however, the BWPC has determined to not issue the short-term permit and issue this long-term permit for pilot and full-scale activities. BWPC pre-approval is not required for installation of any future injection wells; however, please report new well installation in UIC reports.

I have enclosed a signed copy of the general permit authorizing the activities as identified in the approved workplan. The responsible party must meet all conditions related to the activity category of this permit. Any additional injection activities not included in the application and workplan will require submission of a new NOI and workplan for UIC approval.

Please note the following sections of the permit:

1. **UIC Reports will be due semi-annually starting February 15, 2017, and be due every February and August thereafter as described in permit.**
2. The issue date of the permit is August 16, 2016, and does not expire until the permit is cancelled (using UIC Form U310);
3. The maximum injection rate is higher by 10 gpm to allow for slight exceedances of the requested maximum rate of 250 gpm and avoid non-compliance. Same for pressure limit - 30 psi requested, 35 psi limit.
4. I.A.1 Authorized injectate is identified on the cover of the permit;
5. Monitoring reports are required under section Part I.A.6.

If you have any questions or comments, please contact me at (775) 687-9428 or rland@ndep.nv.gov.

Sincerely,

Russ Land

Russ Land
Bureau of Water Pollution Control

Enclosures: UIC Permit GU07RL-51056

ecc: Guy Roemer, Tetra Tech, Inc.
James Dotchin, Carlton Parker, Weiquan Dong, NDEP BISC

NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
UIC GENERAL PERMIT GU07RL ID# 51056
LONG TERM REMEDIATION – More than six months

AUTHORIZATION TO INJECT

In compliance with the provisions of the Nevada Revised Statutes (NRS) and the Nevada Underground Injection Control (UIC) Regulations, Nevada Administrative Code (NAC) 445A.810 through 445A.925, eligible applicants are authorized to inject the following compounds and/or water from a treatment facility operated in conjunction with a Corrective Action (CA) project overseen by the Nevada Division of Environmental Protection Bureau of Corrective Actions or other CA agency into Class V injection wells in accordance with limitations, requirements and other conditions set forth in Parts I and II hereof.

This General Permit is for Corrective Action (remediation) projects lasting **more than six months** and allows injection of 1) those materials identified below in Category 1 and/or 2) water which has been treated to meet groundwater quality criteria.

Facility/Site Name: **Nevada Environmental Response Trust (NERT) Site**
Facility Address: **510 South Fourth Street, Henderson, Clark County NV**
Legal Description: **T22S R62E Sec 12**
Well Owner Name: **Nevada Environmental Response Trust**
Address: **35 E. Wacker Drive, Suite 1550, Chicago, IL 60601**
Operator Name & Address: **Tetra Tech, 1489 W. Warm Springs Rd Ste 110, Henderson NV 89014**
Authorized injection wells: Two hundred fifty two (252) injection wells
Authorized rates/volumes: maximum 260 gallons per minute (gpm) water/solution at maximum 35 psi injection pressure; up to 354 lbs of Calcium Polysulfide, electron donors and 8 lbs of tracer dyes as described in the Notice of Intent.
Required for Quarterly sampling: ☒ Per approved State or County Corrective Action Workplan
☐ See UIC permit issuance cover letter Approved plan date: **July 2016**
☐ Additional UIC Sampling required: ____________________

Coverage under this general permit will be authorized if a Notice of Intent (NOI) is submitted and the following injection occurs at a specific site:

CATEGORY 1 - One of the following is injected:

☐ Low-percentage solution of hydrogen peroxide (H_2O_2). Injection shall not exceed 350 gallons/well per month;
☐ Potassium and sodium permanganate;
☐ Ozone;
☐ Oxygen infusers;
X Carbon sources/electron donors (including, but not limited to acetate, lactate, glucose, and complex sugars);
☐ Surfactant
X Sulfate or Polysulfide;
X Nutrients: nitrate, ammonia, phosphate, vitamins;
☐ Hydrogen releasing compounds;
☐ Chemical oxidation compounds

CATEGORY 2 - Injection of water that has been treated to meet groundwater quality criteria.

Modifications to the above requirements must be pre-approved by the UIC Program pursuant to Part I.A.10. The Permittee shall comply with all provisions of this permit and any letter of authorization issued pursuant to it.

This general permit was issued on **October 10, 2012**. This general permit shall expire on: **October 9, 2017**
Effective date for the project above is: **August 16, 2016.** The authorization issued under this permit shall expire at midnight 5 years from the issue date.

Russ Land

Signed this 16th day of August, 2016.

Russ Land
Bureau of Water Pollution Control

PART I

A. LIMITATIONS, MONITORING AND OTHER REQUIREMENTS

Subject to the Nevada Administrative Code (NAC) 445A.894, the director may require any person authorized to inject by a general permit to apply for and obtain an individual permit. **Upon review of the facts, if the Underground Injection Control (UIC) Program staff is concerned about any aspects of the project (such as a public water system supply well or domestic well), the applicant may be required to obtain an individual permit and application will be processed as a UIC UNEV permit.** The Permittee is only authorized to inject what is listed on page 1 of this permit; any actions other than the discharges listed will require an individual UIC UNEV Permit. If an individual permit is issued to a person holding a general permit for the same activity and discharge points, the general permit is automatically terminated on the effective date of the individual permit.

1. During the period beginning on the effective date of this permit for a specific project and lasting through the expiration date, the Permittee is authorized to inject:
   a. **CATEGORY 1**: Compounds which are injected into a well for remediation purposes per approved rates specified and authorized on page 1; and/or
   b. **CATEGORY 2**: Water that has been treated for remediation purposes to meet groundwater quality criteria.

2. **Injection shall not occur in a well that has had free product light non-aqueous phase liquids (LNAPL) and/or dense non-aqueous phase liquids (DNAPL)) during the previous 3 months.**

3. Extraction, treatment, and injection must prevent introduction of any foreign materials or unapproved additives to the injection zone. The use of any other additive(s) requires written authorization from the Nevada Division of Environmental Protection (the Division) prior to injection. **Sodium thiosulfate utilized to dechlorinate potable water may be used for injection under this general permit.**

4. Injection practices shall not cause injectate and/or groundwater to surface at or near the injection points, nor cause any physical, biological, or chemical degradation of groundwater pursuant to the UIC regulations. Surface discharges are not authorized by this permit. Injection practices shall not cause objectionable odors or any surface hazards.

5. The injectate shall be limited and groundwater monitored by the Permittee, pursuant to the criteria listed below.
   a. Only the approved compounds or water extracted and/or generated on-site shall be injected, and only in the volumes and at the injection rates authorized following appropriate treatment to meet groundwater quality criteria. Other water generated as part of the facility's CA project may also be authorized under this permit. These additional waters shall be produced from an on-site activity, treated to meet groundwater quality criteria, and receive prior Division approval. All facilities encompassed by this permit shall conform to the plans and specifications filed with the Division and shall be maintained in good working order at all times.
   b. Monitoring and reporting shall be conducted pursuant to the following: 1) the approved Corrective Action Workplan; 2) the corresponding category sampling required in Part I.A.6.; and 3) any additional UIC monitoring requirements identified on page 1 of this permit.
   c. A laboratory certified by the state of Nevada must perform analyses. Testing methods for constituents must be EPA or Division approved. It must be clearly stated on all reports which analyses were performed.
   d. The analytical method reporting limits for all chemical constituents must be at least as low as primary or secondary drinking water standards when applicable.

e. The Division may decrease or increase the monitoring of any parameter for good cause.

6. **Monitoring and Reporting Requirements:**

The Permittee shall submit semi-annual reports (August and February) in accordance with Part I.A.7. for UIC activities in a UIC Summary Report submitted to the UIC Program on a continuous basis, whether actively injecting or not.

The required sampling type, frequency and location are based on the discharge category, as follows:

Table 1: Category 1 – Compound Injection

Parameter and Location	Frequency	Limitations	Sampling Location
Injection volume/mass (gallons/pounds per well per month)	Total monthly	See authorization on page 1	Injection well
Solution Ratio (%)	Each injection event	See authorization on page 1	Injection well

Table 2: Category 2 – Pump and Treat

Parameter and Location	Frequency	Limitations	Sampling Location
Injectate Flow Rate (gpm)	Total monthly	See authorization on page 1 (daily average)	Injection well
UIC Sample List 3 – Organics (Attachment I)	Day 7 & 90 of pumping / injection (including restart), Annually thereafter	Monitor and Report	Inlet of treatment system
UIC Sample List 3 – Organics (Attachment I)	Day 7 of pumping / injection (including restart), Quarterly thereafter	Drinking Water Standards	Outfall of treatment system
Depth to Groundwater (feet)	Quarterly	Monitor and Report, water level shall not rise to within three (3) feet of ground surface.	---
Groundwater Elevation (amsl)	Quarterly	Monitor and Report	---

gpm: Gallons per minute amsl: Above mean sea level

a. The UIC Summary Report shall at a minimum contain the following:

1. UIC General Permit and unique ID number.
2. Reporting period: semi-annual period and year; and date submitted.
3. Individual/company reporting.
4. Project name and address.
5. Corrective Action Case Officer name and Facility ID #.
6. Identify which wells were used for injection, which wells were used for extraction (if applicable) and injection rate, volume, date, time and concentration of the

substance injected. If no injection occurred, state so in report.

7. The results of the sampling analyses and monitoring as required by the tables above.
8. Is free product present on-site? If free product is encountered, indicate free product type(s) and date(s) observed.
9. Brief summary detailing normal and any unusual activities.
10. Statement that all required CA Reports have been provided to the appropriate regulatory agency.
11. Name, title and signature of authorized reporting individual.
12. The UIC Summary Report for Category 1 injection shall be no longer than two (2) pages.
13. The UIC Summary Report for Category 2 injection is recommended to be no longer than five (5) pages.

The chain-of-custody documents and laboratory analytical data shall not be submitted with the UIC Summary Report. These documents shall be held on site and made available upon request by the Division.

7. Monitoring results and other requirements obtained during the previous reporting period, whether injection has occurred or not, shall be summarized for each month and reported **no later than 45 days** following the end of the reporting period (January-June, July-December).

Signed copies of only the UIC Summary Report shall be submitted to the UIC program at the following address:

Nevada Division of Environmental Protection
Bureau of Water Pollution Control
Attn: Injection Monitoring Report
901 South Stewart Street, Suite 4001
Carson City, Nevada 89701

8. If, during operation of this facility, the Permittee or their representatives become aware of any condition which degrades the quality of the aquifer (outside of the treatment zone for injection), injection shall cease immediately and the UIC Program shall be notified pursuant to Part II.B.2.

9. Monitoring and system management shall continue for a period of not less than one year following remedial system shutdown approval. **Decisions regarding terminating Corrective Actions (remediation) per NAC 445A.22745 and decisions regarding no further action for the Site per NAC 445A.22725 will be made by the BCA or state-authorized county programs after monitoring groundwater conditions for a minimum of one (1) year per NAC 445A.22745 (2).**

A request may be submitted to the UIC program to cease reporting during the one year monitoring period, or to cancel the UIC permit. Permittee must notify the UIC Program in writing of this request; and for cancellation, must indicate their understanding of the consequences of cancellation prior to receiving final closure approval. Following an evaluation by the UIC Program, the Permittee will be notified in writing granting cancellation or denial of cancellation with rational for such action. **Requests for cancellation must contain: 1) Either certification of well abandonment OR written confirmation from a regulatory agency for continued use as monitoring wells on a well by well basis; 2) final UIC monitoring report; and 3) Notice of Termination U310 Form 4) any affidavits not already on file in UIC permit. Any wells that are not needed for monitoring are required to be properly abandoned prior to UIC permit cancellation.**

10. The Permittee shall operate and maintain the system per established procedures and as approved by the Division. Any modification to the injection practices which is not approved on page 1 of

this permit requires submission of changes and re-issuance of this permit by the UIC Program prior to implementation.

11. Nothing in this authorization shall be construed to eliminate the responsibility for remediation of this site. Remediation shall be accomplished in accordance with plans approved by the BCA, or other State-approved corrective action program.

12. All facilities encompassed by this permit shall conform to the plans and specifications filed with the UIC Program and shall be maintained in good working order at all times.

13. The Permittee shall submit the annual review and services fee in accordance with NAC 445A.872 starting **July 1st** of the year immediately following permit issuance and every year thereafter while the Permittee is authorized to inject under the general permit.

14. The Permittee shall comply with all provisions of the UIC regulations, NAC 445A.810 through 445A.925, and all pertinent laws and regulations. Nothing in this permit relieves the Permittee from responsibilities, liabilities or penalties established by any other state, federal or local jurisdiction.

15. Upon completion of the remediation project, all wells shall be abandoned pursuant to current Division of Water Resources (DWR) regulations (NAC 534) and by UIC regulations by filling them with cement grout from total depth to land surface. A driller licensed in the state of Nevada shall perform all abandonment work.

B. SCHEDULE OF COMPLIANCE

1. The Permittee shall implement and comply with the provisions of the schedule of compliance after approval by the Administrator, including in said implementation and compliance, any additions or modifications which the Administrator may make in approving the schedule of compliance.

   a. The Permittee shall achieve compliance with the conditions, limitations and requirements of the permit at the commencement of relevant activity.
   b. The Permittee shall submit any items listed in this General Permit issuance letter as required.

PART II

A. RECORDKEEPING AND OTHER MONITORING REQUIREMENTS

1. Sampling and Test Procedures

   Samples and measurements taken as required herein shall be representative of the volume and/or nature of the subject of interest. Test procedures for the analyses of required constituents shall comply with applicable analytical methods cited and described in Tables IA - IE of 40 CFR part 136 or in Appendix III of 40 CFR part 261 unless the Administrator approves other procedures.

   A laboratory certified by the state of Nevada must perform all analyses conducted pursuant to permit requirements.

2. Recording of Results

   For each measurement or sample taken pursuant to the requirements of this permit, the Permittee shall record the following information:

a. Chain-of-custody sheets with the exact place, date, and time of sampling;
b. The dates the analyses were performed;
c. The person(s) who performed the analyses;
d. The analytical techniques or methods used;
e. The results of all required analyses;
f. The precision and accuracy of the analytical data; and
g. Raw laboratory data result sheets.

3. Additional Monitoring by Permittee

If the Permittee monitors any constituent at the location(s) designated herein more frequently than required by this permit, or monitors additional constituents other than those required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be made available to the Division.

4. Records Retention

All records and information resulting from the monitoring activities required by this permit, including all records and analyses performed, calibration and maintenance of instrumentation, and recordings from continuous monitoring instrumentation, **shall be retained for a minimum of three (3) years**, or longer if required by the Administrator.

5. Modification of Monitoring Frequency, Location and Sample Type

After considering monitoring data, discharge flow or receiving water conditions, the Division may, for just cause, modify the monitoring frequency, location and/or sample type by issuing a Notice or an Administrative Order to the Permittee.

B. MANAGEMENT REQUIREMENTS

1. Change in Effluents or Discharge

All effluents or discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any constituent identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipated facility expansions, or treatment modifications which will result in new, different, or increased effluents or discharges must be reported by submission of a new application or, if such changes will not violate the limitations specified in this permit, by notice to the permit issuing authority of such changes. Following such notice, the permit may be modified to specify and limit any constituents not previously limited.

2. Noncompliance Notification

If, for any reason, the Permittee does not comply with or will be unable to comply with the conditions, requirements and limitations specified in this permit, the Permittee shall provide the Administrator with the following information, in writing, within five (5) days of becoming aware of such conditions:

a. A description of the noncompliance or violation.
b. The period of noncompliance, including exact dates and times, or if not corrected, the time the noncompliance is expected to continue, and steps being taken to reduce, eliminate and prevent recurrence of the noncompliance.
c. Notification shall be provided verbally as soon as possible but not later than the end of the first working day after learning of the violation.

3. Facilities Operation

The Permittee shall at all times maintain in good working order and operate as efficiently as possible, all treatment or control facilities, devices or systems installed or used by the Permittee to achieve compliance with the terms and conditions of this permit.

4. Adverse Impact

The Permittee shall take all reasonable steps, including such accelerated or additional monitoring as necessary to determine the nature and impact of the non-complying effluent or discharge, to minimize any adverse impact to waters of the State resulting from noncompliance with any limitations specified in this permit.

5. Bypass

Any diversion from or bypass of facilities necessary to maintain compliance with the terms and conditions of this permit is prohibited except where unavoidable to prevent loss of life or severe property damage. The Division will have the final authority in the determination of whether a discharge is deemed unavoidable. The Permittee shall promptly notify the Administrator in writing of each such diversion or bypass, in accordance with the procedure specified in Part II.B.2 above.

C. RESPONSIBILITIES

1. Right of Entry

Pursuant to NRS 445A.655, the Permittee shall allow the Administrator and/or his authorized representatives, upon the presentation of credentials:

a. To enter upon the Permittee's premises where a source is located or in which any records are required to be kept under the terms and conditions of this permit;

b. To have access to and copy any records required to be kept under the terms and conditions of this permit;
c. To inspect any monitoring equipment or monitoring method required in this permit; and
d. To perform any necessary sampling to determine compliance with this permit or to sample any effluent or discharge.

2. Transfer of Ownership or Control

In the event of any change in ownership or control, the Permittee shall notify the succeeding owner of the existence of this permit, in writing, at the earliest possible date to allow sufficient time for the succeeding owner to demonstrate financial responsibility to the Division within 30 days prior to transfer of ownership. The letter shall include the date agreed upon by both parties for the transfer of ownership. A copy of the letter shall be forwarded to the Administrator. The Administrator of the Division of Environmental Protection shall approve all transfers of permits. The Administrator may require modification, or revocation with subsequent reissuance of the permit, to change the name of the new Permittee and incorporate additional requirements as deemed necessary due to any changes made to the injection wells or system by the new Permittee.

3. Availability of Reports

Except for data determined to be confidential under NRS 445A.665, all reports prepared in accordance with the terms of this permit shall be available for public inspection. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in NRS 445A.710.

4. Permit Modification, Suspension or Revocation

After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;
b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or
c. A change in any condition that requires either a temporary or permanent reduction or elimination of the effluent or discharge.

5. Civil and Criminal Liability

a. Nothing in this permit shall be construed to relieve the Permittee from civil or criminal penalties for noncompliance.
b. Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the Permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation.
c. The issuance of this permit does not convey any property rights, in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, State or local laws or regulations.

Attachment I

Nevada Division of Environmental Protection
Underground Injection Control Program - Sampling and Monitoring Report Form

Facility Name :	**Depth of sampled water's origin :**
Facility Owner:	**County:**
NDEP UIC Permit # :	**Location :** Lattitude Longitude
Well ID # :	**Sampler :**
Type of Well : Monitor Production Injection	**Date Sampled :**

UIC Sample List 3 - Organic EPA Method 8260B (page 1 of 2)

Parameter	**IRIS RfD ug/kg-d**	**DW Health Advisories ug/L**	**DW Standards mg/L**	**DW Standards ug/L**	**Measured Values**
Acetone	100				
Dichlorodifluoromethane (Freon 12)	200	1,000			
Chloromethane	4	3			
Vinyl chloride			0.002	2	
Chloroethane					
Bromomethane (Methyl Bromide)	1	10			
Trichlorofluoromethane (Freon 11)	300	2,000			
1,1-Dichloroethene			0.007	7	
Tertiary Butyl Alcohol (TBA)					
Dichloromethane (Methylene chloride)			0.005	5	
tran-1,2-Dichloroethene			0.1	100	
Methyl tert-butyl ether (MTBE)			0.20 or 0.020*	200 or 20	
1,1-Dichloroethane					
Di-isopropyl Ether (DIPE)					
cis-1,2-Dichloroethene			0.07	70	
Bromochloromethane	13	90			
Chloroform			0.08	80	
Ethyl Tertiary Butyl Ether (ETBE)					
2,2-Dichloropropane					
1,2-Dichloroethane			0.005	5	
1,1,1-Trichloroethane (TCA)			0.2	200	
1,1-Dichloropropene					
Carbon tetrachloride			0.005	5	
Benzene			0.005	5	
Tertiary Amyl Methyl Ether (TAME)					
Dibromomethane					
1,2-Dichloropropane			0.005	5	
Trichloroethene (TCE)			0.005	5	
Bromodichloromethane			0.0**	0.0**	
cis and trans-1,3-Dichloropropene	30	0.4			
1,1,2-Trichloroethane			0.005	5	
Toluene			1	1,000	
1,3-Dichloropropane					
Dibromochloromethane			0.060**	60**	
1,2-Dibromoethane (EDB)			0.00005	0.5	
Tetrachloroethene (PCE)			0.005	5	
1,1,1,2-Tetrachloroethane	30	1-70			
Chlorobenzene			0.1	100	
Ethylbenzene			0.7	700	
o-Xylene & m,p-Xylene			10.0***	10,000***	

IRIS RfD and DW Health Advisories (chronic) are from USEPA Region 9, Drinking Water Standards and Health Advisories Table, February 2004. These values are provided for guidance when there is not a Federal Maximum Contaminant Level (MCL).

* State of Nevada Action Level dependant on distance to sensitive receptors.
** MCLG. This compound is one of the Total Trihalomethanes whose MCL is 0.080 mg/L or 80 ug/L.
*** The MCL for the sum of all xylenes is 10.0 mg/L or 10,000 ug/L.

Nevada Division of Environmental Protection
Underground Injection Control Program - Sampling and Monitoring Report Form

Facility Name :	**Depth of sampled water's origin :**
Facility Owner:	**County:**
NDEP UIC Permit # :	**Location :**
Well ID # :	**Sampler :**
Type of Well : Monitor Production Injection	**Date Sampled :**

UIC Sample List 3 - Organic EPA Method 8260B (page 2 of 2)

Parameter	IRIS RfD ug/kg-d	DW Health Advisories ug/L	DW Standards mg/L	DW Standards ug/L	Measured Values
Bromoform			0**	0.0**	
Styrene			0.1	100	
1,1,2,2-Tetrachloroethane	0.05	0.2-0.3			
1,2,3-Trichloropropane	6	40			
Isopropylbenzene (cumene)	100	11,000 (acute)			
Bromobenzene		4,000 (acute)			
n-Propylbenzene					
2- and 4-Chlorotoluene (o and p)	20	100			
1,3,5-Trimethylbenzene					
tert-Butylbenzene					
1,2,4-Trimethylbenzene					
sec-Butylbenzene					
1,3-Dichlorobenzene (m)	90	600			
1,4-Dichlorobenzene (p)			0.075	75	
4-Isopropyltoluene					
1,2-Dichlorobenzene (o)			0.6	600	
n-Butylbenzene					
1,2-Dibromo-3-chloropropane (DBCP)			0.0002	0.2	
1,2,4-Trichlorobenzene			0.07	70	
Naphthalene	20	100			
Hexachlorobutadiene	2	1			
1,2,3-Trichlorobenzene					
tert-Butyl formate (TBF)					

IRIS RfD and DW Health Advisories (chronic) are from USEPA Region 9, Drinking Water Standards and Health Advisories Table, February 2004. These values are provided for guidance when there is not a Federal Maximum Contaminant Level (MCL).

* State of Nevada Action Level dependant on distance to sensitive receptors.

** MCLG. This compound is one of the Total Trihalomethanes whose MCL is 0.080 mg/L or 80 ug/L.

*** The MCL for the sum of all xylenes is 10.0 mg/L or 10,000 ug/L.

OFFICE OF THE NEVADA ENVIRONMENTAL RESPONSE TRUST TRUSTEE
Le Petomane XXVII, Inc., Not Individually, But Solely as the Nevada Environmental Response Trust Trustee
35 East Wacker Drive - Suite 1550
Chicago, Illinois 60601
Tel: (702) 357-8149, x104

April 4, 2017

Mr. Russ Land
Bureau of Water Pollution Control
Nevada Division of Environmental Protection
901 S. Stewart St., Suite 4001
Carson City, NV 89701

RE: Notification under Long-term UIC General Permit GU07RL-51056
Nevada Environmental Response Trust
Henderson, Nevada

Dear Mr. Land:

The Nevada Environmental Response Trust (NERT) maintains Long-term Underground Injection Control (UIC) General Permit GU07RL-51056, issued on August 16, 2016, for the NERT site in the Black Mountain Industrial Complex in Henderson, Nevada. The permit supports groundwater remediation being performed at the direction of the Nevada Division of Environmental Protection, Bureau of Industrial Site Cleanup (BISC). This letter provides notification to the Bureau of Water Pollution Control of new discharges to currently permitted injection wells. Notification complies with Section II.B.1 of the permit, which requires notice to the permit issuing authority for new discharges that do not violate limitations specified in the permit.

The new discharges consist of the activities described in the work plan for an in-situ chromium treatability study, approved by the BISC on June 28, 2016. The injection wells to support the in-situ chromium treatability study were part of the long-term forecast number of injection wells in NERT's July 2, 2016, Notice of Intent (NOI) application for a UIC permit, at Attachment 4, Table 1, of the NOI. Consistent with Attachment 4 of the NOI, this next phase of remediation work will consist of multiple tasks implemented to evaluate the in-situ treatment of contaminated groundwater within the Ammonium Perchlorate (AP) Area boundary shown on Figure 1 in the July 2, 2016 NOI and repeated on Figure 1 attached to this notification.

As part of the in-situ chromium treatability study, electron donors will be injected into approximately six injection wells with new downgradient monitoring wells used to assess the effectiveness of biological treatment for hexavalent chromium and other parameters, including perchlorate. The location of the in-situ chromium treatability study injection area is shown inside the AP Area boundary on Figure 1 (attached). Injections are anticipated to begin in April 2017 and are consistent with the limitations in UIC Permit GU07RL-51056 as described in Table 1, below.

Table 1. New Discharge Compliance with Terms of UIC Permit GU07RL-51056

Parameter	Current Permit Limitation	Compliance with Permit Limitation
In-situ chromium treatability study	Authorization for up to 252 injection wells	Approximately six injection wells are forecast to support the in-situ chromium treatability study portion of long-term remediation activity within the AP Area boundary.

Parameter	Current Permit Limitation	Compliance with Permit Limitation
Injection area	Within AP Area boundary	Injection will occur in an existing retention basin, labeled In-Situ Chromium Treatability Study Area, inside the AP Area boundary (Figure 1).
Injection well construction	Quaternary Alluvium and Upper Muddy Creek Formation	Quaternary Alluvium and Upper Muddy Creek Formation
Injection rate	Maximum 260 gallons per minute	*Less than 260 gallons per minute*
Injection pressure	***Maximum 35 psi***	*Less than 35 psi*
Injectate[1]	**Water, electron donors, sulfate or polysulfide, nutrients, sodium bisulfate, tracer dyes**	*Water, electron donor[2], nutrients, sodium bisulfite, tracer dyes.*

[1] The July 2, 2016 NOI, Attachment 5 – Proposed Injection Program, listed electron donors with injection either continuous or pulsed at an estimated volume of 50,000 gallons over a 2-year period. The amount and type will vary based on results of bench-scale testing, field testing, and perchlorate concentrations. Based on preliminary bench-scale testing results and site-specific hydrologic parameters, NERT is planning to inject electron donors for the in-situ chromium treatability study during not more than six batch injection events over a 6- month period, with not more than 15,000 gallons of electron donor injected during each batch injection event.

[2] Electron donors may include the following, or a mixture of, molasses, industrial sugar water, and EOS, which is a water-mixable vegetable oil-based organic source of carbon for in-situ remediation.

NERT will submit a summary of all injection activity under UIC General Permit GU07RL-51056 as part of the next semi-annual report, due no later than August 15, 2017. If you have questions regarding this permit notification, please contact Dan Pastor, Tetra Tech Project Manager, at (303) 447-1823 or myself at (702) 960-4309 or at steve.clough@nert-trust.com.

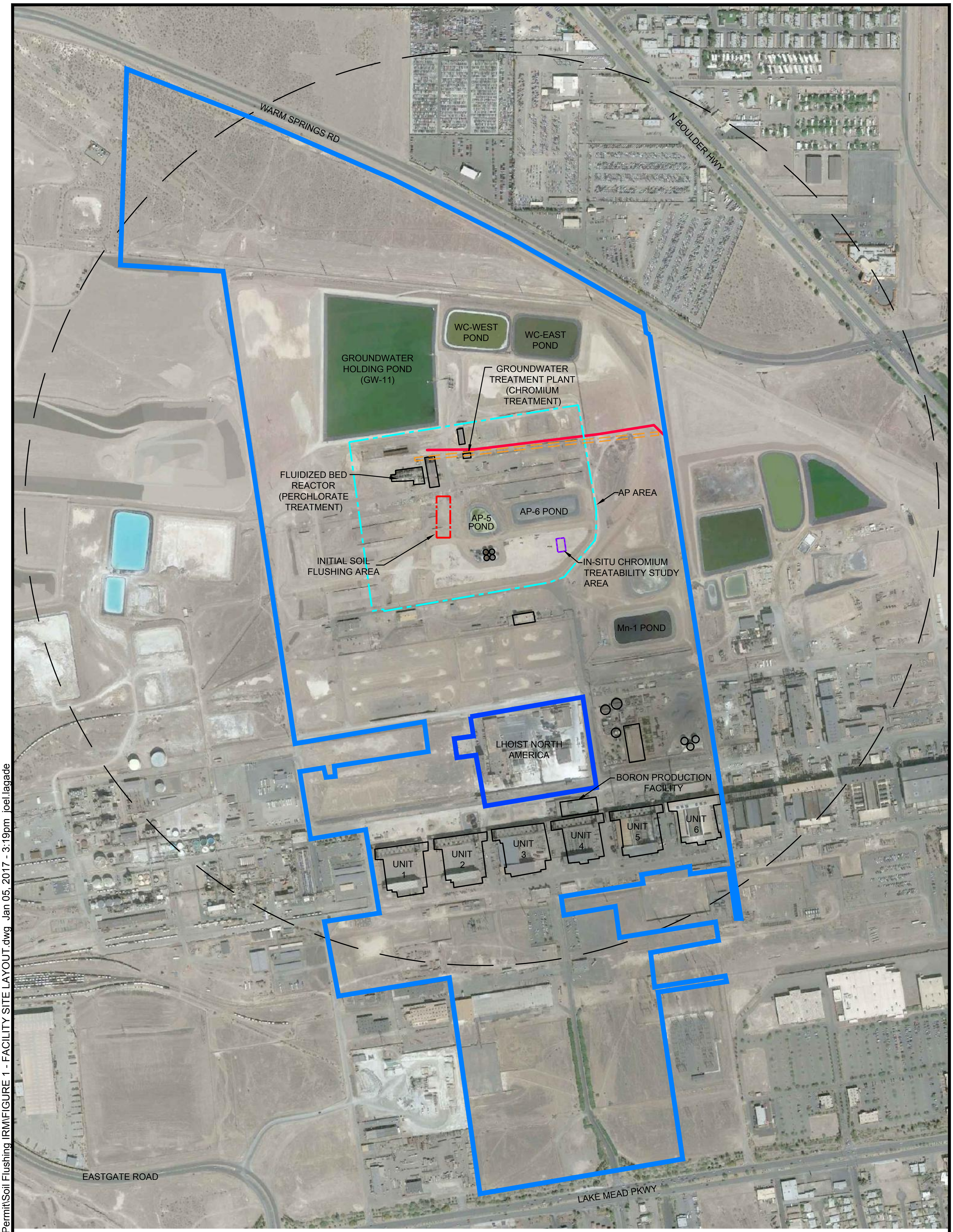
Office of the Nevada Environmental Response Trust

Stephen R. Clough

Stephen R. Clough, P.G., CEM
Remediation Director
CEM Certification Number: 2399, exp. 3/24/19

Cc (via NERT Sharefile Distribution):

James Dotchin, NDEP Bureau of Industrial Site Cleanup
Carlton Parker, NDEP Bureau of Industrial Site Cleanup
Weiquan Dong, NDEP Bureau of Industrial Site Cleanup
Christa Smaling, NDEP Bureau of Industrial Site Cleanup
Jay Steinberg, as President of the Nevada Environmental Response Trust Trustee and not individually
Andrew Steinberg, as Vice President of the Nevada Environmental Response Trust Trustee and not individually
Tanya C. O’Neill, Foley and Lardner, LLP
Derek Amidon, Tetra Tech
Dan Pastor, Tetra Tech
Allan DeLorme, Ramboll Environ
John Pekala, Ramboll Environ



LEGEND

NERT SITE BOUNDARY
GROUNDWATER BARRIER WALL
AP AREA BOUNDARY
INITIAL SOIL FLUSHING IRM BOUNDARY
IN-SITU CHROMIUM TREATABILITY STUDY AREA
3,000-FOOT RADIUS
BUILDING/STRUCTURE
INTERCEPTOR WELL FIELD (IWF)

N

APPROXIMATE SCALE IN FEET
0 600 1,200

NOTES:
1. "LAS VEGAS, NV." MAP. GOOGLE EARTH PRO. GOOGLE, 22 MAR. 2015.
2. ALL LOCATIONS ARE APPROXIMATE.

FACILITY / SITE LAYOUT

NEVADA ENVIRONMENTAL RESPONSE TRUST HENDERSON, NEVADA

PREPARED BY:
TETRA TECH, INC.
1489 WEST WARM SPRINGS ROAD, SUITE 110
HENDERSON, NEVADA 89014
Phone (702) 966-8340

PROJECT NUMBER	APPROVED BY	DRAWN BY	DATE	FIGURE
87600001	MC	JRL	JAN 2017	1

P:\87600008-NERT-K01CADAffidavit - UIC Permit\Soil Flushing IRM\FIGURE 1 - FACILITY SITE LAYOUT.dwg Jan 05, 2017 - 3:19pm joel.lagade

---

From: Russ Land <rland@ndep.nv.gov>
Sent: Thursday, June 01, 2017 8:44 AM
To: Brodsky, Gwen
Cc: Ayyaswami, Arul; Lenker, Carl; Pastor, Dan; Steve Clough
Subject: RE: NERT In-situ Chromium Treatability Study - sodium bicarbonate

Received, approved and filed

Thanks, Russ

Russ Land
Underground Injection Control Program

Nevada Division of Environmental Protection
Bureau of Water Pollution Control
901 S. Stewart Street, Suite 4001
Carson City, Nevada 89701

p: (775) 687-9428
f: (775) 687-4684
e: rland@ndep.nv.gov
www.ndep.nv.gov

From: Brodsky, Gwen [mailto:Gwen.Brodsky@tetratech.com]
Sent: Friday, May 26, 2017 8:17 AM
To: Russ Land <rland@ndep.nv.gov>
Cc: Ayyaswami, Arul <Arul.Ayyaswami@tetratech.com>; Lenker, Carl <Carl.Lenker@tetratech.com>; Pastor, Dan <Dan.Pastor@tetratech.com>; Steve Clough <steve.clough@nert-trust.com>
Subject: NERT In-situ Chromium Treatability Study - sodium bicarbonate

Russ,

Thank you for the phone discussion this week regarding the proposed addition of sodium bicarbonate during the NERT In-situ Chromium Treatability Study. With this email, the following addition is made to the attached April 4, 2017 notification letter under UIC Permit #GU07RL-51056, Table 1, which NDEP approved on April 4 (attached):

Injectates will include the addition of sodium bicarbonate to assist with buffering pH of the carbon substrate injections for the In-Situ Chromium Treatability Study to prevent a pH shock to the bacteria populations and because the naturally-occurring groundwater does not have sufficient buffering capacity without supplementation.

Thank you, again, for your assistance with this,
Gwen

Gwen Brodsky | Planning and Permitting Lead | Energy and Mineral Services
Direct **(303) 448-7434** | Business **(303) 664-4630** | Mobile **(303) 362-3121**

Tetra Tech | Complex World, Clear Solutions™
1100 South McCaslin Blvd., Suite 150, Superior, CO 80027 | tetratech.com

Biological Reduction Study

BRIAN SANDOVAL
GOVERNOR

STATE OF NEVADA

BRADLEY CROWELL
Director

JASON KING, P.E.
State Engineer

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
400 Shadow Lane, Suite 201
Las Vegas, Nevada 89106
(702) 486-2770 · Fax (702) 486-2781
http://water.nv.gov

NOTICE OF INTENT CARD
REVIEW FORM

To: Bob Nix

Date: June 19, 2017

Facsimile No.: ______ or E-mail Address: bnix@cascade-env.com

This document was: ☑ E-mailed ☐ Faxed

NOI Card Number: 39758 ☑ **Approved** ☐ **Rejected** (See reasons below)

Work performed	missing	☐	invalid	☐
Proposed use of well	missing	☐	invalid	☐
Intended start date	missing	☐	invalid	☐
Waiver/Permit number if applicable	missing	☐	invalid	☐
Well location (legal description, GPS coordinates)	missing	☐	invalid	☐
Parcel number	missing	☐	invalid	☐
Address at well location	missing	☐	invalid	☐
Permit number	missing	☐	invalid	☐
Waiver number or NDEP Facility ID Number	missing	☐	invalid	☐
Address of Client	missing	☐	invalid	☐
Name of client/owner	missing	☐	invalid	☐
Contractor's license number	missing	☐	invalid	☐
Onsite well driller's license number	missing	☐	invalid	☐
Drilling company name/address	missing	☐	invalid	☐
Driller's signature	missing	☐	invalid	☐
Replacement well	Yes	☐	No	☐

If yes, existing well must be plugged at time the replacement well is drilled, pursuant to NAC 534.300 Replacement Well.

Instructions: Please note that you must provide a copy of the well driller's report for the installation of two (2) 2-inch monitor wells within 30 days of completion. If you have any questions, please do not hesitate to give our office a call.

JG

Person reviewing NOI Card: Christi Cooper, waiver issued by Tracy Geter

Date reviewed: June 16, 2017

BRIAN SANDOVAL
Governor

BRADLEY CROWELL
Interim Director

STATE OF NEVADA

JASON KING, P.E.
State Engineer

JOHN GUILLORY, P.E.
Supervising Engineer

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
SOUTHERN NEVADA BRANCH OFFICE
400 Shadow Lane, Suite 201
Las Vegas, Nevada 89106
(702) 486-2770 • Fax (702) 486-2781
http://water.nv.gov

June 19, 2017

MO-3316

Bob Nix
Operations Manager
Cascade Drilling, LP
4221 West Oquendo Road
Las Vegas, Nevada 89118

RE: Request for waiver to install two (2) temporary monitor wells to collect groundwater samples and analyze the samples as requested by Nevada Division of Environmental Protection (NDEP) Order Number H-000539, located on a non-addressed parcel, just east of 510 South 4th Street, Clark County, Nevada and within the Las Vegas Valley Basin (212).

Dear Mr. Nix:

As provided in Nevada Administrative Code (NAC) § 534.450 of the Regulation for Water Well and Related Drilling, permission is herewith **granted** to install two (2) temporary monitor wells to assess water conditions as described in your request received June 16, 2017. Your statement ensuring Nevada Environmental Response Trust responsibility for abandonment of the well upon project completion was received in this office on June 16, 2017.

The two (2) proposed monitor wells referenced in your letter are listed below:

Well Name	Legal Description	GPS Coordinates (NAD 83/ WGS 84)
CTMW-05	NW¼, SE¼ Section 12, T.22S, R62E	36° 02' 49.25" N, -115° 00' 06.29" W
CTMW-05	NW¼, SE¼ Section 12, T.22S, R62E	36° 02' 49.22" N, -115° 00' 05.96" W

This office also waives the provisions that require a mandate to install monitoring wells, NAC § 534.4351 (1) (c). The purpose of this well is to collect groundwater samples and analyze the samples as requested by NDEP Order Number H-000539, located on a non-addressed parcel, just east of 510 South 4th Street, Clark County, Nevada. The wellhead shall be protected from damage due to vandalism or sunlight. If polyvinyl chloride (PVC) casing is used, then these wells must be completed with ASTM F-480 (Sch. 40 or heavier) well casing as provided in NAC § 534.362.

Glued casing joint connections will not be allowed. Full compliance with the remainder of the statute and regulation is required.

A plot map showing the actual location of the completed wells must be submitted upon completion of the drilling operations. Please include an accurate description of the location of the monitor well on the completion reports (GPS coordinates are required).

The well driller's reports shall bear this waiver number: MO-3316.

Authorization to drill under this waiver expires one (1) year from the date of this letter.

The well driller must have a copy of this waiver in possession at all times during drilling activities pertaining to this project. This well may only be pumped when necessary to obtain samples.

Please note that you must notify the Nevada Division of Environmental Protection (NDEP) for possible permitting requirements for groundwater or temporary surface discharge permits, which may include Underground Injection Control (UIC) or National Pollution Discharge Elimination System (NPDES) Permit Numbers. For more information regarding the permitting process with NDEP, please contact Mr. Nicholas Brothers at (775) 687-4670.

The wells shall be plugged and abandoned, as provided by regulation, upon project completion. The current owner of Assessor's Parcel Number 178-12-701-004 is shown as Nevada Environmental Response Trust by the records of the Clark County Assessor's office. This waiver does not imply or grant any land use agreements between Nevada Environmental Response Trust and any land owners. It is expressly understood that this authorization does not relieve the operator of the requirements of any other state, federal or local agencies.

If you have any questions, please contact this office at 702-486-2770.

Sincerely,

Tracy

Tracy Geter
Drilling Supervisor

cc: File
Christi Cooper, SNBO Office
Carson City Office
Nicholas Brothers, NDEP-Permits Group, Carson City, Nevada (e-mail)
JD Dotchin, NDEP-Bureau of Industrial Site Cleanup, Las Vegas, Nevada (e-mail)
Jay A. Steinberg, Nevada Environmental Response Trust, Chicago, Illinois

STATE OF NEVADA

BRIAN SANDOVAL
GOVERNOR

LEO DROZDOFF
Director

JASON KING, P.E.
State Engineer

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

DIVISION OF WATER RESOURCES

400 Shadow Lane, Suite 201
Las Vegas, Nevada 89106
(702) 486-2770 · Fax (702) 486-2781
http://water.nv.gov

NOTICE OF INTENT CARD
REVIEW FORM

To: Bob Nix
National EWP

Date: December 1, 2016

Facsimile No.: ____________ or E-mail Address: bnix@nationalewp.com

This document was: ☑ E-mailed ☐ Faxed

NOI Card Number: 39157 ☑ **Approved** ☐ **Rejected** (See reasons below)

Work performed	missing	☐	invalid	☐
Proposed use of well	missing	☐	invalid	☐
Intended start date	missing	☐	invalid	☐
Waiver/Permit number if applicable	missing	☐	invalid	☐
Well location (legal description, GPS coordinates)	missing	☐	invalid	☐
Parcel number	missing	☐	invalid	☐
Address at well location	missing	☐	invalid	☐
Permit number	missing	☐	invalid	☐
Waiver number or NDEP Facility ID Number	missing	☐	invalid	☐
Address of Client	missing	☐	invalid	☐
Name of client/owner	missing	☐	invalid	☐
Contractor's license number	missing	☐	invalid	☐
Onsite well driller's license number	missing	☐	invalid	☐
Drilling company name/address	missing	☐	invalid	☐
Driller's signature	missing	☐	invalid	☐
Replacement well	Yes	☐	No	☐

If yes, existing well must be plugged at time the replacement well is drilled, pursuant to NAC 534.300 Replacement Well.

Instructions: Please note that you must provide a copy of the well driller's report for the installation of four (4) monitor wells within 30 days of installation. If you have any questions, please do not hesitate to give our office a call.

Person reviewing NOI Card: Tracy Geter

Date reviewed: November 30, 2016

BRIAN SANDOVAL
Governor

KAY SCHERER
Interim Director

STATE OF NEVADA

JASON KING, P.E.
State Engineer

JOHN GUILLORY, P.E.
Supervising Engineer

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
SOUTHERN NEVADA BRANCH OFFICE
400 Shadow Lane, Suite 201
Las Vegas, Nevada 89106
(702) 486-2770 • Fax (702) 486-2781
http://water.nv.gov

December 1, 2016

MO-3243

Bob Nix
Operations Manager
National EWP
4221 W. Oquendo Road
Las Vegas, Nevada 89118

RE: Request for waiver to install four (4) temporary monitor wells to collect groundwater samples and analyze the samples as requested by Nevada Division of Environmental Protection (NDEP) Order Number H-000539, located at 510 S. Fourth Street, Henderson, Nevada and within the Las Vegas Valley Basin (212).

Dear Mr. Nix:

As provided in Nevada Administrative Code (NAC) § 534.450 of the Regulation for Water Well and Related Drilling, permission is herewith **granted** to install four (4) temporary monitor wells to assess water conditions as described in your request received November 28, 2016. Your statement ensuring Nevada Environmental Response Trust responsibility for abandonment of the well upon project completion was received in this office on November 28, 2016.

The four (4) proposed monitor wells referenced in your letter are listed below:

Well Name	Legal Description	GPS Coordinates (NAD 83/WGS 84)
CTMW-01	NW¼, SE¼ Section 12, T.22S, R62E	36°02'48.97" N, 115°0'06.06" W
CTW-02	NW¼, SE¼ Section 12, T.22S, R62E	36°02'49.18" N, 115°0'05.65" W
CTIW-01S	NW¼, SE¼ Section 12, T.22S, R62E	36°02'48.70" N, 115°0'05.69" W
CTIW-01D	NW¼, SE¼ Section 12, T.22S, R62E	36°02'48.65" N, 115°0'05.35" W

This office also waives the provisions that require a mandate to install monitoring wells, NAC § 534.4351 (1)(c). The purpose of this well is to collect groundwater samples and analyze the samples as requested by NDEP Order Number H-000539, located at 510 S. Fourth Street, Henderson, Nevada. The wellhead shall be protected from damage due to vandalism or sunlight. If polyvinyl chloride (PVC) casing is used, then these wells must be completed with ASTM F-480 (Sch. 40 or heavier) well casing as provided in NAC § 534.362.

Glued casing joint connections will not be allowed. Full compliance with the remainder of the statute and regulation is required.

A plot map showing the actual location of the completed wells must be submitted upon completion of the drilling operations. Please include an accurate description of the location of the monitor well on the completion reports (GPS coordinates are required).

The well driller's reports shall bear this waiver number: MO-3243.

Authorization to drill under this waiver expires one (1) year from the date of this letter.

The well driller must have a copy of this waiver in possession at all times during drilling activities pertaining to this project. This well may only be pumped when necessary to obtain samples.

Please note that you must notify the Nevada Division of Environmental Protection (NDEP) for possible permitting requirements for groundwater or temporary surface discharge permits, which may include Underground Injection Control (UIC) or National Pollution Discharge Elimination System (NPDES) Permit Numbers. For more information regarding the permitting process with NDEP, please contact Mr. Nicholas Brothers at (775) 687-4670.

The wells shall be plugged and abandoned, as provided by regulation, upon project completion. The current owner of Assessor's Parcel Number 178-12-701-004 is shown as Nevada Environmental Response Trust by the records of the Clark County Assessor's office. This waiver does not imply or grant any land use agreements between Nevada Environmental Response Trust and any land owners. It is expressly understood that this authorization does not relieve the operator of the requirements of any other state, federal or local agencies.

If you have any questions, please contact this office at 702-486-2770.

Sincerely,

Tracy Geter
Drilling Supervisor

cc: File
Carson City Office
Nicholas Brothers, NDEP-Permits Group, Carson City, Nevada (e-mail)
Weiquan Dong, NDEP-Las Vegas Office, Las Vegas, Nevada (e-mail)
Jay A. Steinberg, Property Owner, Nevada Environmental Response Trust, Chicago, Illinois

ORIGINAL
FILE WITH DIVISION OF
WATER RESOURCES

NOTICE OF INTENT

No. 39157

Today's Date: 11-28-16
Intended Start Date: 12-2-16
Well ID (if applicable): CTwm-01

Type of Work to be Done: Drilling: ☑ Deepening: ☐ Reconditioning: ☐ Plugging: ☐

Is this a replacement well? Yes ☐ No ☑
If there is an existing well, what is the well log number?

Proposed use of well: Monitor
Diameter of well: 2 inches
Number of wells: 4

If this well is a domestic well, is it located within a water purveyor's service area? Yes ☐ No ☐
If yes, what is the DOM waiver:

If this is a monitor well required by another government agency, what is the facility ID number? H-000539
Agency: NDEP

If this well is being completed under a waiver, please provide the corresponding waiver number:

If a water right is associated with this well, what is the permit number?

Location of the well by Public Land Survey: NW 1/4 SE 1/4 Sec. 12 T 22 [✓ N]/S R 62 E

Latitude: 36° 02' 48.97" N
UTM E
☐ NAD 27

Longitude: 115°00. 06.66" W or
UTM N
☐ NAD 83/WGS 84

Address at well location: 510 S. Forth St Henderson NV 89105

Assessor Parcel Number: 178-12-701-004

County: Clark
Subdivision Name:

Name of Client: NERT Nevada Environmental Response Trust

Address of Client: 35 E. Wacker Dr Suite 1550 Chicago IL 60601

Contractor's License Number: 00735355
On-Site Driller's License Number: 2512

Company Name and Address: National EWP 4221 W Oquendo Rd. Las Vegas NV 89118

Need Log Forms ☐ **Need Intent Cards** ☐

(Rev. 1-14)
Driller's Signature: Bob

IN THE OFFICE OF THE STATE ENGINEER OF NEVADA

AFFIDAVIT OF INTENT
TO PLUG A MONITORING WELL

Notice of Intent # 39157

I, Jay A. Steinberg Pres. Name & Title

Nevada Environmental Response Trust Company

35 E. Wacker Drive, Suite 1550 Address

Chicago, IL 60601

(702) 686-9611 Telephone Number

DCNR/DWR/SNBO
RECEIVED
NOV 28 2016

of the real property located at:

Street Address (if any) 510 S. Fourth Street, Henderson, NV 89015

County Assessor Parcel Number (APN) 178-12-701-004

Situated within the NW ¼ SE ¼ Section 12 T 22 S R 62 E, M.D.B. & M.

Latitude (N):	See attached	or	UTM (m) E:	--		Datum
Longitude (W):	table		UTM (m) N:	--		NAD83/WGS84

and whereupon one or more monitoring wells are located or to be located, fully understand that I shall be responsible for, and shall cause the wells to be plugged in accordance with the provisions contained in Nevada Administrative Code (NAC) 534.4365 and all other applicable rules and regulations for drilling/plugging wells in the State of Nevada, **not later than thirty days after the date when monitoring is no longer required.**

I shall further make any purchaser of this parcel aware of these conditions.

Responsible Party
(Printed Name): Jay A Stein Pres (Signature):

State of ~~Nevada~~ Illinois

County of KANE

Subscribed and sworn to before me on 11/25/2016

by STEVEN R SCHROEDER

Signature of Notary Public Required

"OFFICIAL SEAL"
STEVEN R. SCHROEDER
Notary Public - State of Illinois
My Commission Expires January 13, 2019

Notary Seal

Revised 12/14

NOI-39157

Additional Well Locations

Coordinate system Lat/Long

Datum NAD27

Well ID/Name	Coordinates		1/4	1/4	Sec.	Twn	Rng	APN
CTW-02	36*02'49.18"N	115*00'05.65"W	NW	SE	12	22S	62E	178-12-701-004
CTIW-01S	36* 02' 48.70"N	115* 00' 05.69"W	NW	SE	12	22S	62E	178-12-701-004
CTIW-01D	36* 02' 48.65" N	115* 00' 05.35"W	NW	SE	12	22S	62E	178-12-701-004

Chemical Reduction Study

BRIAN SANDOVAL
GOVERNOR

STATE OF NEVADA

LEO DROZDOFF
Director

JASON KING, P.E.
State Engineer

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
400 Shadow Lane, Suite 201
Las Vegas, Nevada 89106
(702) 486-2770 · Fax (702) 486-2781
http://water.nv.gov

NOTICE OF INTENT CARD
REVIEW FORM

To: Bob Nix
National EWP

Date: July 13, 2016

Facsimile No.: ____________ or E-mail Address: ____________

This document was: ☑ E-mailed ☐ Faxed

NOI Card Number: 37996 ☑ **Approved** ☐ **Rejected** (See reasons below)

Work performed	missing	☐	invalid	☐
Proposed use of well	missing	☐	invalid	☐
Intended start date	missing	☐	invalid	☐
Waiver/Permit number if applicable	missing	☐	invalid	☐
Well location (legal description, GPS coordinates)	missing	☐	invalid	☐
Parcel number	missing	☐	invalid	☐
Address at well location	missing	☐	invalid	☐
Permit number	missing	☐	invalid	☐
Waiver number or NDEP Facility ID Number	missing	☐	invalid	☐
Address of Client	missing	☐	invalid	☐
Name of client/owner	missing	☐	invalid	☐
Contractor's license number	missing	☐	invalid	☐
Onsite well driller's license number	missing	☐	invalid	☐
Drilling company name/address	missing	☐	invalid	☐
Driller's signature	missing	☐	invalid	☐
Replacement well	Yes	☐	No	☐

If yes, existing well must be plugged at time the replacement well is drilled, pursuant to NAC 534.300 Replacement Well.

Instructions: Please note that you must provide a copy of the well driller's report of the eight (8) temporary monitor wells within 30 days of installation. If you have any questions, please do not hesitate to give our office a call.

Person reviewing NOI Card: Christi Cooper, waiver completed by Tracy Geter.

Date reviewed: July 12, 2016

BRIAN SANDOVAL
Governor

LEO DROZDOFF
Director

STATE OF NEVADA

JASON KING, P.E.
State Engineer

JOHN GUILLORY, P.E.
Supervising Engineer

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
SOUTHERN NEVADA BRANCH OFFICE
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http://water.nv.gov

July 13, 2016

MO-3195

Bob Nix
Operations Manager
National EWP
4221 W. Oquendo Road
Las Vegas, Nevada 89118

RE: Request for waiver to install eight (8) temporary monitor wells to collect groundwater samples and analyze the samples as requested by Nevada Division of Environmental Protection (NDEP) Order Number H-000539, located just southwest of 510 South Fourth Street, Henderson, Nevada and within the Las Vegas Valley Basin (212).

Dear Mr. Nix:

As provided in Nevada Administrative Code (NAC) § 534.450 of the Regulation for Water Well and Related Drilling, permission is herewith **granted** to install eight (8) temporary monitor wells to assess water conditions as described in your request received July 7, 2016. Your statement ensuring Nevada Environmental Response Trust responsibility for abandonment of the well upon project completion was received in this office on July 7, 2016.

The eight (8) proposed monitor wells referenced in your letter are listed below:

Well Name	Legal Description	GPS Coordinates (NAD 83/WGS 84)
I-AS	NE¼, SW¼ Section 12, T.22S, R62E	36.04733° N, -115.00433° W
I-AT	NE¼, SW¼ Section 12, T.22S, R62E	36.04793° N, -115.00432° W
I-AU	NE¼, SW¼ Section 12, T.22S, R62E	36.04793° N, -115.00412° W
I-AV	NE¼, SW¼ Section 12, T.22S, R62E	36.04747° N, -115.00440° W
I-AW	NE¼, SW¼ Section 12, T.22S, R62E	36.04747° N, -115.00431° W
I-AX	NE¼, SW¼ Section 12, T.22S, R62E	36.04747° N, -115.00423° W
I-AY	NE¼, SW¼ Section 12, T.22S, R62E	36.04747° N, -115.00415° W
I-AZ	NE¼, SW¼ Section 12, T.22S, R62E	36.04746° N, -115.00406° W

This office waives regulation NAC 534.4355(3) - "Monitor Wells: Casing; prevention of contamination: The diameter of the casing must not exceed 4 inches in nominal size."

You will be required to provide for a maximum of six (6) inch nominal diameter steel casing that complies with NAC 534.360 (3)(c) or PVC casing that complies with NAC 534.362 inclusive.

This office also waives the provisions that require a mandate to install monitoring wells, NAC § 534.4351 (1)(c). The purpose of this well is to collect groundwater samples and analyze the samples as requested by NDEP Order Number H-000539, located just southwest of 510 South Fourth Street, Henderson, Nevada. The wellhead shall be protected from damage due to vandalism or sunlight. If polyvinyl chloride (PVC) casing is used, then these wells must be completed with ASTM F-480 (Sch. 40 or heavier) well casing as provided in NAC § 534.362.

Glued casing joint connections will not be allowed. Full compliance with the remainder of the statute and regulation is required.

A plot map showing the actual location of the completed wells must be submitted upon completion of the drilling operations. Please include an accurate description of the location of the monitor well on the completion reports (GPS coordinates are required).

The well driller's reports shall bear this waiver number: MO-3195.

Authorization to drill under this waiver expires one (1) year from the date of this letter.

The well driller must have a copy of this waiver in possession at all times during drilling activities pertaining to this project. This well may only be pumped when necessary to obtain samples.

Please note that you must notify the Nevada Division of Environmental Protection (NDEP) for possible permitting requirements for groundwater or temporary surface discharge permits, which may include Underground Injection Control (UIC) or National Pollution Discharge Elimination System (NPDES) Permit Numbers. For more information regarding the permitting process with NDEP, please contact Mr. Nicholas Brothers at (775) 687-4670.

The wells shall be plugged and abandoned, as provided by regulation, upon project completion. The current owner of Assessor's Parcel Number 178-12-301-005 is shown as Nevada Environmental Response Trust by the records of the Clark County Assessor's office. This waiver does not imply or grant any land use agreements between Nevada Environmental Response Trust and any land owners. It is expressly understood that this authorization does not relieve the operator of the requirements of any other state, federal or local agencies.

If you have any questions, please contact this office at 702-486-2770.

Sincerely,

Tracy Geter
Drilling Supervisor

cc: File
Carson City Office
Christi Cooper, SNBO Office
Nevada Environmental Response Trust, Property Owner, Chicago, IL
Nicholas Brothers, NDEP-Permits Group, Carson City, Nevada

STATE OF NEVADA

BRIAN SANDOVAL
GOVERNOR

LEO DROZDOFF
Director

JASON KING, P.E.
State Engineer

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES
400 Shadow Lane, Suite 201
Las Vegas, Nevada 89106
(702) 486-2770 · Fax (702) 486-2781
http://water.nv.gov

NOTICE OF INTENT CARD
REVIEW FORM

To: Bob Nix
National EWP

Date: July 13, 2016

Facsimile No.: ________ or E-mail Address: ________

This document was: ☑ E-mailed ☐ Faxed

NOI Card Number: 37995 ☑ **Approved** ☐ **Rejected** (See reasons below)

Work performed	missing	☐	invalid	☐
Proposed use of well	missing	☐	invalid	☐
Intended start date	missing	☐	invalid	☐
Waiver/Permit number if applicable	missing	☐	invalid	☐
Well location (legal description, GPS coordinates)	missing	☐	invalid	☐
Parcel number	missing	☐	invalid	☐
Address at well location	missing	☐	invalid	☐
Permit number	missing	☐	invalid	☐
Waiver number or NDEP Facility ID Number	missing	☐	invalid	☐
Address of Client	missing	☐	invalid	☐
Name of client/owner	missing	☐	invalid	☐
Contractor's license number	missing	☐	invalid	☐
Onsite well driller's license number	missing	☐	invalid	☐
Drilling company name/address	missing	☐	invalid	☐
Driller's signature	missing	☐	invalid	☐
Replacement well	Yes	☐	No	☐

If yes, existing well must be plugged at time the replacement well is drilled, pursuant to NAC 534.300 Replacement Well.

Instructions: Please note that you must provide a copy of the well driller's report for each of the 37 temporary monitor wells within 30 days of installation. If you have any questions, please do not hesitate to give our office a call.

Person reviewing NOI Card: Christi Cooper, waiver completed by Tracy Geter.

Date reviewed: July 12, 2016

BRIAN SANDOVAL
Governor

LEO DROZDOFF
Director

STATE OF NEVADA

JASON KING, P.E.
State Engineer

JOHN GUILLORY, P.E.
Supervising Engineer

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http://water.nv.gov

July 13, 2016

MO-3196

Bob Nix
Operations Manager
National EWP
4221 W. Oquendo Road
Las Vegas, Nevada 89118

RE: Request for waiver to install thirty-seven (37) temporary monitor wells to collect groundwater samples and analyze the samples as requested by Nevada Division of Environmental Protection (NDEP) Order Number H-000539, located just southwest of 510 South Fourth Street, Henderson, Nevada and within the Las Vegas Valley Basin (212).

Dear Mr. Nix:

As provided in Nevada Administrative Code (NAC) § 534.450 of the Regulation for Water Well and Related Drilling, permission is herewith **granted** to install thirty-seven (37) temporary monitor wells to assess water conditions as described in your request received July 7, 2016. Your statement ensuring Nevada Environmental Response Trust responsibility for abandonment of the well upon project completion was received in this office on July 7, 2016.

The thirty-seven (37) proposed monitor wells referenced in your letter are listed below:

Well Name	Legal Description	GPS Coordinates (NAD 83/WGS 84)
UFIW-05I	NE¼, SW¼ Section 12, T.22S, R62E	36.04733° N, -115.00432° W
UFIW-05D	NE¼, SW¼ Section 12, T.22S, R62E	36.04732° N, -115.00432° W
UFIW-06S	NE¼, SW¼ Section 12, T.22S, R62E	36.04733° N, -115.00427° W

Well Name	Legal Description	GPS Coordinates (NAD 83/WGS 84)
UFIW-06I	NE¼, SW¼ Section 12, T.22S, R62E	36.04732° N, -115.00426° W
UFIW-06D	NE¼, SW¼ Section 12, T.22S, R62E	36.04732° N, -115.00426° W
UFIW-07S	NE¼, SW¼ Section 12, T.22S, R62E	36.04733° N, -115.00421° W
UFIW-07I	NE¼, SW¼ Section 12, T.22S, R62E	36.04733° N, -115.00419° W
UFIW-07D	NE¼, SW¼ Section 12, T.22S, R62E	36.04732° N, -115.00420° W
UFIW-08S	NE¼, SW¼ Section 12, T.22S, R62E	36.04733° N, -115.00415° W
UFIW-08I	NE¼, SW¼ Section 12, T.22S, R62E	36.04733° N, -115.00413° W
UFIW-08D	NE¼, SW¼ Section 12, T.22S, R62E	36.04732° N, -115.00414° W
UFIW-01S	NE¼, SW¼ Section 12, T.22S, R62E	36.04782° N, -115.00433° W
UFIW-01I	NE¼, SW¼ Section 12, T.22S, R62E	36.04783° N, -115.00431° W
UFIW-01D	NE¼, SW¼ Section 12, T.22S, R62E	36.04781° N, -115.00432° W
UFIW-02S	NE¼, SW¼ Section 12, T.22S, R62E	36.04782° N, -115.00426° W
UFIW-02I	NE¼, SW¼ Section 12, T.22S, R62E	36.04782° N, -115.00425° W
UFIW-02D	NE¼, SW¼ Section 12, T.22S, R62E	36.04781° N, -115.00426° W
UFIW-03S	NE¼, SW¼ Section 12, T.22S, R62E	36.04782° N, -115.00420° W
UFIW-03I	NE¼, SW¼ Section 12, T.22S, R62E	36.04782° N, -115.00419° W
UFIW-03D	NE¼, SW¼ Section 12, T.22S, R62E	36.04781° N, -115.00420° W
UFIW-04S	NE¼, SW¼ Section 12, T.22S, R62E	36.04782° N, -115.00414° W
UFIW-04I	NE¼, SW¼ Section 12, T.22S, R62E	36.04782° N, -115.00413° W
UFIW-04D	NE¼, SW¼ Section 12, T.22S, R62E	36.04781° N, -115.00414° W
DFPZ-01	NE¼, SW¼ Section 12, T.22S, R62E	36.04793° N, -115.00436° W
DFPZ-02	NE¼, SW¼ Section 12, T.22S, R62E	36.04793° N, -115.00426° W

Well Name	Legal Description	GPS Coordinates (NAD 83/WGS 84)
DFPZ-03	NE¼, SW¼ Section 12, T.22S, R62E	36.04793° N, -115.00416° W
DFPZ-04	NE¼, SW¼ Section 12, T.22S, R62E	36.04747° N, -115.00436° W
DFPZ-05	NE¼, SW¼ Section 12, T.22S, R62E	36.04747° N, -115.00427° W
DFPZ-06	NE¼, SW¼ Section 12, T.22S, R62E	36.04747° N, -115.00419° W
DFPZ-07	NE¼, SW¼ Section 12, T.22S, R62E	36.04747° N, -115.00410° W
UFMW-01S	NE¼, SW¼ Section 12, T.22S, R62E	36.04788° N, -115.00432° W
UFMW-02S	NE¼, SW¼ Section 12, T.22S, R62E	36.04788° N, -115.00424° W
UFMW-03S	NE¼, SW¼ Section 12, T.22S, R62E	36.04788° N, -115.00417° W
UFMW-04S	NE¼, SW¼ Section 12, T.22S, R62E	36.04740° N, -115.00433° W
UFMW-05S	NE¼, SW¼ Section 12, T.22S, R62E	36.04740° N, -115.00423° W
UFMW-06S	NE¼, SW¼ Section 12, T.22S, R62E	36.04740° N, -115.00413° W

This office also waives the provisions that require a mandate to install monitoring wells, NAC § 534.4351 (1)(c). The purpose of this well is to collect groundwater samples and analyze the samples as requested by NDEP Order Number H-000539, located just southwest of 510 South Fourth Street, Henderson, Nevada. The wellhead shall be protected from damage due to vandalism or sunlight. If polyvinyl chloride (PVC) casing is used, then these wells must be completed with ASTM F-480 (Sch. 40 or heavier) well casing as provided in NAC § 534.362.

Glued casing joint connections will not be allowed. Full compliance with the remainder of the statute and regulation is required.

A plot map showing the actual location of the completed wells must be submitted upon completion of the drilling operations. Please include an accurate description of the location of the monitor well on the completion reports (GPS coordinates are required).

The well driller's reports shall bear this waiver number: MO-3196.

Authorization to drill under this waiver expires one (1) year from the date of this letter.

The well driller must have a copy of this waiver in possession at all times during drilling activities pertaining to this project. This well may only be pumped when necessary to obtain samples.

Please note that you must notify the Nevada Division of Environmental Protection (NDEP) for possible permitting requirements for groundwater or temporary surface discharge permits, which may include Underground Injection Control (UIC) or National Pollution Discharge Elimination System (NPDES) Permit Numbers. For more information regarding the permitting process with NDEP, please contact Mr. Nicholas Brothers at (775) 687-4670.

The wells shall be plugged and abandoned, as provided by regulation, upon project completion. The current owner of Assessor's Parcel Number 178-12-301-005 is shown as Nevada Environmental Response Trust by the records of the Clark County Assessor's office. This waiver does not imply or grant any land use agreements between Nevada Environmental Response Trust and any land owners. It is expressly understood that this authorization does not relieve the operator of the requirements of any other state, federal or local agencies.

If you have any questions, please contact this office at 702-486-2770.

Sincerely,

Tracy Geter
Drilling Supervisor

cc: File
Carson City Office
Christi Cooper, SNBO Office
Nevada Environmental Response Trust, Property Owner, Chicago, IL
Nicholas Brothers, NDEP-Permits Group, Carson City, Nevada

Appendix G
Summary Data Tables

Biological Reduction Study

Table G-1 Summary of Soil Physical Results - Biological Field Study

Central Retention Basin

Boring Location	Sample Depth (ft bgs)	Sample ID	Sample Date	Solids Content (%)	Moisture Content (% Weight)	Density		Porosity (%Vb)		Total Pore Fluid Saturations (%Pv)	Vertical 25 PSI Confining Stress		Horizontal 25 PSI Confining Stress		
						Dry Bulk (g/cc)	Grain (g/cc)	Total	Air-Filled		Effective Permeability to Water (millidarcy)	Hydraulic Conductivity (cm/s)	Effective Permeability to Water (millidarcy)	Hydraulic Conductivity (cm/s)	Intrinsic Permeability to Water (cm)
CTIW-01S	21.3	CTIW-01S-21.0-20161201	12/01/16	83.1	16.9	1.67	2.58	35.3	7.10	79.8	18.7	1.91E-05	92.8	9.21E-05	9.16E-10
CTIW-01D	35.3	CTIW-01D-35.0-20161129	11/29/16	45.6	54.4	0.99	2.66	62.8	8.90	85.9	10.2	1.04E-05	14.6	1.43E-05	1.45E-10
CTIW-02S	21.9	CTIW-02S-21.5-20170327	03/27/17	58.4	41.6	1.10	2.61	58.0	12.3	78.7	94.0	9.51E-05	74.5	7.40E-05	7.36E-10
CTIW-02D	41.6	CTIW-02D-41.5-20170324	03/24/17	43.8	56.2	0.96	2.62	63.3	9.2	85.5	0.65	6.61E-07	4.10	4.08E-06	4.04E-11
CTIW-03S	21.6	CTIW-03S-21.5-20170327	03/27/17	80.9	19.1	1.34	2.63	48.8	23.1	52.7	356	3.59E-04	712	7.01E-04	7.03E-09
CTIW-03D	41.1	CTIW-03D-41.0-20170327	03/27/17	50.0	50.0	1.07	2.63	59.3	5.8	90.2	0.89	9.09E-07	4.12	4.06E-06	4.07E-11
CTMW-01S	21.6	CTMW-01S-21.5-20170321	03/21/17	67.0	33.0	1.01	2.63	61.5	28.1	54.3	243	2.46E-04	387	3.83E-04	3.82E-09
CTMW-01D	43.1	CTMW-01D-43.0-20170321	03/21/17	50.2	49.8	1.02	2.64	61.2	10.1	83.4	0.75	7.64E-07	4.05	4.02E-06	3.99E-11
CTMW-02S	21.6	CTMW-02S-21.5-20170323	03/23/17	86.7	13.3	1.56	2.63	40.7	20.0	51.0	113	1.15E-04	733	7.34E-04	7.23E-09
CTMW-02D	41.6	CTMW-02D-41.5-20170323	03/23/17	46.6	53.4	1.02	2.62	60.9	6.1	89.9	1.05	1.07E-06	7.76	7.75E-06	7.66E-11
CTMW-03S	20.3	CTMW-03S-20.0-20161130	11/30/16	71.6	28.4	1.21	2.53	52.1	17.7	66.0	179	1.82E-04	268	2.64E-04	2.65E-09
CTMW-03D	35.3	CTMW-03D-35.0-20161130	11/30/16	62.8	37.2	1.29	2.63	51.0	3.10	93.9	2.28	2.33E-06	9.19	9.11E-06	9.08E-11
CTMW-04S	21.6	CTMW-04S-21.5-20170322	03/22/17	89.6	10.4	1.54	2.64	41.6	25.5	38.6	822	8.31E-04	391	3.91E-04	3.86E-09
CTMW-04D	41.6	CTMW-04D-41.5-20170322	03/22/17	41.5	58.5	0.98	2.62	62.6	5.3	91.5	0.59	6.02E-07	3.55	3.54E-06	3.50E-11
CTMW-05S	21.5	CTMW-05S-21.5-20170605	06/05/17	86.9	13.1	1.38	2.64	47.9	29.8	37.7	750	7.43E-04	1450	1.46E-03	1.43E-08
CTMW-05D	45.0	CTMW-05D-45.0-20170605	06/05/17	31.1	68.9	0.84	2.54	66.8	8.7	87.0	5.99	5.98E-06	6.21	6.25E-06	6.13E-11
CTMW-06S	21.5	CTMW-06S-21.5-20170606	06/06/17	89.4	10.6	1.52	2.62	41.8	25.6	38.7	300	3.00E-04	71.7	7.16E-05	7.07E-10
CTMW-06D	45.0	CTMW-06D-45.0-20170606	06/06/17	46.8	53.2	0.98	2.65	63.0	10.9	82.7	8.46	8.49E-06	4.35	4.37E-06	4.29E-11

Notes:

%Vb	Percentage bulk volume
%Pv	Percentage pore volume
% weight	Percentage weight
Air Filled	Pore channels not occupied by pore fluids
cm/s	Centimeters per second
g/cc	Grams per cubic centimeter
ft bgs	Feet below ground surface
Total Porosity	All interconnected pore channels

TETRA TECH

Table G-2 Summary of Soil Analytical Results - Biological Field Study

Central Retention Basin

Boring Location	Sample Depth (ft bgs)	Sample ID	Sample Date	Chlorate by USEPA Method 300.1B (ug/kg)	Perchlorate by USEPA Method 314.0 (ug/kg)	Hexavalent Chromium by USEPA Method 7199 (ug/kg)	Total Chromium by USEPA Method 6010B (ug/kg)	Anions by USEPA Method 300.0 (mg/L)			Soluble Metals by USEPA Method 6010B (mg/L)			
								Chloride	Nitrate as NO3	Sulfate	Calcium	Magnesium	Potassium	Sodium
CTIW-01S	21.0	CTIW-01S-21.0-20161201	12/01/16	–	35,000	730	22,000	--	--	--	--	--	--	--
	21.0	CTIW-01S-21.0-20161201-FD	12/01/16	–	58,000	980	27,000	--	--	--	--	--	--	--
CTIW-01D	0.5	CTIW-01D-0.5-20161128	11/28/16	–	1,500,000	190 J	22,000	--	--	--	--	--	--	--
	5.0	CTIW-01D-5.0-20161128	11/28/16	–	43,000	<160	19,000	--	--	--	--	--	--	--
	10.0	CTIW-01D-10.0-20161128	11/28/16	–	17,000	<170	16,000	--	--	--	--	--	--	--
	15.0	CTIW-01D-15.0-20161128	11/28/16	–	350,000	<160	11,000	--	--	--	--	--	--	--
	20.0	CTIW-01D-20.0-20161128	11/28/16	–	140,000	<180	36,000	--	--	--	--	--	--	--
	25.0	CTIW-01D-25.0-20161129	11/29/16	–	380,000	8,400	36,000	--	--	--	--	--	--	--
	25.0	CTIW-01D-25.0-20161129-FD	11/29/16	–	400,000	12,000	42,000	--	--	--	--	--	--	--
	30.0	CTIW-01D-30.0-20161129	11/29/16	–	400,000	11,000	54,000	--	--	--	--	--	--	--
	35.0	CTIW-01D-35.0-20161129	11/29/16	–	720,000	10,000	31,000	--	--	--	--	--	--	--
	40.0	CTIW-01D-40.0-20161129	11/29/16	–	1,400,000	19,000	48,000	--	--	--	--	--	--	--
	45.0	CTIW-01D-45.0-20161129	11/29/16	–	970,000	20,000	47,000	--	--	--	--	--	--	--
	50.0	CTIW-01D-50.0-20161129	11/29/16	–	520,000	16,000	40,000	--	--	--	--	--	--	--
	55.0	CTIW-01D-55.0-20161129	11/29/16	–	610,000	6,900	29,000	--	--	--	--	--	--	--
	60.0	CTIW-01D-60.0-20161129	11/29/16	–	120,000	650	30,000	--	--	--	--	--	--	--
CTIW-02S	22.0	CTIW-02S-22.0-20170327	03/27/17	380,000	73,000	1,500	29,000	110	360	280	5.3 B	3.5 B	3.4 J	200
CTIW-02D	0.5	CTIW-02D-0.5-20170320	03/20/17	9,800	660,000	<160	21,000	--	--	--	--	--	--	--
	5.0	CTIW-02D-5.0-20170324	03/24/17	17,000	350,000	200 J	20,000	--	--	--	--	--	--	--
	10.0	CTIW-02D-10.0-20170324	03/24/17	980 F1	18,000	<180	15,000	--	--	--	--	--	--	--
	15.0	CTIW-02D-15.0-20170324	03/24/17	750	120,000	<160	15,000	--	--	--	--	--	--	--
	15.0	CTIW-02D-15.0-20170324-FD	03/24/17	950	65,000	<180	18,000	--	--	--	--	--	--	--
	20.0	CTIW-02D-20.0-20170324	03/24/17	11,000	530,000	<200	31,000	--	--	--	--	--	--	--
	25.0	CTIW-02D-25.0-20170324	03/24/17	1,800,000	240,000	7,700	49,000	--	--	--	--	--	--	--
	30.0	CTIW-02D-30.0-20170324	03/24/17	2,400,000	290,000	8,300	50,000	--	--	--	--	--	--	--
	35.0	CTIW-02D-35.0-20170324	03/24/17	1,900,000	390,000	8,900	32,000	--	--	--	--	--	--	--
	40.0	CTIW-02D-40.0-20170324	03/24/17	3,200,000	820,000	12,000	51,000	--	--	--	--	--	--	--
	45.0	CTIW-02D-45.0-20170324	03/24/17	3,600,000	890,000	13,000	48,000	--	--	--	--	--	--	--
	50.0	CTIW-02D-50.0-20170324	03/24/17	1,900,000	520,000	6,700	20,000	--	--	--	--	--	--	--
CTIW-03S	22.0	CTIW-03S-22.0-20170327	03/27/17	10,000	80,000	220 J	35,000	100	330	210	16 B	17 B	3.1 J	98
CTIW-03D	0.5	CTIW-03D-0.5-20170320	03/20/17	24,000	140,000	370	24,000	--	--	--	--	--	--	--
	5.0	CTIW-03D-5.0-20170327	03/27/17	3,000	350,000	160 J	24,000	--	--	--	--	--	--	--
	10.0	CTIW-03D-10.0-20170327	03/27/17	22,000	72,000	<160	17,000	--	--	--	--	--	--	--
	10.0	CTIW-03D-10.0-20170327-FD	03/27/17	21,000	40,000	<160	18,000	--	--	--	--	--	--	--
	15.0	CTIW-03D-15.0-20170327	03/27/17	8,800	11,000	<160	13,000	--	--	--	--	--	--	--
	20.0	CTIW03-20.0-20170327	03/27/17	18,000	150,000	<190	26,000	--	--	--	--	--	--	--
	25.0	CTIW03-25.0-20170327	03/27/17	1,200,000	200,000	6,400	42,000	--	--	--	--	--	--	--
	25.0	CTIW03-25.0-20170327-FD	03/27/17	1,000,000	140,000	4,700	25,000	--	--	--	--	--	--	--
	30.0	CTIW03-30.0-20170327	03/27/17	2,300,000	370,000	11,000	55,000	--	--	--	--	--	--	--
	35.0	CTIW03-35.0-20170327	03/27/17	2,900,000	560,000	12,000	44,000	--	--	--	--	--	--	--
	40.0	CTIW03-40.0-20170327	03/27/17	3,300,000	930,000	16,000	52,000	--	--	--	--	--	--	--
	41.5	CTIW03-41.5-20170327	03/27/17	3,100,000	790,000	12,000	41,000	480	32	530	34 B	19 B	5.8	200
	45.0	CTIW03-45.0-20170327	03/27/17	2,400,000	1,100,000	17,000	50,000	--	--	--	--	--	--	--
	50.0	CTIW03-50.0-20170327	03/27/17	1,500,000	1,000,000	9,000	40,000	--	--	--	--	--	--	--

Notes:

USEPA	United States Environmental Protection Agency
ft bgs	Feet below ground surface
mg/kg	Milligram per kilogram
<	Denotes concentration is less than the laboratory method detection limit indicated
J	Denotes concentration is less than the laboratory reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value
F1	MS and /or msd Recovery is outside acceptance limits
F2	MS/MSD RPD exceeds control limits
–	Not Analyzed

Table G-2 Summary of Soil Analytical Results - Biological Field Study

Central Retention Basin

Boring Location	Sample Depth (ft bgs)	Sample ID	Sample Date	Chlorate by USEPA Method 300.1B (ug/kg)	Perchlorate by USEPA Method 314.0 (ug/kg)	Hexavalent Chromium by USEPA Method 7199 (ug/kg)	Total Chromium by USEPA Method 6010B (ug/kg)	Anions by USEPA Method 300.0 (mg/L)			Soluble Metals by USEPA Method 6010B (mg/L)			
								Chloride	Nitrate as NO3	Sulfate	Calcium	Magnesium	Potassium	Sodium
CTMW-01D	0.5	CTMW-01D-0.5-20170320	03/20/17	200 J	6,700	<170	21,000	--	--	--	--	--	--	--
	5.0	CTMW-01D-5.0-20170321	03/21/17	1,200	160,000	<170	57,000	--	--	--	--	--	--	--
	10.0	CTMW-01D-10.0-20170321	03/21/17	3,500	190,000	<160	22,000	--	--	--	--	--	--	--
	15.0	CTMW-01D-15.0-20170321	03/21/17	7,500	520,000	<160	13,000	--	--	--	--	--	--	--
	20.0	CTMW-01D-20.0-20170321	03/21/17	2,300,000	230,000	1,800	37,000	--	--	--	--	--	--	--
	25.0	CTMW-01D-25.0-20170321	03/21/17	1,100,000	140,000	4,800	25,000	--	--	--	--	--	--	--
	30.0	CTMW-01D-30.0-20170321	03/21/17	2,200,000	420,000	11,000	43,000	--	--	--	--	--	--	--
	35.0	CTMW-01D-35.0-20170321	03/21/17	2,200,000	520,000	9,400	81,000	--	--	--	--	--	--	--
	40.0	CTMW-01D-40.0-20170321	03/21/17	2,600,000	580,000	13,000	39,000	--	--	--	--	--	--	--
	45.0	CTMW-01D-45.0-20170321	03/21/17	2,700,000	730,000	13,000	38,000	--	--	--	--	--	--	--
	50.0	CTMW-01D-50.0-20170321	03/21/17	3,100,000	550,000	13,000	35,000	--	--	--	--	--	--	--
	55.0	CTMW-01D-55.0-20170321	03/21/17	3,000,000	690,000	11,000	34,000	--	--	--	--	--	--	--
	55.0	CTMW-01D-55.0-20170321-FD	03/21/17	2,800,000	570,000	9,700	31,000	--	--	--	--	--	--	--
	60.0	CTMW-01D-60.0-20170321	03/21/17	3,200,000	930,000	10,000	40,000	--	--	--	--	--	--	--
CTMW-02D	0.5	CTMW-02D-0.5-20170320	03/20/17	<57	2,800	240 J F1	21,000	--	--	--	--	--	--	--
	5.0	CTMW-02D-5.0-20170323	03/23/17	26,000	420,000	<160	20,000	--	--	--	--	--	--	--
	10.0	CTMW-02D-10.0-20170323	03/23/17	5,700	49,000	<160	18,000	--	--	--	--	--	--	--
	10.0	CTMW-02D-10.0-20170323-FD	03/23/17	5,600	68,000	<160	17,000	--	--	--	--	--	--	--
	15.0	CTMW-02D-15.0-20170323	03/23/17	7,600	22,000	<160	16,000	--	--	--	--	--	--	--
	20.0	CTMW-02D-20.0-20170323	03/23/17	31,000	110,000	<180	17,000	--	--	--	--	--	--	--
	25.0	CTMW-02D-25.0-20170323	03/23/17	2,200,000	280,000	8,800	59,000	--	--	--	--	--	--	--
	30.0	CTMW-02D-30.0-20170323	03/23/17	1,600,000	230,000	6,000	51,000	--	--	--	--	--	--	--
	35.0	CTMW-02D-35.0-20170323	03/23/17	2,300,000	580,000	8,200	34,000	--	--	--	--	--	--	--
	40.0	CTMW-02D-40.0-20170323	03/23/17	2,900,000	840,000	14,000	45,000	--	--	--	--	--	--	--
	45.0	CTMW-02D-45.0-20170323	03/23/17	2,400,000	610,000	12,000	46,000	--	--	--	--	--	--	--
	50.0	CTMW-02D-50.0-20170323	03/23/17	2,100,000	740,000	9,800	38,000	--	--	--	--	--	--	--
	55.0	CTMW-02D-55.0-20170323	03/23/17	3,700,000	1,100,000	22,000	49,000	--	--	--	--	--	--	--
	60.0	CTMW-02D-60.0-20170323	03/23/17	4,000,000	1,200,000	14,000	53,000	--	--	--	--	--	--	--
CTMW-03D	0.5	CTMW-03-0.5-20161130	11/30/16	–	700 F1	<160	29,000	--	--	--	--	--	--	--
	5.0	CTMW-03-5.0-20161130	11/30/16	–	1,800,000	<170	28,000	--	--	--	--	--	--	--
	10.0	CTMW-03-10.0-20161130	11/30/16	–	420,000	<160	17,000	--	--	--	--	--	--	--
	15.0	CTMW-03-15.0-20161130	11/30/16	–	260,000	<160	24,000	--	--	--	--	--	--	--
	20.0	CTMW-03-20.0-20161130	11/30/16	–	580,000	1,400	44,000	--	--	--	--	--	--	--
	25.0	CTMW-03-25.0-20161130	11/30/16	–	87,000	1,700	17,000	--	--	--	--	--	--	--
	30.0	CTMW-03-30.0-20161130	11/30/16	–	410,000	9,500	54,000	--	--	--	--	--	--	--
	30.0	CTMW-03-30.0-20161130-FD	11/30/16	–	380,000	11,000	67,000	--	--	--	--	--	--	--
	35.0	CTMW-03-35.0-20161130	11/30/16	–	290,000	6,200	32,000	--	--	--	--	--	--	--
	40.0	CTMW-03-40.0-20161201	12/01/16	–	1,100,000	13,000	42,000	--	--	--	--	--	--	--
	45.0	CTMW-03-45.0-20161201	12/01/16	–	1,100,000	17,000	41,000	--	--	--	--	--	--	--
	50.0	CTMW-03-50.0-20161201	12/01/16	–	650,000	13,000	32,000	--	--	--	--	--	--	--
	55.0	CTMW-03-55.0-20161201	12/01/16	–	430,000	9,200 F2	23,000	--	--	--	--	--	--	--
	60.0	CTMW-03-60.0-20161201	12/01/16	–	340,000	1,800	23,000	--	--	--	--	--	--	--

Notes:

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mg/kg	Milligram per kilogram
<	Denotes concentration is less than the laboratory method detection limit indicated
J	Denotes concentration is less than the laboratory reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value
F1	MS and /or msd Recovery is outside acceptance limits
F2	MS/MSD RPD exceeds control limits
–	Not Analyzed

Table G-2 Summary of Soil Analytical Results - Biological Field Study

Central Retention Basin

Boring Location	Sample Depth (ft bgs)	Sample ID	Sample Date	Chlorate by USEPA Method 300.1B (ug/kg)	Perchlorate by USEPA Method 314.0 (ug/kg)	Hexavalent Chromium by USEPA Method 7199 (ug/kg)	Total Chromium by USEPA Method 6010B (ug/kg)	Anions by USEPA Method 300.0 (mg/L)			Soluble Metals by USEPA Method 6010B (mg/L)			
								Chloride	Nitrate as NO3	Sulfate	Calcium	Magnesium	Potassium	Sodium
CTMW-04D	0.5	CTMW-04D-0.5-20170320	03/20/17	740	32,000	220 J	23,000	--	--	--	--	--	--	--
	5.0	CTMW-04D-5.0-20170322	03/22/17	3,200 F1	340,000	<160	16,000	--	--	--	--	--	--	--
	10.0	CTMW-04D-10.0-20170322	03/22/17	4,600	1,800,000	260 J	14,000	--	--	--	--	--	--	--
	15.0	CTMW-04D-15.0-20170322	03/22/17	4,800	3,000,000	200 J	17,000	--	--	--	--	--	--	--
	20.0	CTMW-04D-20.0-20170322	03/22/17	9,800	3,300,000	<160	14,000	--	--	--	--	--	--	--
	25.0	CTMW-04D-25.0-20170322	03/22/17	1,600,000	240,000	8,100	44,000	--	--	--	--	--	--	--
	25.0	CTMW-04D-25.0-20170322-FD	03/22/17	1,600,000	250,000	6,200	43,000	--	--	--	--	--	--	--
	30.0	CTMW-04D-30.0-20170322	03/22/17	2,000,000	320,000	9,600	73,000	--	--	--	--	--	--	--
	35.0	CTMW-04D-35.0-20170322	03/22/17	2,100,000	470,000	11,000	44,000	--	--	--	--	--	--	--
	40.0	CTMW-04D-40.0-20170322	03/22/17	2,400,000	700,000	11,000	42,000	--	--	--	--	--	--	--
	45.0	CTMW-04D-45.0-20170322	03/22/17	3,600,000	890,000	16,000	53,000	--	--	--	--	--	--	--
	50.0	CTMW-04D-50.0-20170322	03/22/17	2,300,000	440,000	8,100	26,000	--	--	--	--	--	--	--
	55.0	CTMW-04D-55.0-20170322	03/22/17	2,900,000	830,000	11,000	38,000	--	--	--	--	--	--	--
	60.0	CTMW-04D-60.0-20170322	03/22/17	2,800,000	750,000	10,000	27,000	--	--	--	--	--	--	--
CTMW-05D	0.5	CTMW-05D-0.5-20170605	06/05/17	340	1,600 F1	920	14,000	--	--	--	--	--	--	--
	5.0	CTMW-05D-5.0-20170605	06/05/17	<550	3,900	230 J	20,000	--	--	--	--	--	--	--
	10.0	CTMW-05D-10.0-20170605	06/05/17	1,700	310,000	<180	11,000	--	--	--	--	--	--	--
	15.0	CTMW-05D-15.0-20170605	06/05/17	3,900	940,000	<160	17,000	--	--	--	--	--	--	--
	15.0	CTMW-05D-15.0-20170605-FD	06/05/17	4,200	310,000	<170	17,000							
	20.0	CTMW-05D-20.0-20170605	06/05/17	270,000	4,900,000	8,000	51,000	120	44	49	52 B	14	17	310
	25.0	CTMW-05D-25.0-20170605	06/05/17	1,400,000	330,000	2,300	36,000	--	--	--	--	--	--	--
	30.0	CTMW-05D-30.0-20170605	06/05/17	1,800,000	340,000	4,500	40,000	--	--	--	--	--	--	--
	35.0	CTMW-05D-35.0-20170605	06/05/17	2,300,000	330,000	2,700	42,000	--	--	--	--	--	--	--
	40.0	CTMW-05D-40.0-20170605	06/05/17	1,300,000	250,000	4,800	36,000	--	--	--	--	--	--	--
	45.0	CTMW-05D-45.0-20170605	06/05/17	2,600,000	1,000,000	10,000	51,000	60	4.0	64	17 B	7.6	6.9	260
	50.0	CTMW-05D-50.0-20170605	06/05/17	2,200,000	650,000	7,600	39,000	--	--	--	--	--	--	--
	55.0	CTMW-05D-55.0-20170605	06/05/17	1,300,000	450,000	5,500	26,000	--	--	--	--	--	--	--
	60.0	CTMW-05D-60.0-20170605	06/05/17	2,900,000	940,000	1,600	46,000	--	--	--	--	--	--	--
CTMW-06D	0.5	CTMW-06D-0.5-20170606	06/06/17	2,800 F1	2,500	<160	18,000	--	--	--	--	--	--	--
	5.0	CTMW-06D-5.0-20170606	06/06/17	3,800	520,000	<160	15,000	--	--	--	--	--	--	--
	10.0	CTMW-06D-10.0-20170606	06/06/17	9,300	3,700,000	<160	14,000	--	--	--	--	--	--	--
	10.0	CTMW-06D-10.0-20170606-FD	06/06/17	9,400	3,800,000	<160	12,000	--	--	--	--	--	--	--
	15.0	CTMW-06D-15.0-20170606	06/06/17	9,000	3,400,000	<160	25,000	--	--	--	--	--	--	--
	20.0	CTMW-06D-20.0-20170606	06/06/17	63,000	3,000,000	<180	58,000	110	31	38	25B	9.1	17	360
	25.0	CTMW-06D-25.0-20170606	06/06/17	980,000	500,000	<630	54,000	--	--	--	--	--	--	--
	30.0	CTMW-06D-30.0-20170606	06/06/17	1,400,000	340,000	1,700	44,000	--	--	--	--	--	--	--
	35.0	CTMW-06D-35.0-20170606	06/06/17	1,300,000	210,000	2,900	45,000	--	--	--	--	--	--	--
	40.0	CTMW-06D-40.0-20170606	06/06/17	760,000	450,000	5,400	50,000	--	--	--	--	--	--	--
	43.5	CTMW-06D-43.5-20170606	06/06/17	2,300,000	750,000	2,800	51,000	44	4.1	60	19 B	8.2	6.3	260
	45.0	CTMW-06D-45.0-20170606	06/06/17	2,500,000	670,000	9,800	43,000	--	--	--	--	--	--	--
	50.0	CTMW-06D-50.0-20170606	06/06/17	2,000,000	740,000	9,000	51,000	--	--	--	--	--	--	--
	55.0	CTMW-06D-55.0-20170606	06/06/17	2,900,000	1,000,000	3,700	43,000	--	--	--	--	--	--	--

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F2	MS/MSD RPD exceeds control limits
–	Not Analyzed

TETRA TECH

Table G-2 Summary of Soil Analytical Results - Biological Field Study

Central Retention Basin

Boring Location	Sample Depth (ft bgs)	Sample ID	Sample Date	Dissolved Metals by USEPA Method 6020 (mg/kg)												
				Arsenic	Barium	Beryllium	Chromium	Cobalt	Copper	Lead	Molybdenum	Nickel	Selenium	Silver	Vanadium	Zinc
CTIW-01S	21.0	CTIW-01S-21.0-20161201	12/01/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	21.0	CTIW-01S-21.0-20161201-FD	12/01/16	--	--	--	--	--	--	--	--	--	--	--	--	--
CTIW-01D	0.5	CTIW-01D-0.5-20161128	11/28/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	5.0	CTIW-01D-5.0-20161128	11/28/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	10.0	CTIW-01D-10.0-20161128	11/28/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	15.0	CTIW-01D-15.0-20161128	11/28/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	20.0	CTIW-01D-20.0-20161128	11/28/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	25.0	CTIW-01D-25.0-20161129	11/29/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	25.0	CTIW-01D-25.0-20161129-FD	11/29/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	30.0	CTIW-01D-30.0-20161129	11/29/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	35.0	CTIW-01D-35.0-20161129	11/29/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	40.0	CTIW-01D-40.0-20161129	11/29/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	45.0	CTIW-01D-45.0-20161129	11/29/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	50.0	CTIW-01D-50.0-20161129	11/29/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	55.0	CTIW-01D-55.0-20161129	11/29/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	60.0	CTIW-01D-60.0-20161129	11/29/16	--	--	--	--	--	--	--	--	--	--	--	--	--
CTIW-02S	22.0	CTIW-02S-22.0-20170327	03/27/17	22	26 F1	<0.96	25	3.1 J	7.4	4.2	<3.2	8.2	<1.3	<0.64	21	<32 F1
CTIW-02D	0.5	CTIW-02D-0.5-20170320	03/20/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	5.0	CTIW-02D-5.0-20170324	03/24/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	10.0	CTIW-02D-10.0-20170324	03/24/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	15.0	CTIW-02D-15.0-20170324	03/24/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	15.0	CTIW-02D-15.0-20170324-FD	03/24/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	20.0	CTIW-02D-20.0-20170324	03/24/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	25.0	CTIW-02D-25.0-20170324	03/24/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	30.0	CTIW-02D-30.0-20170324	03/24/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	35.0	CTIW-02D-35.0-20170324	03/24/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	40.0	CTIW-02D-40.0-20170324	03/24/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	45.0	CTIW-02D-45.0-20170324	03/24/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	50.0	CTIW-02D-50.0-20170324	03/24/17	--	--	--	--	--	--	--	--	--	--	--	--	--
CTIW-03S	22.0	CTIW-03S-22.0-20170327	03/27/17	22	140	<0.84	35	4.4	9.2	5.1	<2.8	11	<1.1	<0.56	37	<28
CTIW-03D	0.5	CTIW-03D-0.5-20170320	03/20/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	5.0	CTIW-03D-5.0-20170327	03/27/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	10.0	CTIW-03D-10.0-20170327	03/27/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	10.0	CTIW-03D-10.0-20170327-FD	03/27/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	15.0	CTIW-03D-15.0-20170327	03/27/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	20.0	CTIW03-20.0-20170327	03/27/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	25.0	CTIW03-25.0-20170327	03/27/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	25.0	CTIW03-25.0-20170327-FD	03/27/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	30.0	CTIW03-30.0-20170327	03/27/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	35.0	CTIW03-35.0-20170327	03/27/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	40.0	CTIW03-40.0-20170327	03/27/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	41.5	CTIW03-41.5-20170327	03/27/17	17	85	<1.1	36	6.2	14	9.1	<3.6	14	<1.4	1.2 J	40	42 J
	45.0	CTIW03-45.0-20170327	03/27/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	50.0	CTIW03-50.0-20170327	03/27/17	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:

USEPA	United States Environmental Protection Agency
ft bgs	Feet below ground surface
mg/kg	Milligram per kilogram
<	Denotes concentration is less than the laboratory method detection limit indicated
J	Denotes concentration is less than the laboratory reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value
F1	MS and /or msd Recovery is outside acceptance limits
F2	MS/MSD RPD exceeds control limits
–	Not Analyzed

Table G-2 Summary of Soil Analytical Results - Biological Field Study

Central Retention Basin

Boring Location	Sample Depth (ft bgs)	Sample ID	Sample Date	Dissolved Metals by USEPA Method 6020 (mg/kg)												
				Arsenic	Barium	Beryllium	Chromium	Cobalt	Copper	Lead	Molybdenum	Nickel	Selenium	Silver	Vanadium	Zinc
CTMW-01D	0.5	CTMW-01D-0.5-20170320	03/20/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	5.0	CTMW-01D-5.0-20170321	03/21/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	10.0	CTMW-01D-10.0-20170321	03/21/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	15.0	CTMW-01D-15.0-20170321	03/21/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	20.0	CTMW-01D-20.0-20170321	03/21/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	25.0	CTMW-01D-25.0-20170321	03/21/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	30.0	CTMW-01D-30.0-20170321	03/21/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	35.0	CTMW-01D-35.0-20170321	03/21/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	40.0	CTMW-01D-40.0-20170321	03/21/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	45.0	CTMW-01D-45.0-20170321	03/21/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	50.0	CTMW-01D-50.0-20170321	03/21/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	55.0	CTMW-01D-55.0-20170321	03/21/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	55.0	CTMW-01D-55.0-20170321-FD	03/21/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	60.0	CTMW-01D-60.0-20170321	03/21/17	--	--	--	--	--	--	--	--	--	--	--	--	--
CTMW-02D	0.5	CTMW-02D-0.5-20170320	03/20/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	5.0	CTMW-02D-5.0-20170323	03/23/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	10.0	CTMW-02D-10.0-20170323	03/23/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	10.0	CTMW-02D-10.0-20170323-FD	03/23/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	15.0	CTMW-02D-15.0-20170323	03/23/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	20.0	CTMW-02D-20.0-20170323	03/23/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	25.0	CTMW-02D-25.0-20170323	03/23/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	30.0	CTMW-02D-30.0-20170323	03/23/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	35.0	CTMW-02D-35.0-20170323	03/23/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	40.0	CTMW-02D-40.0-20170323	03/23/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	45.0	CTMW-02D-45.0-20170323	03/23/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	50.0	CTMW-02D-50.0-20170323	03/23/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	55.0	CTMW-02D-55.0-20170323	03/23/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	60.0	CTMW-02D-60.0-20170323	03/23/17	--	--	--	--	--	--	--	--	--	--	--	--	--
CTMW-03D	0.5	CTMW-03-0.5-20161130	11/30/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	5.0	CTMW-03-5.0-20161130	11/30/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	10.0	CTMW-03-10.0-20161130	11/30/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	15.0	CTMW-03-15.0-20161130	11/30/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	20.0	CTMW-03-20.0-20161130	11/30/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	25.0	CTMW-03-25.0-20161130	11/30/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	30.0	CTMW-03-30.0-20161130	11/30/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	30.0	CTMW-03-30.0-20161130-FD	11/30/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	35.0	CTMW-03-35.0-20161130	11/30/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	40.0	CTMW-03-40.0-20161201	12/01/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	45.0	CTMW-03-45.0-20161201	12/01/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	50.0	CTMW-03-50.0-20161201	12/01/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	55.0	CTMW-03-55.0-20161201	12/01/16	--	--	--	--	--	--	--	--	--	--	--	--	--
	60.0	CTMW-03-60.0-20161201	12/01/16	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:

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ft bgs	Feet below ground surface
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F1	MS and /or msd Recovery is outside acceptance limits
F2	MS/MSD RPD exceeds control limits
–	Not Analyzed

Table G-2 Summary of Soil Analytical Results - Biological Field Study

Central Retention Basin

Boring Location	Sample Depth (ft bgs)	Sample ID	Sample Date	Dissolved Metals by USEPA Method 6020 (mg/kg)												
				Arsenic	Barium	Beryllium	Chromium	Cobalt	Copper	Lead	Molybdenum	Nickel	Selenium	Silver	Vanadium	Zinc
CTMW-04D	0.5	CTMW-04D-0.5-20170320	03/20/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	5.0	CTMW-04D-5.0-20170322	03/22/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	10.0	CTMW-04D-10.0-20170322	03/22/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	15.0	CTMW-04D-15.0-20170322	03/22/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	20.0	CTMW-04D-20.0-20170322	03/22/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	25.0	CTMW-04D-25.0-20170322	03/22/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	25.0	CTMW-04D-25.0-20170322-FD	03/22/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	30.0	CTMW-04D-30.0-20170322	03/22/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	35.0	CTMW-04D-35.0-20170322	03/22/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	40.0	CTMW-04D-40.0-20170322	03/22/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	45.0	CTMW-04D-45.0-20170322	03/22/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	50.0	CTMW-04D-50.0-20170322	03/22/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	55.0	CTMW-04D-55.0-20170322	03/22/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	60.0	CTMW-04D-60.0-20170322	03/22/17	--	--	--	--	--	--	--	--	--	--	--	--	--
CTMW-05D	0.5	CTMW-05D-0.5-20170605	06/05/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	5.0	CTMW-05D-5.0-20170605	06/05/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	10.0	CTMW-05D-10.0-20170605	06/05/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	15.0	CTMW-05D-15.0-20170605	06/05/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	15.0	CTMW-05D-15.0-20170605-FD	06/05/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	20.0	CTMW-05D-20.0-20170605	06/05/17	32	230	0.41	46	3.4	8.7	3.9	<0.66	11	1.0 J	0.19 J	30	18
	25.0	CTMW-05D-25.0-20170605	06/05/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	30.0	CTMW-05D-30.0-20170605	06/05/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	35.0	CTMW-05D-35.0-20170605	06/05/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	40.0	CTMW-05D-40.0-20170605	06/05/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	45.0	CTMW-05D-45.0-20170605	06/05/17	22	39	1.2	44	7.3	16	9.9	1.9	16	1.1 J	<0.17	35	50
	50.0	CTMW-05D-50.0-20170605	06/05/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	55.0	CTMW-05D-55.0-20170605	06/05/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	60.0	CTMW-05D-60.0-20170605	06/05/17	--	--	--	--	--	--	--	--	--	--	--	--	--
CTMW-06D	0.5	CTMW-06D-0.5-20170606	06/06/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	5.0	CTMW-06D-5.0-20170606	06/06/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	10.0	CTMW-06D-10.0-20170606	06/06/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	10.0	CTMW-06D-10.0-20170606-FD	06/06/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	15.0	CTMW-06D-15.0-20170606	06/06/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	20.0	CTMW-06D-20.0-20170606	06/06/17	37	42	0.21 J	61	1.6	4.8	2.1	<0.59	6.3	0.50 J	<0.12	20	9.0 J
	25.0	CTMW-06D-25.0-20170606	06/06/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	30.0	CTMW-06D-30.0-20170606	06/06/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	35.0	CTMW-06D-35.0-20170606	06/06/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	40.0	CTMW-06D-40.0-20170606	06/06/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	43.5	CTMW-06D-43.5-20170606	06/06/17	17	62	1.1	43	5.7	14	8.4	1.3 J	14	1.4 J	<0.16	32	39
	45.0	CTMW-06D-45.0-20170606	06/06/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	50.0	CTMW-06D-50.0-20170606	06/06/17	--	--	--	--	--	--	--	--	--	--	--	--	--
	55.0	CTMW-06D-55.0-20170606	06/06/17	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:

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Table G-2 Summary of Soil Analytical Results - Biological Field Study

Central Retention Basin

Boring Location	Sample Depth (ft bgs)	Sample ID	Sample Date	Mercury by USEPA Method 7471A (mg/kg)	Total Organic Carbon (mg/kg)	pH	Alkalinity as CaCO3 (mg/L)	Total Dissolved Solids (mg/L)	Percent Solids	Moisture Content
CTIW-01S	21.0	CTIW-01S-21.0-20161201	12/01/16	--	--	--	--	--	88.6%	11.4%
	21.0	CTIW-01S-21.0-20161201-FD	12/01/16	--	--	--	--	--	78.6%	21.4%
CTIW-01D	0.5	CTIW-01D-0.5-20161128	11/28/16	--	--	--	--	--	90.4%	9.6%
	5.0	CTIW-01D-5.0-20161128	11/28/16	--	--	--	--	--	92.2%	7.8%
	10.0	CTIW-01D-10.0-20161128	11/28/16	--	--	--	--	--	91.4%	8.6%
	15.0	CTIW-01D-15.0-20161128	11/28/16	--	--	--	--	--	93.9%	6.1%
	20.0	CTIW-01D-20.0-20161128	11/28/16	--	--	--	--	--	84.6%	15.4%
	25.0	CTIW-01D-25.0-20161129	11/29/16	--	--	--	--	--	55.9%	44.1%
	25.0	CTIW-01D-25.0-20161129-FD	11/29/16	--	--	--	--	--	55.4%	44.6%
	30.0	CTIW-01D-30.0-20161129	11/29/16	--	--	--	--	--	58.2%	41.8%
	35.0	CTIW-01D-35.0-20161129	11/29/16	--	--	--	--	--	63.2%	36.8%
	40.0	CTIW-01D-40.0-20161129	11/29/16	--	--	--	--	--	61.6%	38.4%
	45.0	CTIW-01D-45.0-20161129	11/29/16	--	--	--	--	--	58.7%	41.3%
	50.0	CTIW-01D-50.0-20161129	11/29/16	--	--	--	--	--	69.5%	30.5%
	55.0	CTIW-01D-55.0-20161129	11/29/16	--	--	--	--	--	71.2%	28.8%
	60.0	CTIW-01D-60.0-20161129	11/29/16	--	--	--	--	--	86.0%	14.0%
CTIW-02S	22.0	CTIW-02S-22.0-20170327	03/27/17	0.015 J	34,000	8.7	1,400	3,600	77.5%	22.5%
CTIW-02D	0.5	CTIW-02D-0.5-20170320	03/20/17	--	--	--	--	--	91.4%	8.6%
	5.0	CTIW-02D-5.0-20170324	03/24/17	--	--	--	--	--	91.8%	8.2%
	10.0	CTIW-02D-10.0-20170324	03/24/17	--	--	--	--	--	84.4%	15.6%
	15.0	CTIW-02D-15.0-20170324	03/24/17	--	--	--	--	--	93.6%	6.4%
	15.0	CTIW-02D-15.0-20170324-FD	03/24/17	--	--	--	--	--	85.5%	14.5%
	20.0	CTIW-02D-20.0-20170324	03/24/17	--	--	--	--	--	73.5%	26.5%
	25.0	CTIW-02D-25.0-20170324	03/24/17	--	--	--	--	--	53.7%	46.3%
	30.0	CTIW-02D-30.0-20170324	03/24/17	--	--	--	--	--	60.5%	39.5%
	35.0	CTIW-02D-35.0-20170324	03/24/17	--	--	--	--	--	65.8%	34.2%
	40.0	CTIW-02D-40.0-20170324	03/24/17	--	--	--	--	--	61.4%	38.6%
	45.0	CTIW-02D-45.0-20170324	03/24/17	--	--	--	--	--	51.7%	48.3%
	50.0	CTIW-02D-50.0-20170324	03/24/17	--	--	--	--	--	75.1%	24.9%
CTIW-03S	22.0	CTIW-03S-22.0-20170327	03/27/17	<0.014	17,000	8.5	570	1,900	87.5%	12.5%
CTIW-03D	0.5	CTIW-03D-0.5-20170320	03/20/17	--	--	--	--	--	87.6%	12.4%
	5.0	CTIW-03D-5.0-20170327	03/27/17	--	--	--	--	--	93.1%	6.9%
	10.0	CTIW-03D-10.0-20170327	03/27/17	--	--	--	--	--	92.3%	7.7%
	10.0	CTIW-03D-10.0-20170327-FD	03/27/17	--	--	--	--	--	93.6%	6.4%
	15.0	CTIW-03D-15.0-20170327	03/27/17	--	--	--	--	--	94.8%	5.2%
	20.0	CTIW03-20.0-20170327	03/27/17	--	--	--	--	--	82.0%	18.0%
	25.0	CTIW03-25.0-20170327	03/27/17	--	--	--	--	--	57.3%	42.7%
	25.0	CTIW03-25.0-20170327-FD	03/27/17	--	--	--	--	--	66.5%	33.5%
	30.0	CTIW03-30.0-20170327	03/27/17	--	--	--	--	--	60.1%	39.9%
	35.0	CTIW03-35.0-20170327	03/27/17	--	--	--	--	--	58.0%	42.0%
	40.0	CTIW03-40.0-20170327	03/27/17	--	--	--	--	--	63.3%	36.7%
	41.5	CTIW03-41.5-20170327	03/27/17	<0.017	9,000	7.6	110	4,900	68.8%	31.2%
	45.0	CTIW03-45.0-20170327	03/27/17	--	--	--	--	--	60.5%	39.5%
	50.0	CTIW03-50.0-20170327	03/27/17	--	--	--	--	--	63.1%	36.9%

Notes:

USEPA	United States Environmental Protection Agency
ft bgs	Feet below ground surface
mg/kg	Milligram per kilogram
<	Denotes concentration is less than the laboratory method detection limit indicated
J	Denotes concentration is less than the laboratory reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value
F1	MS and /or msd Recovery is outside acceptance limits
F2	MS/MSD RPD exceeds control limits
--	Not Analyzed

Table G-2 Summary of Soil Analytical Results - Biological Field Study

Central Retention Basin

Boring Location	Sample Depth (ft bgs)	Sample ID	Sample Date	Mercury by USEPA Method 7471A (mg/kg)	Total Organic Carbon (mg/kg)	pH	Alkalinity as CaCO3 (mg/L)	Total Dissolved Solids (mg/L)	Percent Solids	Moisture Content
CTMW-01D	0.5	CTMW-01D-0.5-20170320	03/20/17	--	--	--	--	--	88.6%	11.4%
	5.0	CTMW-01D-5.0-20170321	03/21/17	--	--	--	--	--	90.9%	9.1%
	10.0	CTMW-01D-10.0-20170321	03/21/17	--	--	--	--	--	91.8%	8.2%
	15.0	CTMW-01D-15.0-20170321	03/21/17	--	--	--	--	--	95.2%	4.8%
	20.0	CTMW-01D-20.0-20170321	03/21/17	--	--	--	--	--	76.0%	24.0%
	25.0	CTMW-01D-25.0-20170321	03/21/17	--	--	--	--	--	60.2%	39.8%
	30.0	CTMW-01D-30.0-20170321	03/21/17	--	--	--	--	--	64.3%	35.7%
	35.0	CTMW-01D-35.0-20170321	03/21/17	--	--	--	--	--	62.9%	37.1%
	40.0	CTMW-01D-40.0-20170321	03/21/17	--	--	--	--	--	72.1%	27.9%
	45.0	CTMW-01D-45.0-20170321	03/21/17	--	--	--	--	--	65.2%	34.8%
	50.0	CTMW-01D-50.0-20170321	03/21/17	--	--	--	--	--	66.9%	33.1%
	55.0	CTMW-01D-55.0-20170321	03/21/17	--	--	--	--	--	63.2%	36.8%
	55.0	CTMW-01D-55.0-20170321-FD	03/21/17	--	--	--	--	--	69.9%	30.1%
	60.0	CTMW-01D-60.0-20170321	03/21/17	--	--	--	--	--	57.6%	42.4%
CTMW-02D	0.5	CTMW-02D-0.5-20170320	03/20/17	--	--	--	--	--	88.0%	12.0%
	5.0	CTMW-02D-5.0-20170323	03/23/17	--	--	--	--	--	92.3%	7.7%
	10.0	CTMW-02D-10.0-20170323	03/23/17	--	--	--	--	--	93.8%	6.2%
	10.0	CTMW-02D-10.0-20170323-FD	03/23/17	--	--	--	--	--	92.2%	7.8%
	15.0	CTMW-02D-15.0-20170323	03/23/17	--	--	--	--	--	94.5%	5.5%
	20.0	CTMW-02D-20.0-20170323	03/23/17	--	--	--	--	--	84.6%	15.4%
	25.0	CTMW-02D-25.0-20170323	03/23/17	--	--	--	--	--	50.9%	49.1%
	30.0	CTMW-02D-30.0-20170323	03/23/17	--	--	--	--	--	62.0%	38.0%
	35.0	CTMW-02D-35.0-20170323	03/23/17	--	--	--	--	--	66.3%	33.7%
	40.0	CTMW-02D-40.0-20170323	03/23/17	--	--	--	--	--	63.5%	36.5%
	45.0	CTMW-02D-45.0-20170323	03/23/17	--	--	--	--	--	58.7%	41.3%
	50.0	CTMW-02D-50.0-20170323	03/23/17	--	--	--	--	--	69.8%	30.2%
	55.0	CTMW-02D-55.0-20170323	03/23/17	--	--	--	--	--	53.3%	46.7%
	60.0	CTMW-02D-60.0-20170323	03/23/17	--	--	--	--	--	64.3%	35.7%
CTMW-03D	0.5	CTMW-03-0.5-20161130	11/30/16	--	--	--	--	--	95.0%	5.0%
	5.0	CTMW-03-5.0-20161130	11/30/16	--	--	--	--	--	89.8%	10.2%
	10.0	CTMW-03-10.0-20161130	11/30/16	--	--	--	--	--	93.6%	6.4%
	15.0	CTMW-03-15.0-20161130	11/30/16	--	--	--	--	--	92.1%	7.9%
	20.0	CTMW-03-20.0-20161130	11/30/16	--	--	--	--	--	84.2%	15.8%
	25.0	CTMW-03-25.0-20161130	11/30/16	--	--	--	--	--	87.5%	12.5%
	30.0	CTMW-03-30.0-20161130	11/30/16	--	--	--	--	--	57.1%	42.9%
	30.0	CTMW-03-30.0-20161130-FD	11/30/16	--	--	--	--	--	55.8%	44.2%
	35.0	CTMW-03-35.0-20161130	11/30/16	--	--	--	--	--	67.4%	32.6%
	40.0	CTMW-03-40.0-20161201	12/01/16	--	--	--	--	--	66.4%	33.6%
	45.0	CTMW-03-45.0-20161201	12/01/16	--	--	--	--	--	61.1%	38.9%
	50.0	CTMW-03-50.0-20161201	12/01/16	--	--	--	--	--	66.4%	33.6%
	55.0	CTMW-03-55.0-20161201	12/01/16	--	--	--	--	--	76.0%	24.0%
	60.0	CTMW-03-60.0-20161201	12/01/16	--	--	--	--	--	70.9%	29.1%

Notes:

USEPA	United States Environmental Protection Agency
ft bgs	Feet below ground surface
mg/kg	Milligram per kilogram
<	Denotes concentration is less than the laboratory method detection limit indicated
J	Denotes concentration is less than the laboratory reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value
F1	MS and /or msd Recovery is outside acceptance limits
F2	MS/MSD RPD exceeds control limits
–	Not Analyzed

TETRA TECH

Table G-2 Summary of Soil Analytical Results - Biological Field Study

Central Retention Basin

Boring Location	Sample Depth (ft bgs)	Sample ID	Sample Date	Mercury by USEPA Method 7471A (mg/kg)	Total Organic Carbon (mg/kg)	pH	Alkalinity as CaCO3 (mg/L)	Total Dissolved Solids (mg/L)	Percent Solids	Moisture Content
CTMW-04D	0.5	CTMW-04D-0.5-20170320	03/20/17	--	--	--	--	--	91.2%	8.8%
	5.0	CTMW-04D-5.0-20170322	03/22/17	--	--	--	--	--	92.1%	7.9%
	10.0	CTMW-04D-10.0-20170322	03/22/17	--	--	--	--	--	93.1%	6.9%
	15.0	CTMW-04D-15.0-20170322	03/22/17	--	--	--	--	--	93.8%	6.2%
	20.0	CTMW-04D-20.0-20170322	03/22/17	--	--	--	--	--	92.9%	7.1%
	25.0	CTMW-04D-25.0-20170322	03/22/17	--	--	--	--	--	52.5%	47.5%
	25.0	CTMW-04D-25.0-20170322-FD	03/22/17	--	--	--	--	--	53.0%	47.0%
	30.0	CTMW-04D-30.0-20170322	03/22/17	--	--	--	--	--	59.5%	40.5%
	35.0	CTMW-04D-35.0-20170322	03/22/17	--	--	--	--	--	59.9%	40.1%
	40.0	CTMW-04D-40.0-20170322	03/22/17	--	--	--	--	--	63.9%	36.1%
	45.0	CTMW-04D-45.0-20170322	03/22/17	--	--	--	--	--	60.2%	39.8%
	50.0	CTMW-04D-50.0-20170322	03/22/17	--	--	--	--	--	70.5%	29.5%
	55.0	CTMW-04D-55.0-20170322	03/22/17	--	--	--	--	--	64.5%	35.5%
	60.0	CTMW-04D-60.0-20170322	03/22/17	--	--	--	--	--	72.9%	27.1%
CTMW-05D	0.5	CTMW-05D-0.5-20170605	06/05/17	--	--	--	--	--	95.0%	5.0%
	5.0	CTMW-05D-5.0-20170605	06/05/17	--	--	--	--	--	90.3%	9.7%
	10.0	CTMW-05D-10.0-20170605	06/05/17	--	--	--	--	--	84.2%	15.8%
	15.0	CTMW-05D-15.0-20170605	06/05/17	--	--	--	--	--	94.7%	5.3%
	15.0	CTMW-05D-15.0-20170605-FD	06/05/17	--	--	--	--	--	87.6%	12.4%
	20.0	CTMW-05D-20.0-20170605	06/05/17	0.28	12,000	7.9	36	740	74.9%	25.1%
	25.0	CTMW-05D-25.0-20170605	06/05/17	--	--	--	--	--	62.7%	37.3%
	30.0	CTMW-05D-30.0-20170605	06/05/17	--	--	--	--	--	58.8%	41.2%
	35.0	CTMW-05D-35.0-20170605	06/05/17	--	--	--	--	--	58.4%	41.6%
	40.0	CTMW-05D-40.0-20170605	06/05/17	--	--	--	--	--	67.8%	32.2%
	45.0	CTMW-05D-45.0-20170605	06/05/17	<0.020	1,700	8.0	37	570	58.7%	41.3%
	50.0	CTMW-05D-50.0-20170605	06/05/17	--	--	--	--	--	65.2%	34.8%
	55.0	CTMW-05D-55.0-20170605	06/05/17	--	--	--	--	--	73.5%	26.5%
	60.0	CTMW-05D-60.0-20170605	06/05/17	--	--	--	--	--	61.7%	38.3%
CTMW-06D	0.5	CTMW-06D-0.5-20170606	06/06/17	--	--	--	--	--	92.6%	7.4%
	5.0	CTMW-06D-5.0-20170606	06/06/17	--	--	--	--	--	95.3%	4.7%
	10.0	CTMW-06D-10.0-20170606	06/06/17	--	--	--	--	--	93.1%	6.9%
	10.0	CTMW-06D-10.0-20170606-FD	06/06/17	--	--	--	--	--	92.1%	7.9%
	15.0	CTMW-06D-15.0-20170606	06/06/17	--	--	--	--	--	93.9%	6.1%
	20.0	CTMW-06D-20.0-20170606	06/06/17	0.20	6,900	8.1	72	710	84.1%	15.9%
	25.0	CTMW-06D-25.0-20170606	06/06/17	--	--	--	--	--	46.9%	53.1%
	30.0	CTMW-06D-30.0-20170606	06/06/17	--	--	--	--	--	56.5%	43.5%
	35.0	CTMW-06D-35.0-20170606	06/06/17	--	--	--	--	--	68.0%	32.0%
	40.0	CTMW-06D-40.0-20170606	06/06/17	--	--	--	--	--	63.5%	36.5%
	43.5	CTMW-06D-43.5-20170606	06/06/17	0.99	17,000	8.0	36	520	61.6%	38.4%
	45.0	CTMW-06D-45.0-20170606	06/06/17	--	--	--	--	--	59.0%	41.0%
	50.0	CTMW-06D-50.0-20170606	06/06/17	--	--	--	--	--	68.4%	31.6%
	55.0	CTMW-06D-55.0-20170606	06/06/17	--	--	--	--	--	64.4%	35.6%

Notes:

USEPA	United States Environmental Protection Agency
ft bgs	Feet below ground surface
mg/kg	Milligram per kilogram
<	Denotes concentration is less than the laboratory method detection limit indicated
J	Denotes concentration is less than the laboratory reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value
F1	MS and /or msd Recovery is outside acceptance limits
F2	MS/MSD RPD exceeds control limits
–	Not Analyzed

Table G-3 - Summary of Groundwater Analytical Results-Biological Field Study

Central Retention Basin

Well Location	Sample ID	Sample Date	Week	Perchlorate by USEPA Method 314.0 (mg/L)	Hexavalent Chromium by USEPA Method 7199 (mg/L)	Total Metals by USEPA Method 6010B (mg/L)			Disinfection By-Products by USEPA Method 300.1B (mg/L)		Anions by USEPA Method 300.0 (mg/L)		
						Chromium	Total Iron	Total Manganese	Chlorate	Chlorite	Chloride	Nitrate as N	Sulfate
CTMW-01S	CTMW-01S-20170404	04/04/17	Baseline	**410**	**11**	**11**	--	**0.030**	**2,500**	<1	**790**	**120**	**1,400**
	CTMW-01S-20170503	05/03/17	PME1	**340**	**0.026**	**1.7**	--	**0.55**	**870**	<10	**950**	**210**	**1,400**
	CTMW-01S-20170516	05/16/17	PME2	**280**	<0.000025	**0.49**	--	**0.55**	**730**	<10	**940**	**55**	**1,200**
	CTMW-01S-20170531	05/31/17	PME3	**140**	<0.000025	**0.18**	**1.4**	**0.99**	**650**	<10	**1,500**	**2.6**	**1,100**
	CTMW-01S-20170619	06/19/17	PME4	**39**	<0.000026	**1.9**	**17**	**3.3**	**64**	<20	**1,300**	**9.5**	**740**
	CTMW-01S-20170720	07/20/17	PME5	**4**	<0.000025	**0.49**	**25**	**5.5**	**72**	<5	**1,500**	<0.55	**140**
	CTMW-01S-20170824	08/24/17	PME6	**32**	**0.0026**	**2.2**	**18**	**3.3**	**13**	<10	**1,300**	**4.8 J**	**1,000**
	CTMW-01S-20170920	09/20/17	PME7	**0.32**	**0.000037 J**	**0.086**	**11**	**3.6**	<1.0	<10	**970**	<1.1	<130
	CTMW-01S-20171003	10/03/17	PME8	**0.15 F1**	<0.000025	**0.084**	**21**	**2.8**	**0.61 J**	<1	**1,100**	<0.55	**76**
CTMW-01D	CTMW-01D-20170403	04/03/17	Baseline	**1,400**	**24**	**23**	--	**0.042**	**4,900**	<1	**1,900**	**20**	**1,900**
	CTMW-01D-20170503	05/03/17	PME1	**1,400**	**22**	**24**	--	**0.20**	**4,900**	<10	**1,900**	**21**	**1,800**
	CTMW-01D-20170516	05/16/17	PME2	**1,400**	**21**	**24**	--	**0.037 J**	**4,500**	<10	**1,700**	**22**	**1,700**
	CTMW-01D-20170531	05/31/17	PME3	**1,300**	**22**	**23**	**0.15 J**	**0.027 J**	**4,800**	<10	**1,700**	**20**	**1,600**
	CTMW-01D-20170619	06/19/17	PME4	**1,400**	**20**	**22**	<0.25	<0.046	**4,300**	<10	**1,700**	**17**	**1,700**
	CTMW-01D-20170720	07/20/17	PME5	**1,400**	**16**	**16**	<0.10	**0.070**	**4,100**	<10	**2,000**	**14**	**1,700**
	CTMW-01D-20170720-FD	07/20/17	PME5	**1,300**	**16**	**15**	<0.050	**0.063**	**4,100**	<10	**2,000**	**14**	**1,700**
	CTMW-01D-20170824	08/24/17	PME6	**1,400**	**13**	**14**	**0.17 J**	**0.20**	**3,700**	<10	**2,300**	**9.9**	**1,700**
	CTMW-01D-20170920	09/20/17	PME7	**1,500**	**12**	**13**	**0.71**	**0.21**	**3,800**	<10	**2,100**	**12**	**1,600**
	CTMW-01D-20171003	10/03/17	PME8	**1,300**	**12**	**11**	**0.13**	**0.21**	**3,500**	<10	**2,000**	**11**	**1,600**
CTMW-02S	CTMW-02S-20170405	04/05/17	Baseline	**410**	**11**	**11**	--	**0.03**	**2,500**	<10	**780**	**160**	**1,500**
	CTMW-02S-20170504	05/04/17	PME1	**470**	**1.3**	**2.5**	--	**0.36**	**860**	<10	**1,300**	**540**	**1,500**
	CTMW-02S-20170516	05/16/17	PME2	**380**	**0.11**	**0.74**	--	**0.35**	**550**	<10	**1,200**	**530**	**1,400**
	CTMW-02S-20170601	06/01/17	PME3	**440**	**0.76**	**0.68**	**0.11**	**0.23**	**750**	<10	**1,300**	**320**	**1,500**
	CTMW-02S-20170620	06/20/17	PME4	**110**	<0.000025	**0.16**	**2.1**	**1.30**	<0.5	<0.5	**1,500**	<1.1	**890**
	CTMW-02S-20170719	07/19/17	PME5	**26**	<0.000025	**0.084**	**13**	**2.70**	<0.5	<10	**1,400**	**0.63 J**	**29**
	Not Analyzed	08/24/17	PME6	**Well Dry; Unable to sample**									
	CTMW-02S-20170920	09/20/17	PME7	**13**	<0.000025	**0.097**	**13**	**1.4**	<1.0	<10	**1,600**	<0.28	**17**
	CTMW-02S-20171003	10/03/17	PME8	**0.29**	<0.000025	**0.13**	**7.9**	**1.1**	<0.5	<1	**1,600**	<1.1	**6.5 J**
CTMW-02D	CTMW-02D-20170404	04/04/17	Baseline	**960**	**20**	**23**	--	**0.090 J**	**4,800**	<1	**1,300**	**34**	**1,700**
	CTMW-02D-20170404-FD	04/04/17	Baseline	**930**	**20**	**21**	--	**0.076 J**	**4,600**	<1	**1,200**	**31**	**1,600**
	CTMW-02D-20170503	05/03/17	PME1	**1,100**	**15**	**19**	--	**0.10**	**4,200**	<10	**1,500**	**30**	**1,700**
	CTMW-02D-20170503-FD	05/03/17	PME1	**1,800**	**15**	**19**	--	**0.11**	**4,200**	<10	**1,600**	**29**	**1,700**
	CTMW-02D-20170517	05/17/17	PME2	**1,200**	**19**	**18**	--	**0.13**	**4,000**	<10	**1,500**	**26**	**1,500**
	CTMW-02D-20170601	06/01/17	PME3	**1,300**	**19**	**19**	**0.11**	**0.090**	**3,300**	<10	**1,500**	**25**	**1,600**
	CTMW-02D-20170601-FD	06/01/17	PME3	**1,200**	**18**	**18**	**0.051 J**	**0.10**	**3,400**	<10	**1,500**	**25**	**1,500**
	CTMW-02D-20170619	06/19/17	PME4	**1,100**	**16**	**19**	<0.25	**0.13**	**2,000**	<10	**1,500**	**22**	**1,600**
	CTMW-02D-20170619-FD	06/19/17	PME4	**1,200**	**18**	**20**	<0.25	**0.13**	**1,900**	<10	**1,600**	**22**	**1,600**
	CTMW-02D-20170719	07/19/17	PME5	**950**	**13**	**12**	<0.050	**0.26**	**4,400**	<10	**1,800**	**5.8**	**1,300**
	CTMW-02D-20170824	08/24/17	PME6	**1,200**	**14**	**16**	**0.17 J**	**0.40**	**3,500**	<10	**2,000**	**18**	**1,600**
	CTMW-02D-20170920	09/20/17	PME7	**2,500**	**13**	**13**	**6.1**	**0.49**	**3,700**	<10	**2,000**	**14**	**1,400**
	CTMW-02D-20171003	10/03/17	PME8	**1,200**	**15**	**14**	**0.27**	**0.28**	**3,600**	<10	**1,900**	**17**	**1,500**
CTMW-03S	CTMW-03S-20170405	04/05/17	Baseline	**470**	**13**	**14**	--	<0.050	**2,900**	<10	**940**	**55**	**1,500**
	CTMW-03S-20170505	05/05/17	PME1	**460**	**13**	**15**	--	**0.060**	**3,200**	<10	**1,000**	**27**	**1,600**
	CTMW-03S-20170517	05/17/17	PME2	**510**	**14**	**15**	--	**0.058**	**3,200**	<10	**960**	**31**	**1,500**
	CTMW-03S-20170601	06/01/17	PME3	**610**	**14**	**13**	<0.050	**0.060**	**4,000**	<10	**1,000**	**38**	**1,500**
	CTMW-03S-20170620	06/20/17	PME4	**670**	**4.4**	**5.7**	**0.23**	**0.33**	**1,600**	<1	**1,700**	**34**	**1,600**
	CTMW-03S-20170718	07/18/17	PME5	**540**	**14**	**14**	**0.055 J**	**0.33**	**3,100**	<10	**1,100**	**30**	**1,600**
	CTMW-03S-20170823	08/23/17	PME6	**600**	**4.8**	**5.7**	**0.15**	**0.60**	**1,600**	<10	**1,800**	**17**	**1,400**
	CTMW-03S-20170921	09/21/17	PME7	**540**	**14**	**16**	<0.050	**0.38**	**3,400**	<10	**1,100**	**26**	**1,500**
	CTMW-03S-20171003	10/03/17	PME8	**560**	**16**	**16**	<0.050	**0.36**	**3,400**	<10	**1,100**	**26**	**1,500**

Notes:

USEPA	United States Environmental Protection Agency
mg/L	Milligram per liter
<	Denotes concentration is less than the laboratory method detection limit indicated
J	Denotes concentration is less than the laboratory reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value
F1	MS and / or MSD Recovery is outside acceptance limits
F2	MS/MSD RPD exceeds control limits
L	Denotes a negative instrument reading had an absolute value greater than the reporting limit
J	Denotes concentration is less than the laboratory reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value
–	Not Analyzed

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Table G-3 - Summary of Groundwater Analytical Results-Biological Field Study

Central Retention Basin

Well Location	Sample ID	Sample Date	Week	Perchlorate by USEPA Method 314.0 (mg/L)	Hexavalent Chromium by USEPA Method 7199 (mg/L)	Total Metals by USEPA Method 6010B (mg/L)			Disinfection By-Products by USEPA Method 300.1B (mg/L)		Anions by USEPA Method 300.0 (mg/L)		
						Chromium	Total Iron	Total Manganese	Chlorate	Chlorite	Chloride	Nitrate as N	Sulfate
CTMW-03D	CTMW-03D-20170406	04/06/17	Baseline	530	17	16	--	0.031	3,700	<10	1,100	47	1,600
	CTMW-03D-20170505	05/05/17	PME1	490	16	16	--	0.027	3,500	<10	1,100	48	1,600
	CTMW-03D-20170517	05/17/17	PME2	520	16	15	--	<0.020	3,400	<10	960	41	1,500
	CTMW-03D-20170601	06/01/17	PME3	570	15	15	<0.050	0.019 J	3,500	<10	1,000	34	1,500
	CTMW-03D-20170620	06/20/17	PME4	520	15	18	<0.25	<0.075	3,400	<1	1,200	33	1,600
	CTMW-03D-20170720	07/20/17	PME5	580	14	14	<0.050	0.018 J	3,400	<10	1,100	27	1,500
	CTMW-03D-20170823	08/23/17	PME6	610	14	15	<0.050	0.022	3,200	<10	1,100	23	1,500
	CTMW-03D-20170921	09/21/17	PME7	540	14	16	0.24	0.051	3,400	<10	1,100	23	1,500
	CTMW-03D-20171003	10/03/17	PME8	540	15	16	0.095 J	0.030	3,500	<10	1,100	24	1,500
CTMW-04S	CTMW-04S-20170405	04/05/17	Baseline	420	9.9	10	--	0.033	2,500	<20	780	150	1,500
	CTMW-04S-20170504	05/04/17	PME1	440	5.4	19	--	0.11	1,800	<10	1,100	120	1,500
	CTMW-04S-20170517	05/17/17	PME2	540	0.15	0.82	--	0.30	910	<10	1,500	93	1,400
	CTMW-04S-20170602	06/02/17	PME3	650	0.47	1.1	0.19	0.33	1,100	<10	1,500	51	1,400
	CTMW-04S-20170620	06/20/17	PME4	560	<0.000025	0.78	2.9	0.41	290	<1	1,800	18	1,500
	CTMW-04S-20170718	07/18/17	PME5	180	0.000034 J	0.51	2.6	1.1	20	<5	1,900	<1.1	1,100
	CTMW-04S-20170823	08/23/17	PME6	140	<0.000025	0.23	8.7	2.1	16	<10	2,000	<1.1	190
	CTMW-04S-20170921	09/21/17	PME7	510	<0.000025	0.12	14	2.6	5.1	<10	2,200	<1.1 F1	390 F1
	CTMW-04S-20171003	10/03/17	PME8	120	<0.000025	0.083	15	2.0	320	<10	2,300	5.3 J	920
CTMW-04D	CTMW-04D-20170405	04/05/17	Baseline	980	19	20	--	0.013 J	4,300	<10	1,600	26	1,700
	CTMW-04D-20170504	05/04/17	PME1	950	16	6.2	--	0.16	4,200	<10	1,400	33	1,700
	CTMW-04D-20170517	05/17/17	PME2	810	19	22	--	<0.020	4,000	<10	1,200	32	1,500
	CTMW-04D-20170517-FD	05/17/17	PME2	730	20	21	--	<0.020	4,000	<10	1,200	33	1,500
	CTMW-04D-20170602	06/02/17	PME3	860	19	19	0.084 J	<0.010	4,700	<10	1,500	31	1,600
	CTMW-04D-20170621	06/21/17	PME4	990	19	21	<0.050	<0.015	3,700	<10	1,400	33	1,700
	CTMW-04D-20170718	07/18/17	PME5	950	19	19	0.37	0.13	4,600	<10	1,900	34	2,200
	CTMW-04D-20170823	08/23/17	PME6	780	18	19	0.082	0.035	4,100	<10	1,400	36	1,600
	CTMW-04D-20170823-FD	08/23/17	PME6	810	18	18	1.1	0.038	4,100	<10	1,400	36	1,600
	CTMW-04D-20170920	09/20/17	PME7	820	17	19	0.34	<0.015	3,500	<10	1,300	36	1,600
	CTMW-04D-20171003	10/03/17	PME8	740	18	18	0.13	<0.015	3,900	<10	1,200	38	1,500
CTMW-05S	CTMW-05S-20170621	06/21/17	PME4	560	4.9	5.5	0.088 J	0.21	2,100	<10	1,300	60	1,400
	CTMW-05S-20170717	07/17/17	PME5	570	2.5	2.8	<0.050	0.24	1,700	<10	1,600	24	1,400
	CTMW-05S-20170822	08/22/17	PME6	610	3.4	3.7	5.6	0.40	2,000	<10	1,600	32	1,400
	CTMW-05S-20170919	09/19/17	PME7	570	2.3	2.2	<0.050	0.21	1,900	<10	1,700	14	1,300
	CTMW-05S-20171004	10/04/17	PME8	570	5.9	5.7	<0.050	0.21	2,700	<10	1,400	28	1,400
CTMW-05D	CTMW-05D-20170621	06/21/17	PME4	660	16	16	<0.050	<0.015	3,400	<10	1,000	73	1,400
	CTMW-05D-20170621-FD	06/21/17	PME4	590	16	18	<0.050	0.015 J	3,500	<10	1,100	73	1,500
	CTMW-05D-20170718	07/18/17	PME5	510	15 H	15	<0.050	0.10	3,400	<10	1,100	64	1,500
	CTMW-05D-20170822	08/22/17	PME6	550	15	16	0.055 J	<0.015	3,500	<10	1,100	52	1,500
	CTMW-05D-20170919	09/19/17	PME7	550	15	14	0.25	0.016 J	3,300	<10	1,100	52	1,500
	CTMW-05D-20171004	10/04/17	PME8	650	14	16	0.78 F1	0.028	3,400	<10	1,100	48	1,500
CTMW-06S	CTMW-06S-20170621	06/21/17	PME4	460	<0.000025	0.31	2.5	2.0	20	<10	1,700	<1.1	950
	CTMW-06S-20170717	07/17/17	PME5	18 F1	<0.000025	0.29	5.2	4.3	19	<10	1,600	1.2 J	230
	CTMW-06S-20170822	08/22/17	PME6	13	<0.000025	0.13	42	5.7	0.29	<10	1,700	<1.1	14
	CTMW-06S-20170919	09/19/17	PME7	<0.01	<0.000025	0.061	68	5.7	<0.5	<10	1,700	<1.1	<5.0
	CTMW-06S-20171004	10/04/17	PME8	<0.025	<0.000025	0.062	49	7.1	<1	<10	1,600	<2.8	<13
CTMW-06D	CTMW-06D-20170622	06/22/17	PME4	1,000	15	17	<0.050	0.042	4,000	<10	1,300	97	1,500
	CTMW-06D-20170717	07/17/17	PME5	920	17	18	<0.050	0.035	3,900	<10	1,400	84	1,500
	CTMW-06D-20170717-FD	07/17/17	PME5	830	17	17	0.067 J	0.034	4,200	<10	1,500	84	1,500
	CMTW-06D-20170822	08/22/17	PME6	950	15	15	0.63	0.10	3,700	<10	1,400	52	1,400
	CMTW-06D-20170919	09/19/17	PME7	800	14	13	0.85	0.15	2,700	<10	1,700	48	1,500
	CTMW-06D-20170919-FD	09/19/17	PME7	810	13	13	0.79	0.15	2,600	<10	1,600	48	1,500
	CTMW-06D-20171004	10/04/17	PME8	970	12	13	0.83	0.19	3,100	<10	1,700	41	1,400
	CTMW-06D-20171004-FD	10/04/17	PME8	990	13	13	0.71	0.18	3,100	<10	1,700	39	1,400

Notes:

USEPA	United States Environmental Protection Agency
mg/L	Milligram per liter
<	Denotes concentration is less than the laboratory method detection limit indicated
J	Denotes concentration is less than the laboratory reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value
F1	MS and / or MSD Recovery is outside acceptance limits
F2	MS/MSD RPD exceeds control limits
L	Denotes a negative instrument reading had an absolute value greater than the reporting limit
J	Denotes concentration is less than the laboratory reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value
--	Not Analyzed

TETRA TECH

Table G-3 - Summary of Groundwater Analytical Results-Biological Field Study

Central Retention Basin

Well Location	Sample ID	Sample Date	Week	General Water Quality Parameters							
				pH	Temp (°C)	Specific Conductivity (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Sulfide (mg/L)	Ferrous Iron (mg/L)
CTMW-01S	CTMW-01S-20170404	04/04/17	Baseline	7.44	26.10	9.08	170	1.71	0.0	0.00	0.02
	CTMW-01S-20170503	05/03/17	PME1	5.96	28.73	14.2	-166	1.87	15.5	0.00	0.00
	CTMW-01S-20170516	05/16/17	PME2	6.68	24.39	10.7	-298	1.21	59.0	0.11	0.22
	CTMW-01S-20170531	05/31/17	PME3	6.09	28.64	11.2	-157	1.05	9.2	0.05	0.04
	CTMW-01S-20170619	06/19/17	PME4	6.20	30.95	13.9	-127	0.56	455	0.08	0.30
	CTMW-01S-20170720	07/20/17	PME5	5.94	28.95	14.4	-40	0.77	74.7	0.19	0.25
	CTMW-01S-20170824	08/24/17	PME6	6.51	30.10	14.2	-71	2.06	295.0	0.25	0.19
	CTMW-01S-20170920	09/20/17	PME7	6.40	30.84	12.4	-72	0.15	34.7	0.49	--
	CTMW-01S-20171003	10/03/17	PME8	7.75	25.63	11.8	-82	1.09	30.1	0.08	>3.00
CTMW-01D	CTMW-01D-20170403	04/03/17	Baseline	7.03	25.53	15.2	100	1.55	84.7	0.03	0.07
	CTMW-01D-20170503	05/03/17	PME1	6.49	27.00	17.3	79	1.43	81.2	0.01	0.05
	CTMW-01D-20170516	05/16/17	PME2	7.46	27.09	13.9	-23	1.14	4.8	0.00	0.15
	CTMW-01D-20170531	05/31/17	PME3	7.00	27.37	14.5	-14	0.83	0.6	0.00	0.05
	CTMW-01D-20170619	06/19/17	PME4	6.97	28.55	14.0	-130	0.49	4.2	0.00	0.00
	CTMW-01D-20170720	07/20/17	PME5	6.47	26.86	15.1	-120	0.36	7.9	0.03	0.03
	CTMW-01D-20170824	08/24/17	PME6	6.38	26.79	16.1	-162	0.73	26.8	0.06	0.07
	CTMW-01D-20170920	09/20/17	PME7	6.53	25.68	14.6	-103	0.21	11.5	0.06	--
	CTMW-01D-20171003	10/03/17	PME8	7.34	26.72	13.7	-19	0.28	0.0	0.09	0.06
CTMW-02S	CTMW-02S-20170405	04/05/17	Baseline	7.45	27.19	9.23	161	1.56	0.00	0.00	0.09
	CTMW-02S-20170504	05/04/17	PME1	5.05	33.65	13.3	190	7.53	62.9	0.00	0.01
	CTMW-02S-20170516	05/16/17	PME2	6.75	31.31	11.1	-43	1.68	0.0	0.11	0.16
	CTMW-02S-20170601	06/01/17	PME3	6.70	29.55	11.2	150	1.82	6.6	0.06	0.10
	CTMW-02S-20170620	06/20/17	PME4	6.76	27.70	10.5	-145	0.56	239	0.10	0.30
	CTMW-02S-20170719	07/19/17	PME5	6.60	30.00	11.5	-31	0.77	98.1	0.13	0.17
	Not Analyzed	08/24/17	PME6	**Well Dry; Unable to sample**							
	CTMW-02S-20170920	09/20/17	PME7	**Hand bailed due to insufficient water column/slow recharge**							
	CTMW-02S-20171003	10/03/17	PME8	7.30	26.14	9.15	-107	0.26	45.4	0.07	3.23
CTMW-02D	CTMW-02D-20170404	04/04/17	Baseline	7.63	27.81	12.9	120	1.18	28.9	0.06	0.11
	CTMW-02D-20170503	05/03/17	PME1	6.01	29.31	14.8	125	1.21	5.2	0.03	0.14
	CTMW-02D-20170517	05/17/17	PME2	7.13	23.23	12.9	33	3.43	130	0.03	0.00
	CTMW-02D-20170601	06/01/17	PME3	6.74	27.20	13.1	164	0.52	6.6	0.04	0.05
	CTMW-02D-20170619	06/19/17	PME4	6.97	26.55	12.5	-161	0.41	7.2	0.00	0.00
	CTMW-02D-20170719	07/19/17	PME5	6.66	25.64	13.4	39	0.68	26.7	0.03	0.02
	CTMW-02D-20170824	08/24/17	PME6	6.60	26.31	14.6	-163	0.75	31.2	0.04	0.09
	CTMW-02D-20170920	09/20/17	PME7	6.82	24.55	13.3	53	0.12	39.2	0.02	--
	CTMW-02D-20171003	10/03/17	PME8	6.68	27.77	13.5	-14	0.13	20.2	0.00	0.00
CTMW-03S	CTMW-03S-20170405	04/05/17	Baseline	7.34	27.82	9.35	161	1.88	0.0	0.00	0.00
	CTMW-03S-20170505	05/05/17	PME1	6.30	24.86	9.35	-3	1.40	0.5	0.00	0.00
	CTMW-03S-20170517	05/17/17	PME2	7.40	20.91	10.1	145	4.75	1.0	0.08	0.00
	CTMW-03S-20170601	06/01/17	PME3	6.89	27.63	10.6	172	1.14	0.0	0.00	0.00
	CTMW-03S-20170620	06/20/17	PME4	6.53	26.22	11.3	33	0.26	84.0	0.00	0.00
	CTMW-03S-20170718	07/18/17	PME5	6.65	28.20	6.65	124	16.3	16.3	0.00	0.00
	CTMW-03S-20170823	08/23/17	PME6	6.40	27.64	12.3	14	1.53	104.0	0.16	0.16
	CTMW-03S-20170921	09/21/17	PME7	6.87	25.30	10.6	67	0.16	2.1	0.12	--
	CTMW-03S-20171003	10/03/17	PME8	7.32	28.70	8.79	120	0.84	0.0	0.00	0.05

Notes:

USEPA	United States Environmental Protection Agency
°C	Celcius
mg/L	Milligram per liter
mV	Millivolt
NTU	Nephelometric Units
>3.00	Denotes concentration was greater than the test method upper limit indicated.
--	Not Analyzed

Table G-3 - Summary of Groundwater Analytical Results-Biological Field Study

Central Retention Basin

Well Location	Sample ID	Sample Date	Week	General Water Quality Parameters							
				pH	Temp (°C)	Specific Conductivity (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Sulfide (mg/L)	Ferrous Iron (mg/L)
CTMW-03D	CTMW-03D-20170406	04/06/17	Baseline	7.43	22.94	10.9	214	3.39	2.1	0.00	0.00
	CTMW-03D-20170505	05/05/17	PME1	6.50	26.37	11.9	183	2.10	0.5	0.00	0.00
	CTMW-03D-20170517	05/17/17	PME2	8.71	22.65	10.5	167	4.31	0.8	0.01	0.00
	CTMW-03D-20170601	06/01/17	PME3	7.18	27.85	10.7	213	0.58	0.0	0.00	0.00
	CTMW-03D-20170620	06/20/17	PME4	7.65	26.57	10.3	-193	1.15	4.6	0.00	0.00
	CTMW-03D-20170720	07/20/17	PME5	7.24	25.74	10.9	110	0.78	3.0	0.00	0.00
	CTMW-03D-20170823	08/23/17	PME6	7.33	26.52	11.2	-28	0.74	54.5	0.09	0.13
	CTMW-03D-20170921	09/21/17	PME7	7.58	24.29	9.91	71	0.12	1.0	0.03	--
	CTMW-03D-20171002	10/02/17	PME8	7.98	26.17	9.26	77	1.57	0.0	0.00	0.15
CTMW-04S	CTMW-04S-20170405	04/05/17	Baseline	7.27	23.28	9.16	139	1.36	0.0	0.00	0.02
	CTMW-04S-20170504	05/04/17	PME1	5.83	26.56	11.9	120	1.43	6.0	0.00	0.02
	CTMW-04S-20170517	05/17/17	PME2	6.68	25.85	10.6	-12	1.16	47.4	0.17	0.17
	CTMW-04S-20170602	06/02/17	PME3	6.47	27.40	11.1	192	1.45	39.0	0.02	0.03
	CTMW-04S-20170620	06/20/17	PME4	6.88	30.85	10.4	-70	0.36	79	0.09	0.25
	CTMW-04S-20170718	07/18/17	PME5	6.73	29.54	11.3	-1	1.40	60.2	0.07	0.10
	CTMW-04S-20170823	08/23/17	PME6	6.58	31.23	11.8	-239	1.49	69.9	0.17	2.05
	CTMW-04S-20170921	09/21/17	PME7	6.74	26.21	10.8	-119	0.16	18.5	0.11	--
	CTMW-04S-20171003	10/03/17	PME8	6.64	29.98	11.2	-242	0.18	32.1	0.00	2.02
CTMW-04D	CTMW-04D-20170405	04/05/17	Baseline	7.17	25.44	13.4	143	1.10	4.7	0.01	0.00
	CTMW-04D-20170504	05/04/17	PME1	6.20	28.27	15.1	201	3.70	11.9	0.00	0.00
	CTMW-04D-20170517	05/17/17	PME2	8.71	23.42	12.4	185	0.89	13.7	0.01	0.07
	CTMW-04D-20170602	06/02/17	PME3	7.12	27.07	12.4	181	0.34	6.4	0.00	0.00
	CTMW-04D-20170621	06/21/17	PME4	7.52	24.98	11.9	-66	0.50	6.1	0.00	0.00
	CTMW-04D-20170718	07/18/17	PME5	7.28	26.11	12.8	0.71	-36	18.8	0.01	0.02
	CTMW-04D-20170823	08/23/17	PME6	7.21	25.19	12.9	-69	0.78	117.0	0.21	0.26
	CTMW-04D-20170920	09/20/17	PME7	7.42	25.95	11.6	-96	0.16	4.7	0.18	--
	CTMW-04D-20171003	10/03/17	PME8	7.89	26.00	10.1	-131	0.16	0.0	0.00	0.00
CTMW-05S	CTMW-05S-20170621	06/21/17	PME4	6.99	26.80	10.5	113	1.09	18.7	0.02	0.00
	CTMW-05S-20170717	07/17/17	PME5	6.57	31.61	11.9	115	0.82	11.0	0.03	0.04
	CTMW-05S-20170822	08/22/17	PME6	6.78	27.66	11.8	151	0.87	7.6	0.00	0.02
	CTMW-05S-20170919	09/19/17	PME7	6.61	28.81	11.1	163	0.17	4.9	0.01	--
	CTMW-05S-20171004	10/04/17	PME8	6.42	25.37	10.1	147	0.66	0.0	0.01	0.08
CTMW-05D	CTMW-05D-20170621	06/21/17	PME4	7.59	27.30	10.4	142	1.59	8.8	0.00	0.00
	CTMW-05D-20170718	07/18/17	PME5	7.24	26.36	11.4	-120	0.80	3.4	0.00	0.00
	CTMW-05D-20170822	08/22/17	PME6	7.47	25.59	11.6	88	0.72	9.6	0.03	0.00
	CTMW-05D-20170919	09/19/17	PME7	7.34	28.24	10.5	111	0.22	8.2	0.02	--
	CTMW-05D-20171004	10/04/17	PME8	6.94	24.51	9.87	142	2.45	15.0	0.01	0.19
CTMW-06S	CTMW-06S-20170621	06/21/17	PME4	6.74	35.23	10.1	-125	0.66	250	0.020	0.40
	CTMW-06S-20170717	07/17/17	PME5	6.60	34.26	11.7	-120	0.61	155	0.09	0.05
	CTMW-06S-20170822	08/22/17	PME6	6.77	32.53	13.1	-92	6.5	123	0.33	2.17
	CTMW-06S-20170919	09/19/17	PME7	6.64	30.22	12.0	-109	0.18	124	0.08	--
	CTMW-06S-20171004	10/04/17	PME8	6.46	28.33	11.5	-101	0.17	15.6	0.01	2.72
CTMW-06D	CTMW-06D-20170622	06/22/17	PME4	7.23	24.91	11.4	85	0.15	9.7	0.00	0.00
	CTMW-06D-20170717	07/17/17	PME5	6.96	30.51	12.9	87	0.63	7.1	0.00	0.00
	CMTW-06D-20170822	08/22/17	PME6	6.86	26.14	13.3	11	0.90	46.5	0.10	0.00
	CMTW-06D-20170919	09/19/17	PME7	6.75	25.40	12.7	170	0.49	27.8	0.10	--
	CTMW-06D-20171004	10/04/17	PME8	6.58	27.39	11.9	180	0.55	90.7	0.24	0.27

Notes:

USEPA	United States Environmental Protection Agency
°C	Celcius
mg/L	Milligram per liter
mV	Millivolt
NTU	Nephelometric Units
>3.00	Denotes concentration was greater than the test method upper limit indicated.
--	Not Analyzed

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Table G-3 - Summary of Groundwater Analytical Results-Biological Field Study
Central Retention Basin

Well Location	Sample ID	Sample Date	Week	General Chemistry (mg/L)										
				Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Chemical Oxygen Demand	Total Organic Carbon	Total Sulfide	Total Kjeldahl Nitrogen (TKN)	Total Phosphorus	Total Dissolved Solids	Hardness as CaCO3	Orthophosphate as P	Orthophosphorus as PO4
CTMW-01S	CTMW-01S-20170404	04/04/17	Baseline	200	200	--	2.4	0.024 J	<0.10	0.026 J	8,200	1,700	0.067 F1	0.21 F1
	CTMW-01S-20170503	05/03/17	PME1	2,000	2,000	7,100	2,300	<0.020	<2.5	0.52	12,000	3,700	0.34	1.0
	CTMW-01S-20170516	05/16/17	PME2	2,600 B	2,600 B	12,000	3,000	<0.020	0.76	0.37	11,000	3,300	0.72	2.2
	CTMW-01S-20170531	05/31/17	PME3	2,300	2,300	7,200	2,000	3.9	0.20	0.49	10,000	3,100	1.2	3.7
	CTMW-01S-20170619	06/19/17	PME4	5,300 B	5,300 B	22,000	6,600	0.36	190	24	18,000	5,700	18	54
	CTMW-01S-20170720	07/20/17	PME5	6,300 B	6,300 B	26,000	9,000	1.2	47	3.4	20,000	11,000	0.65	2.0
	CTMW-01S-20170824	08/24/17	PME6	3700 B	3700 B	17,000	6,700	<0.027	9,500	5.5	17,000	3,900	5.6	17
	CTMW-01S-20170920	09/20/17	PME7	5200 B	5200 B	19,000	6,200	0.035 J	240	0.79 J	17,000	4,800	0.76	2.3
	CTMW-01S-20171003	10/03/17	PME8	2700 B	2700 B	17,000	6,300	0.47	210	5.2	16,000	4,300	0.47	1.4
CTMW-01D	CTMW-01D-20170403	04/03/17	Baseline	140	140	--	25	0.044 J	<0.10	0.054	14,000	3,400	0.17	0.52
	CTMW-01D-20170503	05/03/17	PME1	130	130	<20	8.0	0.030 J	<0.10	0.11	14,000	3,600	0.082	0.25
	CTMW-01D-20170516	05/16/17	PME2	140	140	<20	9.8	<0.020	<0.10	<0.025	15,000	3,500	0.082	0.25
	CTMW-01D-20170531	05/31/17	PME3	160	160	<50	16	<0.30	<0.10	0.035 J	15,000	3,600	0.051 F1	0.16 F1
	CTMW-01D-20170619	06/19/17	PME4	290	290	<50	11	<0.27 F1	<0.10 F1	0.028 J F1	14,000	3,400	0.085 F1	0.26 F1
	CTMW-01D-20170720	07/20/17	PME5	400	400	<50	66	<0.14	<0.10	0.029 J	12,000	3,700	0.080 F1	0.24 F1
	CTMW-01D-20170720-FD	07/20/17	PME5	380	380	<50	66	<0.27	<0.10	0.030 J	12,000	3,600	0.10	0.31
	CTMW-01D-20170824	08/24/17	PME6	740	740	480	350	<0.027	<0.10	0.22	13,000	4,000	0.10	0.31
	CTMW-01D-20170920	09/20/17	PME7	640	640	410	430	<0.027	<0.10	0.16	14,000	4,000	0.20	0.61
	CTMW-01D-20171003	10/03/17	PME8	920	920	630	440	<0.027	<0.50	0.099	13,000	4,000	0.20	0.62
CTMW-02S	CTMW-02S-20170405	04/05/17	Baseline	160	160	--	2.0	<0.020	<0.10	<0.025	8,400	1,500	0.057	0.18
	CTMW-02S-20170504	05/04/17	PME1	940	940	58	53	<0.080	<0.10	0.26	10,000	2,500	0.15 F1	0.46 F1
	CTMW-02S-20170516	05/16/17	PME2	1,200	1,200	37 J	14	<0.020	<0.10	0.39	10,000	2,400	0.19	0.59
	CTMW-02S-20170601	06/01/17	PME3	1,200	1,200	140	15	<0.14	<0.10	0.26	8,700	1,900	0.27	0.81
	CTMW-02S-20170620	06/20/17	PME4	3,300 B	3,300 B	5,200	1,500	0.090	16	2.1	9,900	2,400	1.2	3.7
	CTMW-02S-20170719	07/19/17	PME5	3,800 B	3,800 B	5,400	2,300	0.16	23	2.6	11,000	2,700	0.56	1.7
	Not Analyzed	08/24/17	PME6	Well Dry; Unable to sample										
	CTMW-02S-20170920	09/20/17	PME7	5,900 B	5,900 B	5,400	2,000	<0.027	65	1.8	11,000	2,500	0.39	1.2
	CTMW-02S-20171003	10/03/17	PME8	2,400 B	2,400 B	5,700	1,900	0.29	68	1.1	10,000	2,400	0.54	1.7
CTMW-02D	CTMW-02D-20170404	04/04/17	Baseline	190	190	--	18	0.052	<0.10	0.045 J	11,000	2,500	0.074	0.23
	CTMW-02D-20170404-FD	04/04/17	Baseline	190	190	--	18	0.025 J	<0.10	0.051	12,000	2,400	0.081	0.25
	CTMW-02D-20170503	05/03/17	PME1	270	270	<20	12	<0.20	<0.10	<0.025	13,000	2,900	0.052	0.16
	CTMW-02D-20170503-FD	05/03/17	PME1	270	270	<20	12	<0.020	<0.10	0.025 J	12,000	2,900	0.052	0.16
	CTMW-02D-20170517	05/17/17	PME2	340	340	<20	11	<0.50	<0.10	0.030 J	13,000	3,200	0.064	0.19
	CTMW-02D-20170601	06/01/17	PME3	290	290	<50	6.2	<0.27	<0.10	0.029 J	13,000	3,200	0.065	0.20
	CTMW-02D-20170601-FD	06/01/17	PME3	320	320	<50	7.5	<0.27	<0.10	0.029 J	13,000	3,100	0.065	0.20
	CTMW-02D-20170619	06/19/17	PME4	450	450	<50	90	<0.27	<0.10	<0.025	12,000	3,100	0.033 J	0.10 J
	CTMW-02D-20170619-FD	06/19/17	PME4	420	420	<50	88	<0.27	<0.10	<0.025	12,000	3,100	0.035 J	0.11 J
	CTMW-02D-20170719	07/19/17	PME5	890	890	<50	150	<0.054	<0.10	0.027 J	12,000	3,100	0.12	0.35
	CTMW-02D-20170824	08/24/17	PME6	540	540	<50	17	<0.027	<0.10	0.11	13,000	3,300	0.1 F1	0.32 F1
	CTMW-02D-20170920	09/20/17	PME7	510	510	<50	8.6	<0.027	<0.10	0.095	12,000	3,300	0.21 F1 F2	0.65 F1 F2
	CTMW-02D-20171003	10/03/17	PME8	590	590	<20	7.8	<0.027	<0.50	0.025	12,000	3,300	0.11	0.34
CTMW-03S	CTMW-03S-20170405	04/05/17	Baseline	140	140	--	1.8	<0.020	<0.10	<0.025	8,700	1,700	0.036 J	0.11 J
	CTMW-03S-20170505	05/05/17	PME1	200	200	<20	2.4	<0.020	<0.10	<0.025	9,600	1,900	0.081 F1	0.25 F1
	CTMW-03S-20170517	05/17/17	PME2	190	190	<20	2.5	<0.50	<0.10	<0.025	9,500	1,900	0.053	0.16
	CTMW-03S-20170601	06/01/17	PME3	200	200	<50	2.1	<0.27	<0.10	0.028 J	9,800	1,900	0.059	0.18
	CTMW-03S-20170620	06/20/17	PME4	1,200	1,200	850	250	<0.14	<0.10	0.88	10,000	2,400	0.44	1.4
	CTMW-03S-20170718	07/18/17	PME5	320	320	<50	5.4	0.077	<0.10	0.046 J	9,400	2,000	0.17	0.51
	CTMW-03S-20170823	08/23/17	PME6	880	880	<20	39	<0.027	<0.10	0.18	9,600	2,200	0.10	0.31
	CTMW-03S-20170921	09/21/17	PME7	300	300	<50	2.8	<0.027	<0.10	0.094	10,000	2,000	0.18	0.54
	CTMW-03S-20171003	10/03/17	PME8	370	370	<20	2.6	<0.027	<0.50	0.049 J	10,000	2,000	0.16	0.48

Notes:

USEPA	United States Environmental Protection Agency
mg/L	Milligram per liter
B	Compound was found in the blank and the sample
<	Denotes concentration is less than the laboratory method detection limit indicated
J	Denotes concentration is less than the laboratory reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value
F1	MS and / or MSD Recovery is outside acceptance limits
F2	MS/MSD RPD exceeds control limits
L	Denotes a negative instrument reading had an absolute value greater than the reporting limit
–	Not Analyzed

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Table G-3 - Summary of Groundwater Analytical Results-Biological Field Study

Central Retention Basin

Well Location	Sample ID	Sample Date	Week	General Chemistry (mg/L)										
				Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Chemical Oxygen Demand	Total Organic Carbon	Total Sulfide	Total Kjeldahl Nitrogen (TKN)	Total Phosphorus	Total Dissolved Solids	Hardness as CaCO3	Orthophosphate as P	Orthophosphorus as PO4
CTMW-03D	CTMW-03D-20170406	04/06/17	Baseline	**130**	**130**	--	**2.7**	<0.020	<0.10	<0.025	**9,600**	**1,800**	**0.038 J**	**0.12 J**
	CTMW-03D-20170505	05/05/17	PME1	**150**	**150**	<20	**3.0**	<0.020	<0.10	<0.025	**11,000**	**1,700**	**0.044 J**	**0.14 J**
	CTMW-03D-20170517	05/17/17	PME2	**150**	**150**	<20	**2.5**	<0.50	<0.10	<0.025	**9,800**	**1,700**	**0.033 J F1**	**0.10 J F1**
	CTMW-03D-20170601	06/01/17	PME3	**160**	**160**	<50 F1	**2.0**	<0.27	<0.10 F1	<0.025 F1	**9,900**	**1,700**	**0.031 J F1**	**0.094 J F1**
	CTMW-03D-20170620	06/20/17	PME4	**170**	**170**	<20	**2.2**	<0.081	<0.10	<0.025	**9,700**	**1,700**	**0.022 J**	**0.068 J**
	CTMW-03D-20170720	07/20/17	PME5	**180**	**180**	<20	**2.0**	<0.054	<0.10	<0.025	**10,000**	**1,800**	**0.064 F1**	**0.20 F1**
	CTMW-03D-20170823	08/23/17	PME6	**170**	**170**	<20	**2.0**	<0.027	<0.10	**0.040 J**	**9,900**	**1,700**	**0.042 J**	**0.13 J**
	CTMW-03D-20170921	09/21/17	PME7	**150**	**150**	<50	**1.9**	<0.027	<0.10	<0.025	**9,800**	**1,700**	**0.055 F1**	**0.17 F1**
	CTMW-03D-20171003	10/03/17	PME8	**180**	**180**	<20	**2.8**	<0.027	<0.50	<0.025	**9,700**	**1,700**	**0.058**	**0.18**
CTMW-04S	CTMW-04S-20170405	04/05/17	Baseline	**180**	**180**	--	**2.0**	<0.020	<0.10	**0.037 J**	**8,200**	**1,700**	**0.078**	**0.24**
	CTMW-04S-20170504	05/04/17	PME1	**730**	**730**	<20	**56**	<0.020	<0.10	**0.095**	**8,700**	**2,000**	**0.049 J**	**0.15**
	CTMW-04S-20170517	05/17/17	PME2	**1,600**	**1,600**	**1,100**	**250**	<0.50	<0.10	**0.32**	**8,800**	**2,600**	**0.54**	**1.6**
	CTMW-04S-20170602	06/02/17	PME3	**1,400**	**1,400**	**360**	**58**	<0.11	<0.10	**0.41 F1**	**9,600**	**2,500**	**0.067 F1**	**0.21 F1**
	CTMW-04S-20170620	06/20/17	PME4	**1,600**	**1,600**	**820**	**170**	<0.054	<0.10	**0.43**	**8,300**	**2,300**	**0.23**	**0.69**
	CTMW-04S-20170718	07/18/17	PME5	**1,900**	**1,900**	**980**	**320**	**0.073**	<0.10	**0.38**	**7,600**	**2,400**	**0.51**	**1.60**
	CTMW-04S-20170823	08/23/17	PME6	**2,900**	**2,900**	**3,000**	**1,800**	**0.41**	<0.10	**0.97**	**9,300**	**2,700**	**1.0**	**3.1**
	CTMW-04S-20170921	09/21/17	PME7	**1,600**	**1,600**	**1,400**	**820**	<0.027	**1.8**	**1.3**	**8,000**	**2,400**	**0.036 J**	**0.11 J**
	CTMW-04S-20171003	10/03/17	PME8	**2,100**	**2,100**	**440**	**140**	**0.47**	<0.50	**1.0**	**8,000**	**2,300**	**0.43**	**1.3**
CTMW-04D	CTMW-04D-20170405	04/05/17	Baseline	**120**	**120**	--	**5.7**	**0.020 J**	<0.10	<0.025	**12,000**	**2,500**	**0.029 J**	**0.089 J**
	CTMW-04D-20170504	05/04/17	PME1	**140**	**140**	<20	**2.9**	<0.040	<0.10	**0.041 J**	**12,000**	**2,400**	**0.037 J**	**0.11 J**
	CTMW-04D-20170517	05/17/17	PME2	**140**	**140**	<20	**3.4**	<0.50	<0.10	<0.025	**12,000**	**2,400**	**0.044 J**	**0.14 J**
	CTMW-04D-20170517-FD	05/17/17	PME2	**140**	**140**	<20	**3.6**	<0.50	<0.10	<0.025	**12,000**	**2,400**	**0.058**	**0.18**
	CTMW-04D-20170602	06/02/17	PME3	**140**	**140**	<50	**3.0**	<0.14	<0.10	<0.025	**12,000**	**2,500**	**0.055**	**0.17**
	CTMW-04D-20170621	06/21/17	PME4	**140**	**140**	<50	**2.6**	<0.054	<0.10	<0.025	**11,000**	**2,500**	**0.044 J**	**0.14 J**
	CTMW-04D-20170718	07/18/17	PME5	**140**	**140**	<50	**2.4**	<0.027	<0.10	<0.025	**12,000**	**2,400**	**0.052**	**0.16**
	CTMW-04D-20170823	08/23/17	PME6	**130**	**130**	<20	**2.8**	<0.027	<0.10	**0.032 J**	**12,000**	**2,400**	**0.051**	**0.16**
	CTMW-04D-20170823-FD	08/23/17	PME6	**120**	**120**	<20	**2.6**	<0.027	<0.17	<0.025	**12,000**	**2,400**	**0.061**	**0.19**
	CTMW-04D-20170920	09/20/17	PME7	**130**	**130**	<50	**3.3**	<0.027	<0.10	<0.025	**11,000**	**2,100**	**0.12**	**0.36**
	CTMW-04D-20171003	10/03/17	PME8	**160**	**160**	<20	**3.7**	<0.027	<0.50	<0.025	**11,000**	**2,100**	**0.056**	**0.17**
CTMW-05S	CTMW-05S-20170621	06/21/17	PME4	**760**	**760**	<50	**8.6**	<0.081	<0.10	**0.033 J**	**9,300**	**2,300**	**0.099**	**0.30**
	CTMW-05S-20170717	07/17/17	PME5	**1100**	**1100**	<50	**7.1**	**0.028 J**	<0.10	**0.027 J**	**9,600**	**2,300**	**0.13**	**0.40**
	CTMW-05S-20170822	08/22/17	PME6	**820**	**820**	<20	**11**	<0.027	<0.10	**0.19**	**9,300**	**2,400**	**0.039 J**	**0.12 J**
	CTMW-05S-20170919	09/19/17	PME7	**750**	**750**	<20	**7.1**	<0.027	<0.10	**0.037 J**	**9,600**	**2,300**	**0.82**	**2.5**
	CTMW-05S-20171004	10/04/17	PME8	**800**	**800**	<20	**3.5**	<0.027	<0.10	<0.025	**10,000**	**2,200**	**0.31**	**0.94**
CTMW-05D	CTMW-05D-20170621	06/21/17	PME4	**160**	**160**	<50	**3.5**	<0.054	<0.10	<0.025	**9,900**	**1,900**	**0.078**	**0.24**
	CTMW-05D-20170621-FD	06/21/17	PME4	**160**	**160**	<50	**3.1**	<0.054	<0.10	<0.025	**9,900**	**1,900**	**0.054**	**0.17**
	CTMW-05D-20170718	07/18/17	PME5	**160**	**160**	<50 F1	**2.3**	<0.027 F1	<0.10 F1	<0.025 F1	**9,700**	**1,900**	**0.053 F1**	**0.16 F1**
	CTMW-05D-20170822	08/22/17	PME6	**160**	**160**	<20	**2.6**	<0.027	<0.17	<0.025	**10,000**	**1,800**	**0.024 J**	**0.073 J**
	CTMW-05D-20170919	09/19/17	PME7	**140**	**140**	<20	**2.3**	<0.027	<0.10	<0.025	**11,000**	**2,000**	**0.42**	**1.3**
	CTMW-05D-20171004	10/04/17	PME8	**180**	**180**	<20 F1	**2.3**	<0.027 F1	<0.10 F1	<0.025 F1	**10,000**	**1,800**	**0.077 F1**	**0.24 F1**
CTMW-06S	CTMW-06S-20170621	06/21/17	PME4	**2,400 B**	**2,400 B**	**3,300**	**730**	**0.58**	**0.48**	**0.40**	**7,300**	**2,600**	**0.084**	**0.26**
	CTMW-06S-20170717	07/17/17	PME5	**3,800 B**	**3,800 B**	**9,800**	**3,100**	**7.3**	**15**	**0.93**	**11,000**	**3,700**	**0.670**	**2.00**
	CTMW-06S-20170822	08/22/17	PME6	**4,400**	**4,400**	**6,700**	**3,200**	<0.027	**30**	**2.0**	**11,000**	**3,600**	**0.30**	**0.93**
	CTMW-06S-20170919	09/19/17	PME7	**2,300 B**	**2,300 B**	**7,100**	**2,700**	<0.027	**44**	**1.6**	**12,000**	**3,700**	**2.7**	**8.2**
	CTMW-06S-20171004	10/04/17	PME8	**2,600 B**	**2,600 B**	**10,000**	**3,000**	**0.20**	**54**	**2.7**	**12,000**	**3,700**	**2.2**	**6.7**
CTMW-06D	CTMW-06D-20170622	06/22/17	PME4	**240**	**240**	<50	**3.5**	<0.11	<0.10	<0.025	**12,000**	**2,600**	**0.054**	**0.17**
	CTMW-06D-20170717	07/17/17	PME5	**210**	**210**	<50	**4.9**	**0.030 J**	<0.10	<0.025	**11,000**	**2,600**	**0.064**	**0.2**
	CTMW-06D-20170717-FD	07/17/17	PME5	**210**	**210**	<50	**5.8**	**0.029 J**	<0.10	<0.025	**12,000**	**2,700**	**0.057**	**0.18**
	CMTW-06D-20170822	08/22/17	PME6	**340**	**340**	<50	**25**	<0.027	<0.10	**0.13**	**12,000**	**2,700**	**0.084**	**0.26**
	CMTW-06D-20170919	09/19/17	PME7	**390**	**390**	<20	**85**	<0.027 F1	<0.10	**0.034 J**	**11,000**	**2,600**	**0.58**	**1.8**
	CTMW-06D-20170919-FD	09/19/17	PME7	**400**	**400**	<20	**82**	<0.027	<0.10	**0.040 J**	**11,000**	**2,600**	**0.44**	**1.3**
	CTMW-06D-20171004	10/04/17	PME8	**590**	**590**	<50	**120**	<0.027	<0.10	<0.025	**11,000**	**2,800**	**0.15**	**0.46**
	CTMW-06D-20171004-FD	10/04/17	PME8	**590**	**590**	<20	**110**	<0.027	<0.10	**0.029 J**	**11,000**	**2,700**	**0.12**	**0.36**

Notes:

USEPA	United States Environmental Protection Agency
mg/L	Milligram per liter
B	Compound was found in the blank and the sample
<	Denotes concentration is less than the laboratory method detection limit indicated
J	Denotes concentration is less than the laboratory reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value
F1	MS and / or MSD Recovery is outside acceptance limits
F2	MS/MSD RPD exceeds control limits
L	Denotes a negative instrument reading had an absolute value greater than the reporting limit
–	Not Analyzed

Table G-3 - Summary of Groundwater Analytical Results-Biological Field Study

Central Retention Basin

Well Location	Sample ID	Sample Date	Week	Dissolved Methane (mg/L)	Volatile Fatty Acids (mg/L)					
					Acetic Acid	Formic-acid	Lactic Acid	n-Butyric Acid	Propionic Acid	Pyruvic Acid
CTMW-01S	CTMW-01S-20170404	04/04/17	Baseline	<0.00025	<0.29	**3.0**	<0.31	<0.26	<0.35	<7.4
	CTMW-01S-20170503	05/03/17	PME1	<0.00025	**820**	**400**	**660**	**990**	**200**	<7.4
	CTMW-01S-20170516	05/16/17	PME2	<0.00025	**540**	**180**	<31	**1,600**	**300**	<37
	CTMW-01S-20170531	05/31/17	PME3	<0.00025	**880**	<13	<16	<13	**380**	<19
	CTMW-01S-20170619	06/19/17	PME4	<0.00025	**3,000**	<26	<31	**4,100**	**2,000**	<37
	CTMW-01S-20170720	07/20/17	PME5	**0.16**	<15	<13	<16	<13	<18	<19
	CTMW-01S-20170824	08/24/17	PME6	**0.15**	**3,900**	<5.2	<6.2	**2,400**	**1,800**	<7.4
	CTMW-01S-20170920	09/20/17	PME7	**0.95**	**4,400**	<2.6	<3.1	**2,600**	**2,000**	<3.7
	CTMW-01S-20171003	10/03/17	PME8	**1.8**	**4,200**	<5.2	<6.2	**2,500**	**1,900**	<7.4
CTMW-01D	CTMW-01D-20170403	04/03/17	Baseline	<0.00025	<0.29	<0.26	<0.31	<0.26	<0.35	<7.4
	CTMW-01D-20170503	05/03/17	PME1	<0.00025	<0.29	<0.26	<0.31	<0.26	<0.35	<7.4 F1
	CTMW-01D-20170516	05/16/17	PME2	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-01D-20170531	05/31/17	PME3	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-01D-20170619	06/19/17	PME4	<0.00025	<15 F1	<13	<16	<13	<18	<19 F1
	CTMW-01D-20170720	07/20/17	PME5	**0.00040 J**	**50**	<5.2	**22**	<5.2	<7.0	<7.4 F1
	CTMW-01D-20170720-FD	07/20/17	PME5	<0.00025	**38**	<5.2	**18 J**	<5.2	<7.0	<7.4
	CTMW-01D-20170824	08/24/17	PME6	**0.014**	**170**	<5.2	**80**	**220**	**7.0 J**	<7.4
	CTMW-01D-20170920	09/20/17	PME7	**0.29**	**160**	<2.6 F2	**54**	**350**	<3.5 F1	<3.7 F1 F2
	CTMW-01D-20171003	10/03/17	PME8	**0.038**	**160**	<5.2	**36**	**350**	**33**	<7.4
CTMW-02S	CTMW-02S-20170405	04/05/17	Baseline	<0.00025	<1.5	<1.3	<1.6	<1.3	<1.8	<1.9
	CTMW-02S-20170504	05/04/17	PME1	<0.00025	**11**	<0.26	<0.31	<0.26	<0.35	<7.4
	CTMW-02S-20170516	05/16/17	PME2	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-02S-20170601	06/01/17	PME3	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-02S-20170620	06/20/17	PME4	**0.027**	**1,500**	<13	<16	**490**	**490**	<19
	CTMW-02S-20170719	07/19/17	PME5	**0.15**	**4,000**	<5.2	<6.2	**430**	**660**	<74
	Not Analyzed	08/24/17	PME6	**Well Dry; Unable to sample**						
	CTMW-02S-20170920	09/20/17	PME7	**1.9**	**3,300**	<2.6	**20**	**480**	**340**	<3.7
	CTMW-02S-20171003	10/03/17	PME8	**2.3**	**3,200**	<5.2	<6.2	**560**	**280**	<7.4
CTMW-02D	CTMW-02D-20170404	04/04/17	Baseline	<0.00025	<0.29	<0.26 F1	<0.31 F1	<0.26 F1	<0.35 F1	<7.4
	CTMW-02D-20170404-FD	04/04/17	Baseline	<0.00025	<0.29	<0.26	<0.31	<0.26	<0.35	<7.4
	CTMW-02D-20170503	05/03/17	PME1	<0.00025	<0.29	<0.26	<0.31	<0.26	<0.35	<7.4
	CTMW-02D-20170503-FD	05/03/17	PME1	<0.00025	<0.29 F1	<0.26	<0.31 F1	<0.26 F1 F2	<0.35 F1	<7.4
	CTMW-02D-20170517	05/17/17	PME2	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-02D-20170601	06/01/17	PME3	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-02D-20170601-FD	06/01/17	PME3	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-02D-20170619	06/19/17	PME4	**0.00041 J**	<15	<13	<16	**40 J**	**27 J**	<19
	CTMW-02D-20170619-FD	06/19/17	PME4	**0.00054 J**	**49 J**	<13	<16	**42 J**	**31 J**	<19
	CTMW-02D-20170719	07/19/17	PME5	**0.00038 J**	**220**	<1.3	<1.6	<1.3	<1.8	<19
	CTMW-02D-20170824	08/24/17	PME6	**0.079**	**7.0 J**	<5.2	<6.2	<5.2	<7.0	<7.4
	CTMW-02D-20170920	09/20/17	PME7	**0.11**	<2.9	<2.6	<3.1	<2.6	<3.5	<3.7
	CTMW-02D-20171003	10/03/17	PME8	**0.058**	<2.9	<2.6	<3.1	<2.6	<3.5	<3.7
CTMW-03S	CTMW-03S-20170405	04/05/17	Baseline	<0.00025	<1.5	<1.3 F1	<1.6 F1	<1.3	<1.8	<1.9 F1
	CTMW-03S-20170505	05/05/17	PME1	<0.00025	<0.29	<0.26	<0.31	<0.26	<0.35	<7.4
	CTMW-03S-20170517	05/17/17	PME2	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-03S-20170601	06/01/17	PME3	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-03S-20170620	06/20/17	PME4	<0.00025	**120**	<13	<16	**140**	**72**	<19
	CTMW-03S-20170718	07/18/17	PME5	**0.0033**	<1.5	<1.3	<1.6	<1.3	<1.8	<19
	CTMW-03S-20170823	08/23/17	PME6	**0.025**	**66**	<5.2	<6.2	<5.2	<7.0	<7.4
	CTMW-03S-20170921	09/21/17	PME7	**0.014**	<1.5	<1.3	<1.6	<1.3	<1.8	<1.9
	CTMW-03S-20171003	10/03/17	PME8	**0.41**	<2.9	<2.6	<3.1	<2.6	<3.5	<3.7

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F1	MS and / or MSD Recovery is outside acceptance limits
F2	MS/MSD RPD exceeds control limits
L	Denotes a negative instrument reading had an absolute value greater than the reporting limit
–	Not Analyzed

Table G-3 - Summary of Groundwater Analytical Results-Biological Field Study

Central Retention Basin

Well Location	Sample ID	Sample Date	Week	Dissolved Methane (mg/L)	Volatile Fatty Acids (mg/L)					
					Acetic Acid	Formic-acid	Lactic Acid	n-Butyric Acid	Propionic Acid	Pyruvic Acid
CTMW-03D	CTMW-03D-20170406	04/06/17	Baseline	<0.00025	<1.5	<1.3	<1.6	<1.3	<1.8	<1.9
	CTMW-03D-20170505	05/05/17	PME1	<0.00025	<0.29	<0.26	<0.31	<0.26	<0.35	<7.4
	CTMW-03D-20170517	05/17/17	PME2	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-03D-20170601	06/01/17	PME3	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-03D-20170620	06/20/17	PME4	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-03D-20170720	07/20/17	PME5	<0.00025	<1.5	<1.3	<1.6	<1.3	<1.8	<19
	CTMW-03D-20170823	08/23/17	PME6	**0.030**	<5.8	<5.2	<6.2	<5.2	<7.0	<7.4
	CTMW-03D-20170921	09/21/17	PME7	**0.0084**	<1.5	<1.3	<1.6	<1.3	<1.8	<1.9
	CTMW-03D-20171003	10/03/17	PME8	**0.0096**	<2.9	<2.6	<3.1	<2.6	<3.5	<3.7
CTMW-04S	CTMW-04S-20170405	04/05/17	Baseline	<0.00025	<1.5	<1.3 F1	<1.6	<1.3	<1.8	<1.9
	CTMW-04S-20170504	05/04/17	PME1	<0.00025	**55**	<0.26	<0.31	<0.26	<0.35	<7.4
	CTMW-04S-20170517	05/17/17	PME2	<0.00025	**70**	<13	<16	**54**	<18	<19
	CTMW-04S-20170602	06/02/17	PME3	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-04S-20170620	06/20/17	PME4	<0.00025	**85**	<13	<16	**30 J**	**83**	<19
	CTMW-04S-20170718	07/18/17	PME5	**0.0037**	**570**	<1.3	<1.6	<1.3	<1.8	<1.9
	CTMW-04S-20170823	08/23/17	PME6	**0.0052**	**2,800**	<5.2	<6.2	<5.2	<7.0	<7.4
	CTMW-04S-20170921	09/21/17	PME7	<0.00025	**1,800**	<2.6	<3.1	<2.6	<3.5	<3.7
	CTMW-04S-20171003	10/03/17	PME8	**0.094**	**300**	<13	<16	<13	<18	<19
CTMW-04D	CTMW-04D-20170405	04/05/17	Baseline	<0.00025	<1.5	<1.3	<1.6	<1.3	<1.8	<1.9
	CTMW-04D-20170504	05/04/17	PME1	<0.00025	<0.29	<0.26	<0.31	<0.26	<0.35	<7.4
	CTMW-04D-20170517	05/17/17	PME2	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-04D-20170517-FD	05/17/17	PME2	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-04D-20170602	06/02/17	PME3	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-04D-20170621	06/21/17	PME4	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-04D-20170718	07/18/17	PME5	<0.00025	<1.5	<1.3	<1.6	<1.3	<1.8	<19
	CTMW-04D-20170823	08/23/17	PME6	**0.014**	<5.8	<5.2	<6.2	<5.2	<7.0	<7.4
	CTMW-04D-20170823-FD	08/23/17	PME6	**0.015**	<5.8	<5.2	<6.2	<5.2	<7.0	<7.4
	CTMW-04D-20170920	09/20/17	PME7	**0.032**	<1.5	<1.3	<1.6	<1.3	<1.8	<1.9
	CTMW-04D-20171003	10/03/17	PME8	**0.029**	<2.9	<2.6	<3.1	<2.6	<3.5	<3.7
CTMW-05S	CTMW-05S-20170621	06/21/17	PME4	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-05S-20170717	07/17/17	PME5	<0.00099	<5.8	<5.2	<6.2	<5.2	<7.0	<7.4
	CTMW-05S-20170822	08/22/17	PME6	**0.0037**	**9.5 J**	<5.2	<6.2	<5.2	<7.0	<7.4
	CTMW-05S-20170919	09/19/17	PME7	<0.00025	<1.5	<1.3	<1.6	<1.3	<1.8	<1.9
	CTMW-05S-20171004	10/04/17	PME8	**0.11**	<2.9	<2.6	<3.1	<2.6	<3.5	<19
CTMW-05D	CTMW-05D-20170621	06/21/17	PME4	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-05D-20170621-FD	06/21/17	PME4	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-05D-20170718	07/18/17	PME5	<0.00025	<1.5 F1 F2	<1.3 F1 F2	<1.6 F1	<1.3 F2	<1.8 F1 F2	<19 F1
	CTMW-05D-20170822	08/22/17	PME6	<0.00025	<15	<13	<16	<13	<18	<19
	CTMW-05D-20170919	09/19/17	PME7	<0.00025	<1.5	<1.3	<1.6	<1.3	<1.8	<1.9
	CTMW-05D-20171004	10/04/17	PME8	**0.00044 J**	<2.9	<2.6	<3.1 F1	<2.6	<3.5 F1	<19 F1
CTMW-06S	CTMW-06S-20170621	06/21/17	PME4	<0.00025	**430**	<13	<16	**240**	**100**	<19
	CTMW-06S-20170717	07/17/17	PME5	**0.0084**	**2,800**	<13	<16	**710**	**550**	<19
	CTMW-06S-20170822	08/22/17	PME6	**0.049**	**3,200**	<13	<16	**690**	**550**	<19
	CTMW-06S-20170919	09/19/17	PME7	**0.078**	**3,600**	<5.2	<6.2	**970**	**440**	<7.4
	CTMW-06S-20171004	10/04/17	PME8	**0.27**	**3,700**	<13	<16	**1,200**	**750**	<19
CTMW-06D	CTMW-06D-20170622	06/22/17	PME4	<0.00025	<5.8	<5.2	<6.2	<5.2	<7.0	<7.4
	CTMW-06D-20170717	07/17/17	PME5	<0.00025	<5.8	<5.2	<6.2	<5.2	<7.0	<7.4
	CTMW-06D-20170717-FD	07/17/17	PME5	<0.00099	<5.8	<5.2	<6.2	<5.2	<7.0	<7.4
	CMTW-06D-20170822	08/22/17	PME6	**0.00071 J**	<29	<26	<31	<26	<35	<37
	CMTW-06D-20170919	09/19/17	PME7	**0.00034 J**	**96**	<1.3	<1.6	**26**	<1.8	<1.9
	CTMW-06D-20170919-FD	09/19/17	PME7	**0.00033 J**	**97**	<1.3	<1.6	**26**	<1.8	<1.9
	CTMW-06D-20171004	10/04/17	PME8	**0.0029**	**140**	<2.6	<3.1	**16**	<3.5	<19
	CTMW-06D-20171004-FD	10/04/17	PME8	**0.0024**	**130**	<2.6	**11**	<2.6	**26**	<19

Notes:

USEPA	United States Environmental Protection Agency
mg/L	Milligram per liter
B	Compound was found in the blank and the sample
<	Denotes concentration is less than the laboratory method detection limit indicated
J	Denotes concentration is less than the laboratory reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value
F1	MS and / or MSD Recovery is outside acceptance limits
F2	MS/MSD RPD exceeds control limits
L	Denotes a negative instrument reading had an absolute value greater than the reporting limit
–	Not Analyzed

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Table G-3 - Summary of Groundwater Analytical Results-Biological Field Study

Central Retention Basin

Well Location	Sample ID	Sample Date	Week	Dissolved Metals by USEPA Method 6020 (ug/L)																		
				Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Nickel	Selenium	Silver	Thallium	Uranium	Vanadium	Zinc
CTMW-01S	CTMW-01S-20170404	04/04/17	Baseline	<50	<5.0	**85**	**41**	<2.5	<2.5	**10,000 B**	<5.0	<5.0	<80	<5.0	**32 B**	**5.5 J**	<5.0	<5.0	<5.0	**38**	<50	<25
	CTMW-01S-20170503	05/03/17	PME1	**49**	**8.8**	**200**	**62**	<0.25	<0.25	**1,100**	**5.0**	**10**	**660**	<0.50	**510**	**51**	**2.5**	<0.50	<0.50	**200**	**3.5**	**9.3 J**
	CTMW-01S-20170516	05/16/17	PME2	**26**	**0.53 J**	**210**	**58**	<0.25	<0.25	**360**	**3.4**	**4.6**	**32**	**0.62 J**	**480**	**7.6**	**2.3**	<0.50	<0.50	**210**	**19**	**10 J**
	CTMW-01S-20170531	05/31/17	PME3	<50	<5.0	**350**	**75**	<2.5	<2.5	**150**	<5.0	<5.0	**780**	<5.0	**910**	**13 J**	<5.0	<5.0	<5.0	**190**	<10	<25
	CTMW-01S-20170619	06/19/17	PME4	<50	<5.0	**460**	**47**	<2.5	<2.5	**150**	**5.2 J**	**13 J**	**370 B**	<5.0	**2,600**	**61**	<5.0	<5.0	<5.0	**23**	<10	<25
	CTMW-01S-20170720	07/20/17	PME5	**48 J B**	<2.5	**380**	**400**	<1.3	<1.3	**110**	**3.7 J**	**4.2 J**	**5,200**	<2.5	**4,500**	**37 B**	<2.5	<2.5	<2.5	**6.6**	<5.0	**17 J B**
	CTMW-01S-20170824	08/24/17	PME6	<50	<5.0	**910**	**360**	<2.5	<2.5	**90**	<5.0	<5.0	**390 B**	<5.0	**2,300**	**30**	<5.0	<5.0	<5.0	**80**	**19 J**	<25
	CTMW-01S-20170920	09/20/17	PME7	<25	**4.2 J**	**700**	**570**	<1.3	<1.3	**67**	**2.8 J**	**3.0 J**	**220 B**	<2.5	**3,200**	**18**	<2.5	<2.5	<2.5	**44**	**8.1 J**	<13
	CTMW-01S-20171003	10/03/17	PME8	<25	<2.5	**440**	**610**	<1.3	<1.3	**59**	<2.5	**2.8 J**	**430**	<2.5	**3,000**	**15**	<2.5	<2.5	<2.5	**5.2**	<5.0	**16 J**
CTMW-01D	CTMW-01D-20170403	04/03/17	Baseline	<500	<50	<50	<50	<25	<25	**22,000**	<50	<50	<320	<50	<50	<50	<50	<50	<50	<50	<40	<250
	CTMW-01D-20170503	05/03/17	PME1	**36**	**0.96 J**	**20**	**47**	<0.25	<0.25	**28,000**	**0.77 J**	**2.5**	**65**	<0.50	**44**	**5.1**	**3.5**	<0.50	<0.50	**29**	<150	**6.7 J**
	CTMW-01D-20170516	05/16/17	PME2	**12**	<0.50	**21**	**43**	<0.25	<0.25	**21,000**	**0.83 J**	**2.3 F1**	**55**	**1.2**	**58 F1**	**6.6 F1**	**2.4 F1**	<0.50	<0.50	**30**	<250	**9.5 J F1**
	CTMW-01D-20170531	05/31/17	PME3	<50	<5.0	**24**	**43**	<2.5	<2.5	**21,000**	<5.0	<5.0	<80	<5.0	**36**	**6.3 J**	<5.0	<5.0	<5.0	**43**	<10	<25
	CTMW-01D-20170619	06/19/17	PME4	<50	<5.0	**33**	**43**	<2.5	<2.5	**18,000**	<5.0	<5.0	<80	<5.0	**46**	<5.0	<5.0	<5.0	<5.0	**67**	<10	<25
	CTMW-01D-20170720	07/20/17	PME5	<25	<2.5	**39**	**47**	<1.3	<1.3	**15,000**	<2.5	**3.5 J**	<40	<2.5	**85**	**8.0 J B**	**7.3 J**	<2.5	<2.5	**140**	<5.0 L F1	**32 J B F1**
	CTMW-01D-20170720-FD	07/20/17	PME5	<25	<2.5	**43**	**49**	<1.3	<1.3	**17,000**	<2.5	**3.2 J**	**100**	<2.5	**88**	**7.6 J B**	**6.8 J**	<2.5	<2.5	**140**	<5.0 L	<13
	CTMW-01D-20170824	08/24/17	PME6	<50	<5.0	**33**	**50**	<2.5	<2.5	**11,000**	<5.0	<5.0	<80	<5.0	**180**	**8.0 J**	**6.0 J**	<5.0	<5.0	**230**	<10 L	<25
	CTMW-01D-20170920	09/20/17	PME7	<25	<2.5	**32**	**51**	<1.3	<1.3	**12,000**	<2.5	**3.0 J**	**83 J B**	<2.5	**200**	**7.4 J**	**5.3 J**	<2.5	<2.5	**230**	<5.0 L	<13
	CTMW-01D-20171003	10/03/17	PME8	**6.2 J**	**0.54 J**	**29**	**53**	<0.25	<0.25	**13,000**	**0.50 J**	**0.58 J**	<8.0	<0.50	**200**	**2.7**	**4.8**	<0.50	<0.50	**220**	**7.5**	**3.7 J**
CTMW-02S	CTMW-02S-20170405	04/05/17	Baseline	<50	<5.0	**73**	**36**	<2.5	<2.5	**11,000**	<5.0	<5.0	<800 F1	<5.0	**38**	**11 J**	<5.0	<5.0	<5.0	**31**	<100	**86 J F1**
	CTMW-02S-20170504	05/04/17	PME1	**27**	**1.6 J**	**85**	**58**	<0.25	<0.25	**1,500**	**2.1**	**24**	**79**	<0.50	**290**	**11**	**1.6 J**	<0.50	<0.50	**200**	<150	**18 J**
	CTMW-02S-20170516	05/16/17	PME2	**6.3 J**	<0.50	**53**	**53**	<0.25	<0.25	**240**	**2.1**	**5.2**	**38**	<0.50	**270**	**22**	**2.4**	<0.50	<0.50	**260**	**20**	**13 J**
	CTMW-02S-20170601	06/01/17	PME3	**8.7 J**	<0.50	**110**	**40**	<0.25	<0.25	**580**	**1.3**	**5.1**	<8.0	<0.50	**180**	**4.4**	**2.2**	<0.50	<0.50	**380**	**13**	**5.1 J**
	CTMW-02S-20170620	06/20/17	PME4	<50	<5.0	**850**	**58**	<2.5	<2.5	**130**	<5.0	<5.0	**2,000 B**	<5.0	**1,000**	**19 J**	<5.0	<5.0	<5.0	**420**	**11 J**	<25
	CTMW-02S-20170719	07/19/17	PME5	<50	**5.0 J**	**640**	**350**	<2.5	<2.5	**42**	<5.0	<5.0	**6,800 B**	<5.0	**2,400**	**9.0 J**	<5.0	<5.0	<5.0	**63**	<10	<25
	Not Analyzed	08/24/17	PME6	**Well Dry; Unable to sample**																		
	CTMW-02S-20170920	09/20/17	PME7	<25	**3.0 J**	**530**	**360**	<1.3	<1.3	**46**	<2.5	**24**	**3,500 B**	<2.5	**1,200**	**11**	<2.5	<2.5	<2.5	**25**	**9.8 J**	**14 J**
	CTMW-02S-20171003	10/03/17	PME8	<10	**2.5 J**	**340**	**430**	<0.50	<0.50	**37**	<1.0	**18**	**340**	**1.2 J**	**850**	**5.9**	<1.0	<1.0	<1.0	**4.1**	**6.4**	**22 J**
CTMW-02D	CTMW-02D-20170404	04/04/17	Baseline	<5.0	<0.50	**28**	**41**	<0.25	<0.25	**18,000 B**	**0.80 J**	**1.9 J**	<80	<0.50	**58 B**	**3.7**	**4.2 F1**	<0.50	<0.50	**39**	<100	**3.6 J F2**
	CTMW-02D-20170404-FD	04/04/17	Baseline	**6.4 J**	<0.50	**28**	**39**	<0.25	<0.25	**18,000 B**	**0.76 J**	**1.8 J**	<80	<0.50	**55 B**	**3.9**	**3.6**	<0.50	<0.50	**36**	<100	**4.7 J**
	CTMW-02D-20170503	05/03/17	PME1	**30**	**1.0 J**	**36**	**44**	<0.25	<0.25	**20,000**	**0.81 J**	**1.8 J**	**64**	<0.50	**100**	**5.0**	**3.2**	<0.50	<0.50	**62**	<150	**9.3 J**
	CTMW-02D-20170503-FD	05/03/17	PME1	**40**	**0.91 J**	**38**	**47**	<0.25	<0.25	**22,000**	**0.84 J**	**1.9 J**	**81**	<0.50	**110**	**5.0**	**3.5**	<0.50	<0.50	**65**	<150	**9.8 J**
	CTMW-02D-20170517	05/17/17	PME2	<25	<2.5	**27**	**47**	<1.3	<1.3	**19,000**	<2.5	<2.5	**82 J**	<2.5	**86**	**5.6 J**	**4.9 J**	<2.5	<2.5	**86**	<200	**14 J**
	CTMW-02D-20170601	06/01/17	PME3	<50	<5.0	**39**	**52**	<2.5	<2.5	**21,000**	<5.0	<5.0	<80	<5.0	**120**	**6.5 J**	<5.0	<5.0	<5.0	**94**	<10	<25
	CTMW-02D-20170601-FD	06/01/17	PME3	<50	<5.0	**39**	**52**	<2.5	<2.5	**20,000**	<5.0	<5.0	<80	<5.0	**140**	**5.5 J**	<5.0	<5.0	<5.0	**100**	<10	<25
	CTMW-02D-20170619	06/19/17	PME4	<50	<5.0	**47**	**42**	<2.5	<2.5	**15,000**	<5.0	<5.0	<80	<5.0	**120**	<5.0	<5.0	<5.0	<5.0	**110**	<10 L	<25
	CTMW-02D-20170619-FD	06/19/17	PME4	<50	<5.0	**45**	**43**	<2.5	<2.5	**16,000**	<5.0	**6.6 J**	<80	<5.0	**120**	**5.4 J**	**5.4 J**	<5.0	<5.0	**110**	<10	<25
	CTMW-02D-20170719	07/19/17	PME5	<50	<5.0	**88**	**56**	<2.5	<2.5	**12,000**	<5.0	<5.0	<80 F1 F2	<5.0	**290**	**5.4 J**	<5.0	<5.0	<5.0	**150**	<10 F1 L	<25
	CTMW-02D-20170824	08/24/17	PME6	<50	<5.0	**48**	**66**	<2.5	<2.5	**15,000**	<5.0	<5.0	<80	<5.0	**400**	**9.2 J**	**7.8 J**	<5.0	<5.0	**130**	<10 L F1	**33 J**
	CTMW-02D-20170920	09/20/17	PME7	<25	<2.5	**55**	**57**	<1.3	<1.3	**13,000**	<2.5	**3.0 J**	**60 J B**	<2.5	**380**	**6.9 J**	**4.9 J**	<2.5	<2.5	**150**	<5.0 L F1	<13
	CTMW-02D-20171003	10/03/17	PME8	<25	<2.5	**47**	**54**	<1.3	<1.3	**14,000**	<2.5	**16**	<40	<2.5	**320**	**7.3 J**	**3.4 J**	<2.5	<2.5	**140**	<5.0	**39 J**
CTMW-03S	CTMW-03S-20170405	04/05/17	Baseline	<50	<5.0	**120**	**29**	<2.5	<2.5	**13,000**	<5.0	<5.0	<800	<5.0	**9.1 J**	<5.0	<5.0	<5.0	<5.0	**27**	<100	<25
	CTMW-03S-20170505	05/05/17	PME1	**26 J B**	<2.5	**97**	**31**	<1.3	<1.3	**13,000**	<2.5	<2.5	<8.0	<2.5	**60**	**3.1 J**	**4.9 J**	<2.5	<2.5	**27**	<100	<13
	CTMW-03S-20170517	05/17/17	PME2	**30 J**	<2.5	**110**	**33**	<1.3	<1.3	**14,000**	<2.5	<2.5	**100**	<2.5	**68**	**3.3 J**	**3.9 J**	<2.5	<2.5	**31**	<200	**22 J**
	CTMW-03S-20170601	06/01/17	PME3	<50	<5.0	**140**	**45**	<2.5	<2.5	**17,000**	<5.0	<5.0	<80	<5.0	**87**	<5.0	<5.0	<5.0	<5.0	**43**	<10	<25
	CTMW-03S-20170620	06/20/17	PME4	**63 J**	<5.0	**160**	**51**	<2.5	<2.5	**4,800**	<5.0	<5.0	<80	<5.0	**320**	**10 J**	<5.0	<5.0	<5.0	**110**	<10	<25
	CTMW-03S-20170718	07/18/17	PME5	<25	<2.5	**130**	**43**	<1.3	<1.3	**16,000**	<2.5	<2.5	<40	<2.5	**240**	**4.9 J**	<2.5	<2.5	<2.5	**47**	<5.0 L	<13
	CTMW-03S-20170823	08/23/17	PME6	**9.2 J**	**0.51 J**	**180**	**61**	<0.25	<0.25	**4,600**	**3.1**	**4.0**	**36**	<0.50	**520**	**7.2**	**3.0**	**0.56 J**	<0.50	**98**	<1.0 L F1 F2	**8.1 J**
	CTMW-03S-20170921	09/21/17	PME7	<25	<2.5	**110**	**43**	<1.3	<1.3	**14,000**	<2.5	**4.9 J**	<40	<2.5	**330**	**4.6 J**	**8.6 J**	**57 F1 F2**	<2.5	**44**	<5.0 L F1	<13
	CTMW-03S-20171003	10/03/17	PME8	<25	<2.5	**120**	**42**	<1.3	<1.3	**13,000**	<2.5	**29**	<40	<2.5	**320**	**6.5 J**	**3.9 J**	<2.5	<2.5	**45**	**41**	**31 J**

Notes:

USEPA	United States Environmental Protection Agency
ug/L	Microgram per liter
B	Compound was found in the blank and the sample
<	Denotes concentration is less than the laboratory method detection limit indicated
J	Denotes concentration is less than the laboratory reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value
F1	MS and / or MSD Recovery is outside acceptance limits
F2	MS/MSD RPD exceeds control limits
L	Denotes a negative instrument reading had an absolute value greater than the reporting limit
–	Not Analyzed

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Table G-3 - Summary of Groundwater Analytical Results-Biological Field Study

Central Retention Basin

Well Location	Sample ID	Sample Date	Week	Dissolved Metals by USEPA Method 6020 (ug/L)																		
				Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Nickel	Selenium	Silver	Thallium	Uranium	Vanadium	Zinc
CTMW-03D	CTMW-03D-20170406	04/06/17	Baseline	**110 B F1**	<5.0	**100**	**32**	<2.5	<2.5	**16,000 B**	<5.0	<5.0	<80	<5.0	**36 B**	<5.0	<5.0	<5.0	<5.0	**29**	<50 F1	**36 J F1**
	CTMW-03D-20170505	05/05/17	PME1	<25	<2.5	**98**	**30**	<1.3	<1.3	**14,000**	<2.5	**4.3 J**	**9.1 J**	<2.5	**24**	<2.5	**5.8 J**	**12**	<2.5	**32**	<100	<13
	CTMW-03D-20170517	05/17/17	PME2	<25	<2.5	**110**	**31**	<1.3	<1.3	**15,000**	<2.5	**3.1 J**	**42 J**	<2.5	**22**	**3.9 J**	**5.3 J**	<2.5	<2.5	**36**	<200	**44 J F1**
	CTMW-03D-20170601	06/01/17	PME3	<50	<5.0	**120 F1**	**36**	<2.5	<2.5	**16,000**	<5.0	<5.0	<80	<5.0	**26**	**5.7 J**	<5.0	<5.0	<5.0	**40**	<10 F1 L	<25
	CTMW-03D-20170620	06/20/17	PME4	<50	<5.0	**100**	**29**	<2.5	<2.5	**14,000**	<5.0	<5.0	<80	<5.0	**22**	<5.0	<5.0	<5.0	<5.0	**46**	<10 L	<25
	CTMW-03D-20170720	07/20/17	PME5	<50	<5.0	**110**	**31**	<2.5	<2.5	**15,000**	<5.0	<5.0	<80	<5.0	**25**	<5.0	**5.7 J**	<5.0	<5.0	**52**	<10 L	<25
	CTMW-03D-20170823	08/23/17	PME6	<25	<2.5	**110**	**31**	<1.3	<1.3	**14,000**	<2.5	<2.5	**89 J**	<2.5	**23**	**3.8 J**	**5.3 J**	<2.5	<2.5	**63**	<5.0	<13
	CTMW-03D-20170921	09/21/17	PME7	<25	<2.5	**100**	**29**	<1.3	<1.3	**13,000**	<2.5	<2.5	<40	<2.5	**25**	**3.1 J**	**6.0 J**	<2.5	<2.5	**49**	<5.0 L	<13
	CTMW-03D-20171003	10/03/17	PME8	<25	<2.5	**92**	**27**	<1.3	<1.3	**13,000**	<2.5	**18**	<40	<2.5	**22**	**3.3 J**	**3.4 J**	<2.5	<2.5	**48**	<5.0 L	**29 J**
CTMW-04S	CTMW-04S-20170405	04/05/17	Baseline	<50	<5.0	**65**	**33**	<2.5	<2.5	**9,900**	<5.0	<5.0	<800	<5.0	**38**	**7.2 J**	<5.0	<5.0	<5.0	**34**	<100	<25
	CTMW-04S-20170504	05/04/17	PME1	**41**	**0.89 J**	**120**	**35**	<0.25	<0.25	**6,000**	**1.2**	**1.5 J**	**100**	<0.50	**150**	**4.3**	**3.0**	<0.50	<0.50	**130**	<150	**5.5 J**
	CTMW-04S-20170517	05/17/17	PME2	**20**	<0.50	**130**	**44**	<0.25	<0.25	**550**	**2.0**	**2.3**	**29**	<0.50	**320**	**6.3**	**2.7**	<0.50	<0.50	**260**	**17**	**7.1 J**
	CTMW-04S-20170602	06/02/17	PME3	**11**	<0.50	**170**	**40**	<0.25	<0.25	**710**	**1.6**	**3.1**	**54**	<0.50	**290**	**6.5**	**2.0**	<0.50	<0.50	**230**	**9.6**	**11 J**
	CTMW-04S-20170620	06/20/17	PME4	<50	<5.0	**130**	**43**	<2.5	<2.5	**180**	**5.1 J**	<5.0	**140 J B**	<5.0	**460**	**130**	<5.0	<5.0	<5.0	**320**	**16 J**	**26 J B**
	CTMW-04S-20170718	07/18/17	PME5	<25	<2.5	**510**	**57**	<1.3	<1.3	**200**	**5.3**	<2.5	**170**	<2.5	**1,200**	**53**	<2.5	<2.5	<2.5	**480**	**6.4 J**	<13
	CTMW-04S-20170823	08/23/17	PME6	**16**	**2.1**	**440**	**99**	<0.25	<0.25	**120**	**1.5**	**1.6 J**	**460**	<0.50	**1,800**	**7.6**	**1.4 J**	<0.50	<0.50	**140**	**4.2**	**16 J**
	CTMW-04S-20170921	09/21/17	PME7	**26 B**	**1.3 J**	**370**	**100**	<0.50	<0.50	**86**	<1.0	**1.9 J**	**530**	<1.0	**1,400**	**160**	**1.3 J**	<1.0	<1.0	**40**	**3.8 J**	**5.0 J**
	CTMW-04S-20171003	10/03/17	PME8	<25	<2.5	**150**	**200**	<1.3	<1.3	**70**	<2.5	**13**	**62 J**	<2.5	**2,000**	**2.5 J**	<2.5	<2.5	<2.5	**190**	<5.0	**21 J**
CTMW-04D	CTMW-04D-20170405	04/05/17	Baseline	<50	<5.0	**72**	**39**	<2.5	<2.5	**18,000**	<5.0	<5.0	<800	<5.0	**16**	<5.0	<5.0	<5.0	<5.0	**32**	<100	<25
	CTMW-04D-20170504	05/04/17	PME1	**28**	<0.50	**78**	**45**	<0.25	<0.25	**22,000**	**0.50 J**	**1.5 J**	**52**	<0.50	**15**	**3.1**	**3.3 F1**	<0.50	<0.50	**33**	<150	**17 J,F1**
	CTMW-04D-20170517	05/17/17	PME2	<25	<2.5	**92**	**41**	<1.3	<1.3	**19,000**	<2.5	<2.5	**71 J**	<2.5	**11**	**3.5 J**	<2.5	<2.5	<2.5	**33**	<250	<13
	CTMW-04D-20170517-FD	05/17/17	PME2	<25	<2.5	**95**	**43**	<1.3	<1.3	**20,000**	<2.5	<2.5	**65 J**	<2.5	**12**	**3.8 J**	**4.0 J**	<2.5	<2.5	**35**	<250	<13
	CTMW-04D-20170602	06/02/17	PME3	<50	<5.0	**110**	**49**	<2.5	<2.5	**22,000**	<5.0	<5.0	<80	<5.0	**22**	**5.8 J**	<5.0	<5.0	<5.0	**50**	<10 L	<25
	CTMW-04D-20170621	06/21/17	PME4	<50	<5.0	**80**	**40**	<2.5	<2.5	**18,000**	<5.0	<5.0	<80	<5.0	**11**	<5.0	<5.0	<5.0	<5.0	**32**	<10 L	<25
	CTMW-04D-20170718	07/18/17	PME5	<25	<2.5	**120**	**51**	<1.3	<1.3	**23,000**	<2.5	<2.5	<40	<2.5	**14**	**4.8 J**	**3.4 J**	<2.5	<2.5	**42**	<5.0 L	<13
	CTMW-04D-20170823	08/23/17	PME6	<25	<2.5	**93**	**41**	<1.3	<1.3	**18,000**	<2.5	<2.5	**100**	<2.5	**14**	**4.5 J**	**5.6 J**	<2.5	<2.5	**34**	<5.0	<13
	CTMW-04D-20170823-FD	08/23/17	PME6	<25	<2.5	**90**	**40**	<1.3	<1.3	**17,000**	<2.5	<2.5	**100**	<2.5	**21**	**4.7 J**	**5.1 J**	<2.5	<2.5	**32**	<5.0 L	<13
	CTMW-04D-20170920	09/20/17	PME7	<25	<2.5	**110**	**40**	<1.3	<1.3	**17,000**	<2.5	<2.5	**90 J B**	<2.5	**11**	**4.8 J**	**5.2 J**	<2.5	<2.5	**43**	<5.0 L	<13
	CTMW-04D-20171003	10/03/17	PME8	**55**	<2.5	**110**	**40**	<1.3	<1.3	**17,000**	<2.5	**8.6 J**	<40	<2.5	**9.4**	**4.0 J**	**3.2 J**	<2.5	<2.5	**45**	<5.0	**19 J**
CTMW-05S	CTMW-05S-20170621	06/21/17	PME4	<50	<5.0	**88**	**50**	<2.5	<2.5	**4,900**	<5.0	<5.0	<80	<5.0	**190**	<5.0	<5.0	<5.0	<5.0	**170**	<10	<25
	CTMW-05S-20170717	07/17/17	PME5	<25	<2.5	**130**	**54**	<1.3	<1.3	**3,000**	<2.5	<2.5	<40	<2.5	**260**	**5.5 J**	<2.5	<2.5	<2.5	**250**	<5.0 L	<13
	CTMW-05S-20170822	08/22/17	PME6	**120**	<0.50	**110**	**56**	<0.25	<0.25	**3,200**	**1.2**	**1.9 J**	**80**	<0.50	**210**	**4.1**	**4.1**	<0.50	<0.50	**160**	<1.0	**5.5 J**
	CTMW-05S-20170919	09/19/17	PME7	<10	<1.0	**140**	**53**	<0.50	<1.3	**2,100**	**1.3 J**	**2.8 J**	<16	<1.0	**230**	**4.9**	**4.2**	<1.0	<1.0	**170**	<10	**9.3 J**
	CTMW-05S-20171004	10/04/17	PME8	**530**	<0.50	**110**	**49**	<0.25	<0.25	**6,500**	**0.52 J**	**85**	**17 J**	**8.0**	**190**	**2.6**	**3.3**	<0.50	<0.50	**110**	**20**	**74**
CTMW-05D	CTMW-05D-20170621	06/21/17	PME4	<50	<5.0	**85**	**34**	<2.5	<2.5	**14,000**	<5.0	<5.0	<80	<5.0	**16**	<5.0	<5.0	<5.0	<5.0	**40**	<10	<25
	CTMW-05D-20170621-FD	06/21/17	PME4	<50	<5.0	**94**	**33**	<2.5	<2.5	**14,000**	<5.0	<5.0	<80	<5.0	**19**	<5.0	**18 J**	<5.0	<5.0	**37**	<10 L	<25
	CTMW-05D-20170718	07/18/17	PME5	<25 F1	<2.5 F1	**130**	**46**	<1.3	<1.3	**19,000**	<2.5 F1	<2.5	<40	<2.5	**21**	**3.5 J**	**6.1 J**	<2.5	<2.5	**57 F1**	<5.0 L F1	<13 F1
	CTMW-05D-20170822	08/22/17	PME6	**92 J**	<5.0	**110**	**34**	<2.5	<2.5	**14,000**	<5.0	<5.0	**130 J**	<5.0	**12**	**5.2 J**	**6.6 J**	<5.0	<5.0	**52**	<10	<25
	CTMW-05D-20170919	09/19/17	PME7	<25	<2.5	**120**	**36**	<1.3	<5.0	**14,000**	<2.5	<2.5	<40	<2.5	**21**	**3.9 J**	**5.6 J**	<2.5	<2.5	**56**	<100	<13
	CTMW-05D-20171004	10/04/17	PME8	<25	**3.6 J**	**110**	**34**	<1.3	<1.3	**13,000**	<2.5	**16 F1**	<40	<2.5	**17**	<2.5	**5.2 J**	<2.5	<2.5	**60**	**21**	**25 J F2 F1**
CTMW-06S	CTMW-06S-20170621	06/21/17	PME4	**56 J B**	<5.0	**190**	**210**	<2.5	<2.5	**160**	<5.0	<5.0	**110 J**	<5.0	**1,600**	**15 J**	**8.3 J**	<5.0	<5.0	**450**	<10	<25
	CTMW-06S-20170717	07/17/17	PME5	<25	**4.0 J**	**660**	**1,100**	<1.3	<1.3	**120**	**3.1 J**	<2.5	<40	<2.5	**4,300**	**34**	<2.5	<2.5	<2.5	**370**	**11**	<13
	CTMW-06S-20170822	08/22/17	PME6	**58**	**1.6 J**	**120**	**1,400**	<0.25	<0.25	**62**	**3.9**	**1.7 J**	**410**	<0.50	**4,700**	**11**	**1.2 J**	<0.50	<0.50	**19**	**2.7**	**5.9 J**
	CTMW-06S-20170919	09/19/17	PME7	**43**	**1.9 J**	**190**	**1,200**	<0.50	<0.50	**53**	**1.3 J**	**2.9 J**	**210 B**	<1.0	**5,400**	**8.2**	**1.1 J**	<1.0	<1.0	**1.4 J**	**2.0 J**	**16 J**
	CTMW-06S-20171004	10/04/17	PME8	**7.2 J**	**2.1**	**210**	**920**	<0.25	<0.25	**47**	<0.50	<0.50	**100**	<0.50	**5,600**	**4.1**	**0.82 J**	<0.50	<0.50	**1.3**	**1.4 J**	**3.3 J**
CTMW-06D	CTMW-06D-20170622	06/22/17	PME4	<10	<1.0	**74**	**37**	<0.50	<0.50	**18,000**	<1.0	**1.9 J**	**96 J B**	<1.0	**50**	**3.6 J**	**3.4 J**	<1.0	<1.0	**74**	<10 L	**7.2 J B**
	CTMW-06D-20170717	07/17/17	PME5	<25	<2.5	**110**	**46**	<1.3	<1.3	**22,000**	<2.5	<2.5	<40	<2.5	**61**	**4.7 J**	**2.9 J**	<2.5	<2.5	**110**	<5.0 L	<13
	CTMW-06D-20170717-FD	07/17/17	PME5	<25	<2.5	**110**	**46**	<1.3	<1.3	**23,000**	<2.5	**3.8 J**	<40	<2.5	**55**	**5.4 J**	**3.8 J**	<2.5	<2.5	**110**	<5.0 L	<13
	CMTW-06D-20170822	08/22/17	PME6	<50 F1	<5.0	**90**	**40**	<2.5	<2.5	**15,000**	<5.0	<5.0	<80	<5.0	**92**	**8.0 J**	**7.4 J**	<5.0	<5.0	**130**	<10	<25
	CMTW-06D-20170919	09/19/17	PME7	<25 F1 F2	<2.5	**99**	**46**	<1.3	<5.0	**13,000**	<2.5	<2.5	<40	<2.5	**140**	**5.8 J**	**11**	**36 F1 B**	<2.5	**160**	<100	<13
	CTMW-06D-20170919-FD	09/19/17	PME7	<25	<2.5	**100**	**46**	<1.3	<5.0	**13,000**	<2.5	<2.5	<40	<2.5	**140**	**5.7 J**	**5.1 J**	<2.5	<2.5	**160**	<100	<13
	CTMW-06D-20171004	10/04/17	PME8	<25	<2.5	**110**	**64**	<1.3	<1.3	**12,000**	<2.5	<2.5	<40	<2.5	**180**	**2.7 J**	**4.1 J**	<2.5	<2.5	**170**	**19**	<13
	CTMW-06D-20171004-FD	10/04/17	PME8	**35 J**	<2.5	**120**	**64**	<1.3	<1.3	**12,000**	<2.5	<2.5	<40	<2.5	**180**	**2.6 J**	**4.3 J**	<2.5	<2.5	**180**	**20**	<13

Notes:

USEPA	United States Environmental Protection Agency
ug/L	Microgram per liter
B	Compound was found in the blank and the sample
<	Denotes concentration is less than the laboratory method detection limit indicated
J	Denotes concentration is less than the laboratory reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value
F1	MS and / or MSD Recovery is outside acceptance limits
F2	MS/MSD RPD exceeds control limits
L	Denotes a negative instrument reading had an absolute value greater than the reporting limit
–	Not Analyzed

Table G-3 - Summary of Groundwater Analytical Results-Biological Field Study

Central Retention Basin

Well Location	Sample ID	Sample Date	Week	VOCs by USEPA Method 8260B (ug/L)															
				Acetone	Benzene	Bromodichloro methane	Bromoform	2-Butanone (MEK)	Carbon Tetrachloride	Chloroform	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Hexachloro-butadiene	Methylene Chloride	Methyl-t-Butyl Ether (MTBE)	Tetrachloro-ethene	1,2,3-Trichlorobenzene	Trichloro-ethene
CTMW-01S	CTMW-01S-20170404	04/04/17	Baseline	<100	<2.5	<2.5	<4.0	<25	<2.5	**850**	<2.5	<2.5	<2.5	<2.5	<8.8	<2.5	<2.5	<4.0	<2.5
	CTMW-01S-20170503	05/03/17	PME1	**2,800**	<2.5	<2.5	<4.0	**360**	<2.5	**420**	<2.5	<2.5	<2.5	<2.5	<8.8	<2.5	<2.5	<4.0	<2.5
	CTMW-01S-20170516	05/16/17	PME2	<1,000	<25	<25	<40	**1,200**	<25	**340**	<25	<25	<25	<25	<88	<25	<25	<40	<25
	CTMW-01S-20170531	05/31/17	PME3	<250	<6.3	<6.3	<10	**1,300**	<6.3	**230**	<6.3	<6.3	<6.3	<6.3	**45 J,B**	<6.3	<6.3	<10	<6.3
	CTMW-01S-20170619	06/19/17	PME4	**300 J**	<6.3	<6.3	<10	**3,500**	<6.3	**140**	<6.3	<6.3	<6.3	<6.3	**27 J**	<6.3	<6.3	<10	<6.3
	CTMW-01S-20170720	07/20/17	PME5	<400	<10	<10	<16	**2,400**	<10	**130**	<10	<10	<10	<10	<35	<10	<10	<16	<10
	CTMW-01S-20170824	08/24/17	PME6	**630 J**	<13	<13	<20	**6,400**	<13	**86**	<13	<13	<13	<13	**78 J**	<13	<13	<20	<13
	CTMW-01S-20170920	09/20/17	PME7	**750 J**	<13	<13	<20	**7,200**	<13	**19 J**	<13	<13	<13	<13	<44	<13	<13	<20	<13
	CTMW-01S-20171003	10/03/17	PME8	<1,000	<25	<25	<40	**11,000**	<25	<25	<25	<25	<25	<25	**140 J**	<25	<25	<40	<25
CTMW-01D	CTMW-01D-20170403	04/03/17	Baseline	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,800**	<5.0	<5.0	<5.0	<5.0	<18	<5.0	<5.0	<8.0	<5.0
	CTMW-01D-20170503	05/03/17	PME1	<250	<6.3	<6.3	<10	<63	<6.3	**1,700**	<6.3	<6.3	<6.3	<6.3	<22	<6.3	<6.3	<10	<6.3
	CTMW-01D-20170516	05/16/17	PME2	<400	<10	<10	<16	<100	<10	**1,700**	<10	<10	<10	<10	<35	<10	<10	<16	<10
	CTMW-01D-20170531	05/31/17	PME3	<250	<6.3	<6.3	<10	<63	<6.3	**1,800**	<6.3	<6.3	<6.3	<6.3	<22	<6.3	<6.3	<10	<6.3
	CTMW-01D-20170619	06/19/17	PME4	<250	<6.3	<6.3	<10	<63	<6.3	**1,600**	<6.3	<6.3	<6.3	<6.3	<22	<6.3	<6.3	<10	<6.3
	CTMW-01D-20170720	07/20/17	PME5	<250	<6.3	<6.3	<10	<63	<6.3	**1,700**	<6.3	<6.3	<6.3	<6.3	<22	<6.3	<6.3	<10	<6.3
	CTMW-01D-20170720-FD	07/20/17	PME5	<250	<6.3	<6.3	<10	<63	<6.3	**1,700**	<6.3	<6.3	<6.3	<6.3	<22	<6.3	<6.3	<10	<6.3
	CTMW-01D-20170824	08/24/17	PME6	**320 J**	<5.0	<5.0	<8.0	**150**	<5.0	**1,500**	<5.0	<5.0	<5.0	<5.0	<18	<5.0	<5.0	<8.0	<5.0
	CTMW-01D-20170920	09/20/17	PME7	**440**	<5.0	<5.0	<8.0	**360**	<5.0	**1,500**	<5.0	<5.0	<5.0	<5.0	<18	<5.0	<5.0	<8.0	<5.0
	CTMW-01D-20171003	10/03/17	PME8	**560 J**	<10	<10	<16	**440**	<10	**1,300**	<10	<10	<10	<10	<35	<10	<10	<16	<10
CTMW-02S	CTMW-02S-20170405	04/05/17	Baseline	<250	<6.3	<6.3	<10	<63	<6.3	**950**	<6.3	<6.3	<6.3	<6.3	<22	<6.3	<6.3	<10	<6.3
	CTMW-02S-20170504	05/04/17	PME1	**420**	**0.37 J**	<2.5	<0.40	**38**	<0.25	**620**	<0.25	<0.25	<0.25	<0.25	<0.88	**0.87**	**0.28 J**	**0.57 J**	**1.2**
	CTMW-02S-20170516	05/16/17	PME2	<100	<2.5	<2.5	<4.0	<25	<2.5	**420**	<2.5	<2.5	<2.5	<2.5	<8.8	<2.5	<2.5	<4.0	<2.5
	CTMW-02S-20170601	06/01/17	PME3	**47 J**	<0.63	<0.63	<1.0	<6.3	<0.63	**520**	<0.63	<0.63	<0.63	<0.63	**4.3 J,B**	<0.63	<0.63	<1.0	<0.63
	CTMW-02S-20170620	06/20/17	PME4	**260**	**1.0 J**	<0.63	<1.0	**2,000**	<0.63	**210**	<0.63	<0.63	<0.63	<0.63	**24**	<0.63	<0.63	**3.0**	<0.63
	CTMW-02S-20170719	07/19/17	PME5	<250	<6.3	<6.3	<10	**1,600**	<6.3	**180**	<6.3	<6.3	<6.3	<6.3	**41 J**	<6.3	<6.3	<10	<6.3
	Not Analyzed	08/24/17	PME6	**Well Dry; Unable to sample**															
	CTMW-02S-20170920	09/20/17	PME7	<250	<6.3	<6.3	<10	**1,500**	<6.3	**78**	<6.3	<6.3	<6.3	<6.3	**25 J**	<6.3	<6.3	<10	<6.3
	CTMW-02S-20171003	10/03/17	PME8	<200	<5.0	<5.0	<8.0	**1,200**	<5.0	**13**	<5.0	<5.0	<5.0	<5.0	**27 J**	<5.0	<5.0	<8.0	<5.0
CTMW-02D	CTMW-02D-20170404	04/04/17	Baseline	<250	<6.3	<6.3	<10	<63	<6.3	**1,500**	**9.4 J**	<6.3	<6.3	<6.3	<22	<6.3	<6.3	<10	<6.3
	CTMW-02D-20170404-FD	04/04/17	Baseline	<250	<6.3	<6.3	<10	<63	<6.3	**1,500**	**9.4 J**	<6.3	<6.3	<6.3	<22	<6.3	<6.3	<10	<6.3
	CTMW-02D-20170503	05/03/17	PME1	<250	<6.3	<6.3	<10	<63	<6.3	**1,500**	**13**	<6.3	**6.5 J**	<6.3	<22	<6.3	<6.3	<10	<6.3
	CTMW-02D-20170503-FD	05/03/17	PME1	<250	<6.3	<6.3	<10	<63	<6.3	**1,500**	**14**	<6.3	<6.3	<6.3	<22	<6.3	<6.3	<10	<6.3
	CTMW-02D-20170517	05/17/17	PME2	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,300**	**17**	<5.0	**6.7 J**	<5.0	**29 J**	<5.0	<5.0	<8.0	<5.0
	CTMW-02D-20170601	06/01/17	PME3	<400	<10	<10	<16	<100	<10	**1,900**	**19 J**	<10	<10	<10	**38 J**	<10	<10	<16	<10
	CTMW-02D-20170601-FD	06/01/17	PME3	<400	<10	<10	<16	<100	<10	**1,800**	**15**	<10	**7.2 J**	<10	**22 J**	<10	<10	<16	<10
	CTMW-02D-20170619	06/19/17	PME4	<400	<10	<10	<16	<100	<10	**1,500**	**16 J**	<10	<10	<10	<35	<10	<10	<16	<10
	CTMW-02D-20170619-FD	06/19/17	PME4	<200	<5.0	<5.0	<8.0	**82 J**	<5.0	**1,600**	**16**	<5.0	**7.9 J**	<5.0	<18	<5.0	<5.0	<8.0	<5.0
	CTMW-02D-20170719	07/19/17	PME5	<250	<6.3	<6.3	<10	**290**	<6.3	**1,600**	**12 J**	<6.3	<6.3	<6.3	<22	<6.3	<6.3	<10	<6.3
	CTMW-02D-20170824	08/24/17	PME6	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,400**	**18**	<5.0	<5.0	<5.0	<18	<5.0	<5.0	<8.0	<5.0
	CTMW-02D-20170920	09/20/17	PME7	<100	<2.5	<2.5	<4.0	<25	<2.5	**1,500**	**15**	<2.5	**6.4**	<5.0	<8.8	<2.5	<4.0	<4.0	<2.5
	CTMW-02D-20171003	10/03/17	PME8	<400	<10	<10	<16	<100	<10	**1,500**	**22**	<10	**10 J**	<10	<35	<10	<10	<16	<10
CTMW-03S	CTMW-03S-20170405	04/05/17	Baseline	<200	<5.0	<5.0	<8.0	<50	<5.0	**930**	<5.0	<5.0	<5.0	<5.0	**21 J**	<5.0	<5.0	<8.0	<5.0
	CTMW-03S-20170505	05/05/17	PME1	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,100**	<5.0	<5.0	<5.0	<5.0	**18 J**	<5.0	<5.0	<8.0	<5.0
	CTMW-03S-20170517	05/17/17	PME2	<100	<2.5	<2.5	<4.0	<25	<2.5	**970**	<2.5	<2.5	<2.5	<2.5	**17 J**	<2.5	<2.5	<4.0	<2.5
	CTMW-03S-20170601	06/01/17	PME3	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,200**	<5.0	<5.0	<5.0	<5.0	**18 J**	<5.0	<5.0	<8.0	<5.0
	CTMW-03S-20170620	06/20/17	PME4	**250**	<2.5	<2.5	<4.0	**690**	<2.5	**920**	<2.5	<2.5	<2.5	<2.5	**16 J**	<2.5	<2.5	<4.0	<2.5
	CTMW-03S-20170718	07/18/17	PME5	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,300**	<5.0	<5.0	<5.0	<5.0	<18	<5.0	<5.0	<8.0	<5.0
	CTMW-03S-20170823	08/23/17	PME6	<100	<2.5	<2.5	<4.0	**280**	<2.5	**900**	<2.5	<2.5	<2.5	<2.5	**19 J**	<2.5	<2.5	<4.0	<2.5
	CTMW-03S-20170921	09/21/17	PME7	<50	<1.3	<1.3	<2.0	<13	<1.3	**510**	<1.3	<1.3	<1.3	<1.3	<4.4	<1.3	<1.3	<2.0	<1.3
	CTMW-03S-20171003	10/03/17	PME8	<200	<5.0	<5.0	<8.0	<50	<5.0	**700**	<5.0	<5.0	<5.0	<5.0	<18	<5.0	<5.0	<8.0	<5.0

Notes:

USEPA	United States Environmental Protection Agency
ug/L	Microgram per liter
B	Compound was found in the blank and the sample
<	Denotes concentration is less than the laboratory method detection limit indicated
J	Denotes concentration is less than the laboratory reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value
F1	MS and / or MSD Recovery is outside acceptance limits
F2	MS/MSD RPD exceeds control limits
L	Denotes a negative instrument reading had an absolute value greater than the reporting limit
–	Not Analyzed

Table G-3 - Summary of Groundwater Analytical Results-Biological Field Study

Central Retention Basin

Well Location	Sample ID	Sample Date	Week	VOCs by USEPA Method 8260B (ug/L)															
				Acetone	Benzene	Bromodichloro methane	Bromoform	2-Butanone (MEK)	Carbon Tetrachloride	Chloroform	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Hexachloro-butadiene	Methylene Chloride	Methyl-t-Butyl Ether (MTBE)	Tetrachloro-ethene	1,2,3-Trichlorobenzene	Trichloro-ethene
CTMW-03D	CTMW-03D-20170406	04/06/17	Baseline	<250	<6.3	<6.3	<10	<63	<6.3	**880**	<6.3	<6.3	<6.3	<6.3	<22	<6.3	<6.3	<10	<6.3
	CTMW-03D-20170505	05/05/17	PME1	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,300**	<5.0	<5.0	<5.0	<5.0	**19 J**	<5.0	<5.0	<8.0	<5.0
	CTMW-03D-20170517	05/17/17	PME2	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,100**	<5.0	<5.0	<5.0	<5.0	**26 J**	<5.0	<5.0	<8.0	<5.0
	CTMW-03D-20170601	06/01/17	PME3	<100	<2.5	<2.5	<4.0	<25	<2.5	**1,400**	<2.5	<2.5	<2.5	<2.5	**11 J**	<2.5	<2.5	<4.0	**2.5 J**
	CTMW-03D-20170620	06/20/17	PME4	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,200**	<5.0	<5.0	<5.0	<5.0	**29 J**	<5.0	<5.0	<8.0	<5.0
	CTMW-03D-20170720	07/20/17	PME5	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,300**	<5.0	<5.0	<5.0	<5.0	<18	<5.0	<5.0	<8.0	<5.0
	CTMW-03D-20170823	08/23/17	PME6	<50	<1.3	<1.3	<2.0	<13	<1.3	**1,100**	<1.3	<1.3	<1.3	<1.3	<4.4	<1.3	<1.3	<2.0	**3.0**
	CTMW-03D-20170921	09/21/17	PME7	<10	<0.25	<0.25	<0.40	<2.5	**0.58**	**1,100**	<0.25	<0.25	<0.25	<0.25	<0.88	**1.2**	**0.37 J**	<0.40	**2.9**
	CTMW-03D-20171003	10/03/17	PME8	<400	<10	<10	<16	<100	<10	**1,000**	<10	<10	<10	<10	<35	<10	<10	<16	<10
CTMW-04S	CTMW-04S-20170405	04/05/17	Baseline	<10	<0.25	<0.25	**0.82 J**	<2.5	**0.41 J**	**720**	<0.25	<0.25	<0.25	**0.58**	<0.88	**0.86**	**0.26 J**	<0.40	**2.0**
	CTMW-04S-20170504	05/04/17	PME1	**220**	<2.5	<2.5	<4.0	<25	<2.5	**810**	<2.5	<2.5	<2.5	<2.5	<8.8	<2.5	<2.5	<4.0	<2.5
	CTMW-04S-20170517	05/17/17	PME2	**1,800**	<2.5	<2.5	<4.0	**1,000**	<2.5	**640**	<2.5	<2.5	<2.5	<2.5	<8.8	<2.5	<2.5	<4.0	<2.5
	CTMW-04S-20170602	06/02/17	PME3	**860**	<2.5	<2.5	<4.0	**370**	<2.5	**610**	<2.5	<2.5	<2.5	<2.5	**9.7 J**	<2.5	<2.5	<4.0	<2.5
	CTMW-04S-20170620	06/20/17	PME4	**1,900**	**0.46 J**	<0.25	<0.40	**670**	<0.25	**590**	<0.25	<0.25	<0.25	**0.36 J**	**2.6**	**0.81**	<0.25	<0.40	**0.92**
	CTMW-04S-20170718	07/18/17	PME5	**920**	<2.5	<2.5	<4.0	**650**	<2.5	**620**	<2.5	<2.5	<2.5	<2.5	**15 J**	<2.5	<2.5	<4.0	<2.5
	CTMW-04S-20170823	08/23/17	PME6	**1,200**	<1.3	<1.3	<2.0	**1,300**	<1.3	**520**	<1.3	<1.3	<1.3	<1.3	**24**	<1.3	<1.3	<2.0	<1.3
	CTMW-04S-20170921	09/21/17	PME7	**770**	<0.25	<0.25	<0.40	**1,900**	<0.25	**67**	<0.25	<0.25	<0.25	<0.25	**1.7 J**	**0.49 J**	<0.25	<0.40	<0.25
	CTMW-04S-20171003	10/03/17	PME8	**89**	<0.25	<0.25	<0.40	**140**	<0.25	**48**	<0.25	<0.25	<0.25	<0.25	**4.3**	**0.89**	<0.25	<0.40	<0.25
CTMW-04D	CTMW-04D-20170405	04/05/17	Baseline	<50	<1.3	<1.3	<2.0	<13	<1.3	**1,600**	**5.1**	<1.3	**3.7**	<1.3	<4.4	<1.3	<1.3	<2.0	<1.3
	CTMW-04D-20170504	05/04/17	PME1	<10	<0.25	<0.25	**0.81 J**	<2.5	**0.46 J**	**1,400**	**2.8**	**0.34 J**	**1.9**	<0.25	<0.88	**0.85**	**0.36 J**	<0.40	**1.1**
	CTMW-04D-20170517	05/17/17	PME2	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,600**	<5.0	<5.0	<5.0	<5.0	<18	<5.0	<5.0	<8.0	<5.0
	CTMW-04D-20170517-FD	05/17/17	PME2	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,600**	<5.0	<5.0	<5.0	<5.0	<18	<5.0	<5.0	<8.0	<5.0
	CTMW-04D-20170602	06/02/17	PME3	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,600**	<5.0	<5.0	<5.0	<5.0	**24 J**	<5.0	<5.0	<8.0	<5.0
	CTMW-04D-20170621	06/21/17	PME4	<250	<6.3	<6.3	<10	<63	<6.3	**1,600**	<6.3	<6.3	<6.3	<6.3	**34 J**	<6.3	<6.3	<10	<6.3
	CTMW-04D-20170718	07/18/17	PME5	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,700**	<5.0	<5.0	<5.0	<5.0	<18	<5.0	<5.0	<8.0	<5.0
	CTMW-04D-20170823	08/23/17	PME6	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,700**	<5.0	<5.0	<5.0	<5.0	**24 J**	<5.0	<5.0	<8.0	<5.0
	CTMW-04D-20170823-FD	08/23/17	PME6	<200	<5.0	<5.0	<5.0	<50	<5.0	**1,700**	<5.0	<5.0	<5.0	<5.0	**27 J**	<5.0	<5.0	<8.0	<5.0
	CTMW-04D-20170920	09/20/17	PME7	<200	<5.0	<5.0	<5.0	<50	<5.0	**1,400**	<5.0	<5.0	<5.0	<5.0	<18	<5.0	<5.0	<8.0	<5.0
	CTMW-04D-20171003	10/03/17	PME8	<400	<10	<10	<16	<100	<10	**1,300**	<10	<10	<10	<10	<35	<10	<10	<16	<10
CTMW-05S	CTMW-05S-20170621	06/21/17	PME4	<100	<2.5	<2.5	<4.0	<25	<2.5	**960**	<2.5	<2.5	<2.5	<2.5	**14 J**	<2.5	<2.5	<4.0	<2.5
	CTMW-05S-20170717	07/17/17	PME5	<100	<2.5	<2.5	<4.0	<25	<2.5	**1,100**	<2.5	<2.5	<2.5	<2.5	<8.8	<2.5	<2.5	<4.0	<2.5
	CTMW-05S-20170822	08/22/17	PME6	<100	<2.5	<2.5	<4.0	<25	<2.5	**750**	<2.5	<2.5	<2.5	<2.5	<8.8	<2.5	<2.5	<4.0	<2.5
	CTMW-05S-20170919	09/19/17	PME7	<50	<1.3	<1.3	<1.3	<1.3	<1.3	**410**	<1.3	<1.3	<1.3	<1.3	<4.4	<1.3	<1.3	<2.0	<1.3
	CTMW-05S-20171004	10/04/17	PME8	<100	<2.5	<2.5	<4.0	<25	<2.5	**630**	<2.5	<2.5	<2.5	<2.5	<8.8	<2.5	<2.5	<4.0	<2.5
CTMW-05D	CTMW-05D-20170621	06/21/17	PME4	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,300**	<5.0	<5.0	<5.0	<5.0	**30 J**	<5.0	<5.0	<8.0	<5.0
	CTMW-05D-20170621-FD	06/21/17	PME4	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,300**	<5.0	<5.0	<5.0	<5.0	**35 J**	<5.0	<5.0	<8.0	<5.0
	CTMW-05D-20170718	07/18/17	PME5	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,300**	<5.0	<5.0	<5.0	<5.0	<18	<5.0	<5.0	<8.0	<5.0
	CTMW-05D-20170822	08/22/17	PME6	<250	<6.3	<6.3	<10	<63	<6.3	**1,200**	<6.3	<6.3	<6.3	<6.3	<22	<6.3	<6.3	<10	<6.3
	CTMW-05D-20170919	09/19/17	PME7	<100	<2.5	<2.5	<4.0	<25	<2.5	**630**	<2.5	<2.5	<2.5	<2.5	<8.8	<2.5	<2.5	<4.0	<2.5
	CTMW-05D-20171004	10/04/17	PME8	<250	<6.3	<6.3	<10	<63	<6.3	**1,000**	<6.3	<6.3	<6.3	<6.3	<22	<6.3	<6.3	<10	<6.3
CTMW-06S	CTMW-06S-20170621	06/21/17	PME4	**1,700**	<2.5	<2.5	<4.0	**730**	<2.5	**670**	<2.5	<2.5	<2.5	<2.5	**18 J**	<2.5	<2.5	<4.0	<2.5
	CTMW-06S-20170717	07/17/17	PME5	**1,400**	<10	<10	<16	**2,800**	<10	**610**	<10	<10	<10	<10	<35	<10	<10	<16	<10
	CTMW-06S-20170822	08/22/17	PME6	**1,400**	<5.0	<5.0	<8.0	**3,200**	<5.0	**320**	<5.0	<5.0	<5.0	<5.0	**30 J**	<5.0	<5.0	<8.0	<5.0
	CTMW-06S-20170919	09/19/17	PME7	**780**	<5.0	<5.0	<8.0	**3,700**	<5.0	**170**	<5.0	<5.0	<5.0	<5.0	**41**	<5.0	<5.0	<8.0	<5.0
	CTMW-06S-20171004	10/04/17	PME8	**620**	**2.6 J**	<2.5	<4.0	**4,000**	<2.5	**120**	<2.5	<2.5	<2.5	<2.5	**13 J**	<2.5	<2.5	<4.0	<2.5
CTMW-06D	CTMW-06D-20170622	06/22/17	PME4	<400	<10	<10	<16	<100	<10	**1,500**	<10	<10	<10	<10	<35	<10	<10	<16	<10
	CTMW-06D-20170717	07/17/17	PME5	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,700**	<5.0	<5.0	<5.0	<5.0	<18	<5.0	<5.0	<8.0	<5.0
	CTMW-06D-20170717-FD	07/17/17	PME5	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,700**	<5.0	<5.0	<5.0	<5.0	<18	<5.0	<5.0	<8.0	<5.0
	CMTW-06D-20170822	08/22/17	PME6	<250	<6.3	<6.3	<10	<6.3	<63	**1,400**	<6.3	<6.3	<6.3	<6.3	<22	<6.3	<6.3	<10	<6.3
	CMTW-06D-20170919	09/19/17	PME7	<200	<5.0	<5.0	<8.0	<50	<5.0	**1,200**	<5.0	<5.0	<5.0	<5.0	<18	<5.0	<5.0	<8.0	<5.0
	CTMW-06D-20170919-FD	09/19/17	PME7	**250**	<0.25	**0.27 J**	<0.40	**150**	**0.54**	**1,000**	**3.6**	**0.32 J**	**1.0**	**0.45 J**	**1.1 J**	**0.68**	**0.44 J**	**0.72 J**	**1.0**
	CTMW-06D-20171004	10/04/17	PME8	<250	<6.3	<6.3	<10	<63	<6.3	**1,200**	<6.3	<6.3	<6.3	<6.3	<22	<6.3	<6.3	<10	<6.3
	CTMW-06D-20171004-FD	10/04/17	PME8	<250	<6.3	<6.3	<10	<63	<6.3	**1,200**	<6.3	<6.3	<6.3	<6.3	<22	<6.3	<6.3	<10	<6.3

Notes:

USEPA	United States Environmental Protection Agency
ug/L	Microgram per liter
B	Compound was found in the blank and the sample
<	Denotes concentration is less than the laboratory method detection limit indicated
J	Denotes concentration is less than the laboratory reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value
F1	MS and / or MSD Recovery is outside acceptance limits
F2	MS/MSD RPD exceeds control limits
L	Denotes a negative instrument reading had an absolute value greater than the reporting limit
–	Not Analyzed

TETRA TECH

Chemical Reduction Study

Table G-4 - Summary of Groundwater Analytical Results-Chemical Field Study

AP Area

Well ID	Sample ID	Sample Date	Perchlorate by USEPA Method 314.0 (mg/L)	Hexavalent Chromium by USEPA Method 7199 (mg/L)	Total Metals by USEPA Method 6010B (mg/L)		Disinfection By-Products by USEPA Method 300.1B (mg/L)		Nitrate as N by USEPA Method 300.0 (mg/L)	General Chemistry (mg/L)	
					Chromium	Manganese	Chlorate	Chlorite		Total Dissolved Solids (TDS)	Total Sulfide
UFMW-01S	UFMW-01S-20160809	08/09/16	950	<0.000025	0.035	--	--	--	--	--	--
	UFMW-01S-20170817	08/17/17	92	0.00075	0.0053	--	1.2	<0.1	72	3,200	<0.027
	Not Sampled	10/06/17	Well is dry								
UFMW-01I	UFMW-01I-20160809	08/09/16	920	0.019	0.021	--	--	--	--	--	--
	UFMW-01I-20160809-FD	08/09/16	1,100	0.020	0.021	--	--	--	--	--	--
	UFMW-01I-20170816	08/16/17	150	0.000078	<0.0025	--	1.8	<0.05	23	2,400	<0.027
	UFMW-01I-20171006	10/06/17	160	<0.00008 J	--	--	2.0	<0.5	25	2,300	<0.027
UFMW-01D	UFMW-01D-20160809	08/09/16	1,700	0.015	0.013	--	--	--	--	--	--
	UFMW-01D-20170816	08/16/17	560	0.016	0.018	--	6.1	<0.05	67	4,000	<0.027
	UFMW-01D-20171005	10/05/17	530	0.021	--	--	6.2	<0.2	56	3,300	<0.050
UFMW-02S	UFMW-02S-20160810	08/10/16	1,200	<0.000025	0.18	--	--	--	--	--	--
	Not Sampled	08/17/17	Less Than 1" of Water Observed in Well; Unable to Sample.								
	Not Sampled	10/06/17	Well is dry								
UFMW-02I	UFMW-02I-20160810	08/10/16	1,900	0.018	0.018	--	--	--	--	--	--
	UFMW-02I-20170817	08/17/17	430	0.0052	0.0059	--	3.5	<0.1	54	3,200	<0.027
	UFMW-02I-20171006	10/06/17	370	0.0042	--	--	2.9	<0.5	43	3,000	<0.027
UFMW-02D	UFMW-02D-20160810	08/10/16	2,900	0.012	0.014	--	--	--	--	--	--
	UFMW-02D-20170817	08/17/17	980	0.013	0.015	--	6.2	<0.05	82	4,200	<0.027
	UFMW-02D-20171006	10/06/17	950	0.013	--	--	6.8	<0.5	80	4,500	<0.027
UFMW-03S	Not Sampled	08/08/16	Well is dry								
	Not Sampled	08/15/17	Well is dry								
	Not Sampled	10/06/17	Well is dry								
UFMW-03I	UFMW-03I-20160808	08/08/16	1,400	0.018	0.018	--	--	--	--	--	--
	UFMW-03I-20170817	08/17/17	160	0.0013 J	0.0033 J	--	2.2	<0.05	27	2,900	<0.027
	UFMW-03I-20170817-FD	08/17/17	160	0.0014 J	0.0043 J	--	2.4	<0.05	27	2,900	<0.027
	UFMW-03I-20171006	10/06/17	230	0.0024	--	--	3.6	<0.5	33	2,900	<0.027
UFMW-03D	UFMW-03D-20160808	08/08/16	2,200	0.029	0.033	--	--	--	--	--	--
	UFMW-3D-20170817	08/17/17	610	0.011	0.0140	--	4.9	<0.05	45	3,400	<0.027
	UFMW-03D-20171006	10/06/17	480	0.0083	--	--	4.6	<0.5	40	2,900	<0.027

Notes:

USEPA	United States Environmental Protection Agency
mg/L	Milligram per liter
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
F1	MS and/or MSD Recovery is outside acceptance limits.
H	Compound was found in the blank and sample
c	Matrix Spike and /or Matrix Spike Duplicate recovery is outside acceptance limits.
--	Not Analyzed

TETRA TECH

Table G-4 - Summary of Groundwater Analytical Results-Chemical Field Study

AP Area

Well ID	Sample ID	Sample Date	Perchlorate by USEPA Method 314.0 (mg/L)	Hexavalent Chromium by USEPA Method 7199 (mg/L)	Total Metals by USEPA Method 6010B (mg/L)		Disinfection By-Products by USEPA Method 300.1B (mg/L)		Nitrate as N by USEPA Method 300.0 (mg/L)	General Chemistry (mg/L)	
					Chromium	Manganese	Chlorate	Chlorite		Total Dissolved Solids (TDS)	Total Sulfide
UFMW-04S	UFMW-04S-20160819	08/19/16	220	0.0066	0.037	--	--	--	--	--	--
	UFMW-04S-20170816	08/16/17	130	0.011	0.018	--	0.18	<0.05	55	3,400	<0.027
	UFMW-04S-20171005	10/05/17	21	0.002	--	--	0.86	<0.5	14	3,800	<0.027
UFMW-04I	UFMW-04I-20160818	08/18/16	400	0.026	0.039	--	--	--	--	--	--
	UFMW-04I-20160818-FD	08/18/16	390	0.026	0.044	--	--	--	--	--	--
	UFMW-04I-20170816	08/16/17	240	0.031	0.034	--	10.0	<0.05	22	3,200	<0.027
	UFMW-04I-20171005	10/05/17	31	0.0085	--	--	1.5	<0.5	6.2	3,400	<0.027
UFMW-04D	UFMW-04D-20160818	08/18/16	870	0.027	0.028	--	--	--	--	--	--
	UFMW-4D-20170816	08/16/17	670	0.036	0.038	--	12.0	<0.05	17	3,900	<0.027
	UFMW-04D-20171005	10/05/17	220	0.029	--	--	7.0	<0.5	14	3,800	<0.027
	UFMW-04D-20171005-FD	10/05/17	210	0.029	--	--	7.0	<0.5	18	3,700	<0.027
UFMW-05S	UFMW-05S-20160819	08/19/16	610	<0.000025	0.16 c	--	--	--	--	--	--
	UFMW-05S-20170816	08/16/17	290	0.006	0.021	--	11.0	<0.05	87	4,200	<0.027
	UFMW-05S-20171005	10/05/17	230	0.0011 J	--	--	16.0	<0.5	30	6,300	<0.027
UFMW-05I	UFMW-05I-20160823	08/23/16	610	0.011	0.014	--	--	--	--	--	--
	UFMW-05-20170816	08/16/17	350	0.013	0.018	--	8.7	<0.05	47	3,500	<0.027
	UFMW-05I-20171004	10/04/17	230	0.014	--	--	5.1	<1	30	3,800	<0.027
UFMW-05D	UFMW-05D-20160822	08/22/16	1,400	0.0058	0.0066	--	--	--	--	--	--
	UFMW-5D-20170815	08/15/17	1,400	0.022	0.024	--	11.0	<0.05	35	4,600	<0.027
	UFMW-05D-20171004	10/04/17	630	0.018	--	--	10.0	<1	29	4,700	<0.027
UFMW-06S	UFMW-06S-20160819	08/19/16	730 c	0.028	0.031	--	--	--	--	--	--
	UFMW-06S-20170815	08/15/17	490	0.0045	0.049	--	8.9	<0.05	78	3,600	<0.027
	UFMW-06S-20171005	10/05/17	360	<0.013	--	--	1.2	<0.1	59	4,300	<0.027 F1
UFMW-06I	UFMW-06I-20160822	08/22/16	700	0.027	0.028	--	--	--	--	--	--
	UFMW-06I-20170815	08/15/17	610	0.016	0.017	--	8.7	<0.05	79 H	3,400	<0.027
	UFMW-06I-20170815-DUP	08/15/17	640	0.016 H	0.018	--	8.9	<0.05	77 H	3,400	<0.027
	UFMW-06I-20171004	10/04/17	340	0.0082	--	--	12.0	<1	59	4,300	<0.027
UFMW-06D	UFMW-06D-20160822	08/22/16	1,700	0.016	0.020	--	--	--	--	--	--
	UFMW-06D-20170815	08/15/17	1,300 F1	0.026 H	0.025	--	11.0	<0.1	49 H	3,600	<0.027 F1
	UFMW-06D-20171004	10/04/17	1,300	0.027	--	--	9.9	<1	55	3,700	<0.027

Notes:

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mg/L	Milligram per liter
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
F1	MS and/or MSD Recovery is outside acceptance limits.
H	Compound was found in the blank and sample
c	Matrix Spike and /or Matrix Spike Duplicate recovery is outside acceptance limits.
--	Not Analyzed

Table G-4 - Summary of Groundwater Analytical Results-Chemical Field Study

AP Area

Well ID	Sample ID	Sample Date	Dissolved Metals by USEPA Method 6020 (µg/L)															
			Aluminum	Antimony	Arsenic	Barium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Nickel	Selenium	Thallium	Uranium	Vanadium	Zinc
UFMW-01S	UFMW-01S-20160809	08/09/16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-01S-20170817	08/17/17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Not Sampled	10/06/17	Well is dry															
UFMW-01I	UFMW-01I-20160809	08/09/16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-01I-20160809-FD	08/09/16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-01I-20170816	08/16/17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-01I-20171006	10/06/17	5.9 J, B	<0.50	160	16	0.99 J	<0.50	1.4 J	320	<0.50	10	1.8 J, B	1.8 J	<0.50	28	24	3.7 J
UFMW-01D	UFMW-01D-20160809	08/09/16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-01D-20170816	08/16/17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-01D-20171005	10/05/17	<5.0	<0.50	120	21	18	<0.50	<0.50	<8.0	<0.50	8.9	0.75 J	2.7	0.59 J	39	16	5.7 J
UFMW-02S	UFMW-02S-20160810	08/10/16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Not Sampled	08/17/17	Less Than 1" of Water Observed in Well; Unable to Sample.															
	Not Sampled	10/06/17	Well is dry															
UFMW-02I	UFMW-02I-20160810	08/10/16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-02I-20170817	08/17/17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-02I-20171006	10/06/17	5.7 J B	<0.50	180	15	7.0 B	<0.50	1.7 J	<8.0	<0.50	8.9	2.0 B	1.8 J	<0.50	18	36	6.0 J
UFMW-02D	UFMW-02D-20160810	08/10/16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-02D-20170817	08/17/17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-02D-20171006	10/06/17	<5.0	<0.50	61	25	12 B	<0.50	1.4 J	<8.0	<0.50	7.8	1.9 J, B	2.8	0.80 J	25	14	2.7 J
UFMW-03S	Not Sampled	08/08/16	Well is dry															
	Not Sampled	08/15/17	Well is dry															
	Not Sampled	10/06/17	Well is dry															
UFMW-03I	UFMW-03I-20160808	08/08/16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-03I-20170817	08/17/17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-03I-20170817-FD	08/17/17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-03I-20171006	10/06/17	<5.0	<0.50	150	18	14 B	0.51 J	1.4 J	46	<0.50	33	7.6 B	2.3	<0.50	30	23	2.5 J
UFMW-03D	UFMW-03D-20160808	08/08/16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-3D-20170817	08/17/17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-03D-20171006	10/06/17	5.0 J, B	<0.50	120	18	8.7 B	<0.50	1.5 J	<8.0	<0.50	7.6	1.5 J, B	2.7	1.3	28	17	15 J

Notes:

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mg/L	Milligram per liter
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F1	MS and/or MSD Recovery is outside acceptance limits.
B	Compound was found in the blank and sample
--	Not Analyzed

Table G-4 - Summary of Groundwater Analytical Results-Chemical Field Study

AP Area

Well ID	Sample ID	Sample Date	Dissolved Metals by USEPA Method 6020 (µg/L)															
			Aluminum	Antimony	Arsenic	Barium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Nickel	Selenium	Thallium	Uranium	Vanadium	Zinc
UFMW-04S	UFMW-04S-20160819	08/19/16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-04S-20170816	08/16/17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-04S-20171005	10/05/17	7.1 J, B	1.0 J	180	23	2.1 B	<0.50	2.0	<8.0	<0.50	50	2.7 B	2.1	<0.50	24	40	3.7 J
UFMW-04I	UFMW-04I-20160818	08/18/16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-04I-20160818-FD	08/18/16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-04I-20170816	08/16/17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-04I-20171005	10/05/17	5.7 J, B	<0.50	180	15	7.0 B	<0.50	1.7 J	<8.0	<0.50	8.9	2.0 B	1.8 J	<0.50	18	36	6.0 J
UFMW-04D	UFMW-04D-20160818	08/18/16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-4D-20170816	08/16/17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-04D-20171005	10/05/17	<5.0	<0.50	96	20	25 B	<0.50	1.7 J	<8.0	<0.50	3.8	1.5 J B	2.8	<0.50	23	20	30
	UFMW-04D-20171005-FD	10/05/17	<5.0	<0.50	98	20	25 B	<0.50	1.5 J	<8.0	<0.50	3.6	1.3 J B	2.7	<0.50	23	20	3.5 J
UFMW-05S	UFMW-05S-20160819	08/19/16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-05S-20170816	08/16/17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-05S-20171005	10/05/17	5.6 J, B	<0.50	120	31	1.3 J B	1.1	4.1	15 J	<0.50	130	4.0 B	5.1	<0.50	53	27	7.6 J
UFMW-05I	UFMW-05I-20160823	08/23/16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-05-20170816	08/16/17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-05I-20171004	10/04/17	<25	<2.5	140	24	15	<2.5	<2.5	<40	<2.5	32	<2.5	2.9 J	<2.5	27	28	<13
UFMW-05D	UFMW-05D-20160822	08/22/16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-5D-20170815	08/15/17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-05D-20171004	10/04/17	<25	<2.5	110	26	18	<2.5	<2.5	<40	<2.5	63	<2.5	4.2 J	<2.5	22	18	<13
UFMW-06S	UFMW-06S-20160819	08/19/16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-06S-20170815	08/15/17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-06S-20171005	10/05/17	<5.0	<0.50	140	26	5.8 B	0.63 J	1.3 J	<8.0	<0.50	40	2.3 B	3.9	<0.50	32	35	<2.5
UFMW-06I	UFMW-06I-20160822	08/22/16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-06I-20170815	08/15/17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-06I-20170815-DUP	08/15/17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-06I-20171004	10/04/17	<25	<2.5	160	29	9.3 J	<2.5	<2.5	<40	<2.5	10	<2.5	3.5 J	<2.5	28	32	<13
UFMW-06D	UFMW-06D-20160822	08/22/16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-06D-20170815	08/15/17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	UFMW-06D-20171004	10/04/17	<25	<2.5	140	25	28	<2.5	<2.5	<40	<2.5	5.0	<2.5	4.4 J	<2.5	21	19	<13

Notes:

USEPA	United States Environmental Protection Agency
µg/L	Microgram per liter
mg/L	Milligram per liter
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
F1	MS and/or MSD Recovery is outside acceptance limits.
B	Compound was found in the blank and sample
--	Not Analyzed

Table G-4 - Summary of Groundwater Analytical Results-Chemical Field Study

AP Area

Well ID	Sample ID	Sample Date	General Water Quality Parameters using Field Water Quality Meter							Dye Testing		
			pH	Temp (°C)	Specific Conductivity (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Sulfide (mg/L)	Rhodamine	Uranine	Notes
UFMW-01S	UFMW-01S-20160809	08/09/16	7.90	27.36	7.87	200	1.91	>1,000	--	--	--	--
	UFMW-01S-20170817	08/17/17	6.97	29.10	4.38	142	1.21	52.0	--	1.942	6.746	No visible dye
	Not Sampled	10/06/17	Well is dry									
UFMW-01I	UFMW-01I-20160809	08/09/16	7.62	29.84	6.53	164	0.56	1.9	--	--	--	--
	UFMW-01I-20170816	08/16/17	7.23	23.31	3.55	41	0.00	1.90	--	2.232	4.998	No visible dye
	UFMW-01I-20171006	10/06/17	7.40	22.95	2.98	110	0.24	0.0	--	--	--	No visible dye
UFMW-01D	UFMW-01D-20160809	08/09/16	7.97	29.21	6.73	180	3.54	33.0	--	--	--	--
	UFMW-01D-20170816	08/16/17	7.23	25.24	5.20	61	0.69	0.10	--	1.294	4.090	No visible dye
	UFMW-01D-20171005	10/05/17	7.44	25.31	4.58	154	0.18	0.0	--	--	--	--
UFMW-02S	UFMW-02S-20160810	08/10/16	7.15	27.03	10.3	219	1.89	>1,000	--	--	--	--
	Not Sampled	08/17/17	Less Than 1" of Water Observed in Well; Unable to Sample.									
	Not Sampled	10/06/17	Well is dry									
UFMW-02I	UFMW-02I-20160810	08/10/16	7.60	30.60	7.45	180	0.65	1.1	--	--	--	--
	UFMW-02I-20170817	08/17/17	7.30	24.52	4.74	90	0.00	0.7	--	1.112	7.779	No visible dye
	UFMW-02I-20171006	10/06/17	7.52	23.86	4.08	156	0.19	0.0	--	--	--	--
UFMW-02D	UFMW-02D-20160810	08/10/16	7.79	29.39	8.02	171	0.58	5.5	--	--	--	--
	UFMW-02D-20170817	08/17/17	7.30	25.81	5.59	66	0.00	0.0	--	1.004	5.422	No visible dye
	UFMW-02D-20171006	10/06/17	7.50	24.56	5.18	162	0.23	0.0	--	--	--	No visible dye
UFMW-03S	Not Sampled	08/08/16	Well is dry									
	Not Sampled	08/17/17	Well is dry									
	Not Sampled	10/06/17	Well is dry									
UFMW-03I	UFMW-03I-20160808	08/08/16	7.64	33.48	6.85	152	1.50	0.0	--	--	--	--
	UFMW-03I-20170817	08/17/17	7.32	21.37	4.02	38	0.00	1.30	--	0.983	7.72	No visible dye
	UFMW-03I-20171006	10/06/17	7.21	20.92	3.90	100	3.06	0.0	--	--	--	No visible dye
UFMW-03D	UFMW-03D-20160808	08/08/16	7.75	30.65	7.36	169	2.52	2.03	--	--	--	--
	UFMW-3D-20170817	08/17/17	7.30	23.26	4.95	84	0.00	0.30	--	2.135	8.418	No visible dye
	UFMW-03D-20171006	10/06/17	7.41	20.39	4.37	88	5.31	37.7	--	--	--	--

Notes:

°C	Degrees Celsius
mg/L	Milligram per liter
mS/cm	Millisiemens per centimeter
mV	Milivolt
NTU	Nephelometric turbidity units
--	Not Analyzed

Table G-4 - Summary of Groundwater Analytical Results-Chemical Field Study

AP Area

Well ID	Sample ID	Sample Date	General Water Quality Parameters using Field Water Quality Meter							Dye Testing		
			pH	Temp (°C)	Specific Conductivity (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Sulfide (mg/L)	Rhodamine	Uranine	Notes
UFMW-04S	UFMW-04S-20160819	08/19/16	7.91	25.95	4.80	133	0.96	196	--	--	--	--
	UFMW-04S-20170816	08/16/17	7.20	27.00	4.60	150	0.18	0.00	--	1.113	6.675	No visible dye
	UFMW-04S-20171005	10/05/17	7.30	26.52	4.25	161	0.19	0.00	--	--	--	No visible dye
UFMW-04I	UFMW-04I-20160818	08/18/16	7.84	29.16	4.28	125	2.12	12.0	--	--	--	--
	UFMW-04I-20170816	08/16/17	7.32	26.65	4.67	68	0.00	2.5	--	1.003	8.941	No visible dye
	UFMW-04I-20171005	10/05/17	7.31	26.37	4.02	153	0.10	0.0	--	--	--	No visible dye
UFMW-04D	UFMW-04D-20160818	08/18/16	7.79	28.01	5.04	130	0.95	0.1	--	--	--	--
	UFMW-4D-20170816	08/16/17	7.42	26.69	5.12	75	0.00	1.80	--	1.342	5.770	No visible dye
	UFMW-04D-20171005	10/05/17	7.41	24.43	4.92	173	0.17	0.0	--	--	--	No visible dye
UFMW-05S	UFMW-05S-20160819	08/19/16	8.14	26.66	5.65	31	1.13	205	--	--	--	--
	UFMW-05S-20170816	08/16/17	7.21	27.13	6.72	145	0.30	6.4	--	0.980	2.347	No visible dye
	UFMW-05S-20171005	10/05/17	5.58	25.08	9.02	206	1.63	68.4	--	--	--	No visible dye
UFMW-05I	UFMW-05I-20160823	08/23/16	7.81	26.57	5.37	119	0.32	7.8	--	--	--	--
	UFMW-05-20170816	08/16/17	7.18	26.77	5.08	12	0.00	2.90	--	0.616	4.420	No visible dye
	UFMW-05I-20171004	10/04/17	7.13	27.50	5.39	109	0.51	3.80	--	--	--	No visible dye
UFMW-05D	UFMW-05D-20160822	08/22/16	7.74	30.98	6.10	93	0.55	34.8	--	--	--	--
	UFMW-5D-20170815	08/15/17	7.20	27.49	6.47	116	0.00	0.50	--	0.745	2.316	No visible dye
	UFMW-05D-20171004	10/04/17	7.14	27.38	5.90	115	0.30	4.3	--	--	--	No visible dye
UFMW-06S	UFMW-06S-20160819	08/19/16	7.57	29.61	5.32	88	0.85	5.4	--	--	--	--
	UFMW-06S-20170815	08/15/17	7.07	29.11	5.46	182	0.00	23.1	--	1.139	0.879	No visible dye
	UFMW-06S-20171005	10/05/17	5.93	23.97	6.34	164	1.99	0.3	--	--	--	No visible dye
UFMW-06I	UFMW-06I-20160822	08/22/16	7.52	26.84	5.43	121	0.67	2.3	--	--	--	--
	UFMW-06I-20170815	08/15/17	7.18	26.65	5.71	185	0.51	0.00	--	2.175	4.069	No visible dye
	UFMW-06I-20171004	10/04/17	7.24	25.59	6.8	71	0.61	0.0	--	--	--	No visible dye
UFMW-06D	UFMW-06D-20160822	08/22/16	7.78	29.67	6.61	134	2.46	5.2	--	--	--	--
	UFMW-06D-20170815	08/15/17	7.27	26.61	6.52	178	0.71	1.1	--	1.031	0.923	No visible dye
	UFMW-06D-20171004	10/04/17	7.51	26.76	5.97	49	0.62	9.0	--	--	--	No visible dye

Notes:

°C	Degrees Celsius
mg/L	Milligram per liter
mS/cm	Millisiemens per centimeter
mV	Milivolt
NTU	Nephelometric turbidity units
--	Not Analyzed