Final Danny T Adit Treatability Study Year 1
Technical Memorandum

Barker-Hughesville Mining District
Superfund Site
Cascade and Judith Basin Counties, Montana

EPA Contract No. EP-W-05-049
Work Assignment No: 325-RICO-085N

Prepared by CDM Smith

March 5, 2014

REMEDIAL ACTION CONTRACT
FOR REMEDIAL, ENFORCEMENT OVERSIGHT, AND NON-TIME CRITICAL REMOVAL ACTIVITIES AT SITES OF RELEASE OR THREATENED RELEASE OF HAZARDOUS SUBSTANCES IN EPA REGION VIII

U. S. EPA CONTRACT NO. EP-W-05-049

FINAL DANNY T ADIT TREATABILITY STUDY YEAR 1 TECHNICAL MEMORANDUM

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Table of Contents

List of Figures

List of Tables

Appendices

List of Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
AC	alternating current
Ag	silver
Al	aluminum
APC	aerobic polishing cell
As	arsenic
Ba	barium
BCR	biochemical reactor
Be	beryllium
BOD	biological oxygen demand
Ca	calcium
$Ca(OH)_2$	calcium hydroxide
Cd	cadmium
CDM Smith	CDM Federal Programs Corporation
Chitorem	Chitorem SC-20®
CLP	Contract Laboratory Program
Co	cobalt
Cr	chromium
DEQ	Montana Department of Environmental Quality
DC	direct current
DO	dissolved oxygen
DQO	data quality objective
ESAT	Environmental Services Assistance Team
EPA	U. S. Environmental Protection Agency
Fe	Iron
FS	feasibility study
ft3	cubic feet
gal/day	gallons per day
gpm	gallons per minute
HDPE	high density polyethylene
in^3	cubic inches
L	liter
MIW	mining influenced water
Mg	magnesium
$MG(OH)_2$	magnesium hydroxide
mg/L	milligrams per liter
MIW	mining influenced water
ml/min	milliliters per minute
Mn	manganese
MRE	metal removal efficiency
mS/cm	milliSiemens per centimeter
mV	millivolts
NaOH	sodium hydroxide
Ni	nickel
NPL	National Priorities List
ORP	oxidation-reduction potential

PARCCS	precision, accuracy, representativeness, comparability, completeness, and sensitivity
Pb	lead
PRP	potentially responsible party
PVC	polyvinyl chloride
QAPP	quality assurance project plan
QA	quality assurance
QC	quality control
RAC	remedial action contract
RI	remedial investigation
SAP	sampling and analysis plan
SAPS	successive alkalinity producing system
Sb	antimony
Se	selenium
Site	Barker Hughesville Mining District Superfund Site
SPLP	synthetic precipitation leaching procedure
SRB	sulfite reducing bacteria
SOPs	standard operating procedures
su	standard units
TBD	to be determined
TDS	total dissolved solids
TCLP	toxicity characteristic leaching procedure
Tl	thallium
µg/L	micrograms per liter
µS/cm	microSiemens per centimeter
USFS	United States Forest Service
V	vanadium
Zn	zinc

Section 1

Introduction

CDM Federal Programs Corporation (CDM Smith) has been tasked by the United States Environmental Protection Agency (EPA) Region 8 to conduct bench-scale and pilot-scale treatability studies for the Danny T adit water drainage at the Barker-Hughesville Mining District Superfund Site (the site). This document is a final technical memorandum prepared by CDM Smith to present the results of the studies conducted in accordance with the sampling and analysis plan (SAP) specific for the bench-scale treatability study work (CDM Smith 2013a) and SAP addendum focused on the pilot-scale treatability study work (CDM Smith 2013b). The bench-scale treatability study was conducted from February through April 2013. The pilot-scale treatability was conducted from June through September 2013. These activities are being conducted under CDM Smith's EPA Remedial Action Contract (RAC) for Region VIII (EPA Contract No. EP-W-05-049).

The treatability study activities are intended to evaluate potential passive treatment alternatives for mining influenced water (MIW) emanating from the Danny T adit. The initial phase of the treatability study included bench-scale testing in the laboratory for determination of the most promising alternatives. Following these tests and preliminary assessment of results, the pilot-scale treatability testing was planned, installed, and operated. Results from the treatability studies will be utilized for remedial alternative development and evaluations in the feasibility study (FS). Since the Danny T adit is one of many similar acidic MIW discharges at the site, the passive treatment treatability studies conducted at the Danny T adit can be used as a surrogate for other MIW discharges for the purposes of FS evaluations.

This technical memorandum summarizes the project background, treatment technology, and study objectives (Section 1), the treatability study methods and sampling (Section 2), results, analysis, and discussion (Section 3), and conclusions and recommendations (Section 4) for both the bench-scale and pilot-scale treatability studies.

1.1 Site Description and Background

Exhibit 1-1. Site Location Map

The Barker-Hughesville Mining District Superfund Site (site) is located in central Montana, southeast of Great Falls (Exhibit 1-1). It consists of approximately 9,600 acres in Cascade and Judith Basin Counties. There are no full-time residents at the site, but up to a dozen properties have structures that may be inhabitable during the winter months while other property owners use campers or trailers during the summer. There are 11 drainages on the site and 45 mine sites scattered across those drainages. The two major creeks within these drainages are Galena Creek and Lower Dry Fork Belt Creek. Most of the other tributaries on site feed into those two creeks. The exception is Otter Creek which flows north out of the site. Several smaller mines operated under the name of the Block “P” Mine, are located near the top of Galena Creek. This portion of the site (Block P Mine and Block P Tailings) is currently undergoing removal actions under an EPA order by Doe Run Resources, a potentially responsible party (PRP).

Various sampling events were undertaken by the State of Montana, the US Forest Service (USFS), and Cascade County since 1972. In 2004, EPA directed CDM Smith to summarize the data obtained to date and identify data gaps. That work was presented in the *Final Technical Memorandum, Site Investigation Summary Report for Barker Hughesville Mining District NPL Site* (CDM Smith 2005a). The technical memorandum also established a three-tier ranking system for mine sites which considered their potential threat based on several factors: mass wasting, waste material in contact with surface water, volume of waste material, acid mine drainage discharge to surface water, visual impacts to surface water, and severity of environmental impacts. Tier I sites had the most impacts, and Tier III had the least.

Remedial investigation (RI) and FS sampling activities were initiated by CDM Smith in 2009 and continue to present. Further information on site description, background, sampling activities, and other aspects can be found in the SAP (CDM Smith 2013a).

1.2 Treatment Technology Description

Biochemical reactor (BCR) treatment methods involve a biologically-mediated process in which a carbon source (substrate) is provided as an electron donor for sulfate-reducing bacteria (SRB) to reduce sulfate present in the mining influenced water (MIW) to various aqueous sulfide species. Subsequently, the metals present in MIW react with the sulfide species to form metal sulfide precipitates such as iron, copper, nickel, and zinc sulfides. Formation of metal sulfide precipitates is the dominant mechanism by which metals are removed in the BCR over the long term. The sulfate reduction reaction can be simplified as follows:

$$SO_4^{-2} + 2\ CH_2O \rightarrow HS^{-} + 2\ HCO_3^{-} + H^{+}$$

Sulfate reduction produces both reduced sulfide (S^{-2} and HS^{-}) and alkalinity (HCO_3^{-}, resulting in net increase in pH on the MIW during the reaction. The formation of metal sulfides proceeds generally as follows (where Me = divalent metal species):

$$S^{2-} + Me^{2+} \rightarrow MeS_{(s)} \text{ and } HS^{-} + Me^{2+} \rightarrow MeS_{(s)} + H^{+}$$

CH_2O in the sulfate reduction reaction is a generic representation of an organic substrate. The actual form of organic compound utilized by SRB to reduce sulfate can be complex and can vary for each substrate or combination of substrates. The availability of a readily usable carbon source by SRB is the limiting factor for the overall sulfide generation, and subsequent metal removal rate. Solid substrates must proceed through an anaerobic fermentation process to produce a soluble form of carbon, and a microbial consortium is involved in this process. Common cellulosic-based solid substrates utilized in BCRs include wood chips, sawdust, hay, compost, and manure. Anaerobic fermentation of cellulosic materials converts sugars into volatile fatty acids (VFAs) such as lactic acid that are used by the SRB.

Ex-situ BCR treatment can be implemented at full-scale utilizing a gravity-fed cell filled with substrate material that treats the MIW. Substrate within the BCR cell is most commonly a solid substrate mix of woody materials (e.g., wood chips, shredded wood, sawdust, hay, straw, or yard waste), compost, manure, limestone gravel, and/or inert gravel. A number of other solid materials may be used in the

BCR, such as crab and oyster shells, rice hulls, walnut shells, biosolids, other food waste materials, and inert sand and gravel. Some of this material provides surface area for the microbial biofilm to form and to attach.

As part of an overall passive treatment system, a BCR cell is commonly followed by aeration processes, which may include cascades and an aerobic polishing cell (APC). Aeration provides oxidation to the BCR effluent to decrease sulfides, increases dissolved oxygen (DO), and reduces biological oxygen demand (BOD) and ammonia formed from the BCR organic substrates prior to discharge to the receiving water. A common APC application includes an open settling pond and an oxidative constructed wetland. The pond provides settling capacity for residual suspended solids from the BCR effluent and aeration processes. The wetland component provides additional metals polishing treatment from vegetation as well as additional oxidation and residual solids removal.

In addition to post-treatment methods, a BCR may also be preceded by pre-treatment methods depending on site conditions. Pre-treatment methods may include increasing pH with alkaline reagents or limestone and treatments that reduce the oxidation state of the water prior to the BCR or remove excess iron and aluminum. Some of these pre-treatment aspects were emphasized during the Danny T Adit treatability study as discussed in the sections below.

1.3 Study Objectives and Evaluation Criteria

Completion of bench-scale and pilot-scale treatability studies provides data for evaluating potential MIW treatment technologies at the site. The overall goal of the treatability studies was to determine if a particular method and/or amendment provides more desirable results with regard to reduction of metal concentrations, neutralization of acidic MIW, and practical considerations for full-scale field implementation. The primary goals of the treatability studies were to test the effectiveness of MIW treatment using conventional alkaline addition, pre-treatment methods, and BCR substrates. Treatability study data can be utilized for evaluation of MIW treatment technologies in the FS and utilized for design of full-scale treatment of MIW, should these technologies be selected as part of the site remedy. Post-treatment aeration processes described above are not part of the current study; however, these processes will be considered a necessary component of an overall passive treatment system in FS evaluations.

The pilot-scale treatability study approach was developed based on the results of the bench-scale treatability study, knowledge from tests at other mine sites, and site-specific application for the Danny T adit. While the same type of passive biochemical treatment technology has been effective at removing metals from MIW at other mine sites, site-specific conditions create specialized treatment scenarios. For the Danny T adit, the acidic water chemistry prompted the need to evaluate pre-treatment technologies prior to a passive BCR treatment. The basis for pre-treatment is discussed further in the following section.

The approaches and criteria used to evaluate treatment effectiveness during the treatability studies are presented in the following sections. Important considerations that can impact treatment effectiveness are presented which provide the basis for the treatability study test design. Specific objectives for the bench-and pilot-scale treatability studies were presented as principle study questions in the SAPs (CDM Smith 2013a and b). These study questions and information inputs are presented in the sections below to provide the framework for data assessment in Section 4 of this memorandum. Information inputs provide greater detail on the rationale for the treatability test design during the bench- and pilot-scale phases.

1.3.1 Analytic Approach and Evaluation Criteria

An effective treatment is one where toxic metals are removed from the water efficiently, and the water quality meets federal and state criteria and/or guidelines for ambient water quality. The primary measure of treatment of effectiveness for the study is the metal removal efficiency (MRE). MRE is the percent by which metals are removed between the influent and effluent of the treatment system (or raw untreated water versus treated water) and is calculated as the difference between the influent and effluent concentrations divided by the influent concentration. Where applicable, the MRE calculation was applied to all samples collected in the treatability study to evaluate effectiveness. In addition, metals concentrations measured at the end of the tests (treated water) were compared to Montana Department of Environmental Quality Water Quality Bureau Bulletin 7 (DEQ-7) acute and chronic ambient water quality standards and human health standards.

Several factors are present at the site with the Danny T adit water and other similar MIW sources that can have an effect on the MRE. The first important factor is the MIW pH. Activity of SRB may be limited by low pH, and the Danny T adit water and other similar site MIW discharges are in the acidic range (i.e., 2.0 to 3.5 su). Therefore, pre-treatment of water used in passive biochemical treatment methods may be required to provide suitable chemistry for sulfate reduction to occur effectively.

Other factors affecting the treatment process are the oxidation state of the MIW and the presence of iron and aluminum in the MIW at significant concentrations. In acidic MIW such as the Danny T adit, high iron and aluminum in an oxygen atmosphere can result in formation of aluminum (Al) and iron (Fe) oxy-hydroxide precipitates. Under oxidizing conditions (high DO and positive oxidation-reduction potential [ORP]), the rate of precipitation can be increased. These precipitates can lead to build up of scale and potential plugging in the BCR piping and substrate layers and possible premature failure of the treatment system. The Danny T adit water quality is known to contain high concentrations of Al and Fe, and in addition evidence of oxy-hydroxide precipitates are widespread at the site in association with MIW discharges to surface water. Therefore, pre-treatment of the MIW to reduce iron and aluminum concentrations prior to the BCR may be beneficial to provide protection of the BCR cell from plugging and provide enhancement of efficiency and longevity of the substrate.

Similar to low pH MIW, oxygenated MIW can also reduce the activity of the anaerobic SRB. In the presence of high oxygen concentrations, SRB can die and/or form spores, whereas aerobic microbes will thrive. Therefore, pre-treatment processes that can reduce the oxidation state of the MIW may be beneficial to enhance the efficiency of the SRB and hence MRE.

In addition to metals removal, BCR treatment effectiveness is measured by several metrics that indicate the extent of the sulfate reduction process and the type of metal removal mechanism(s) that are occurring. The extent of sulfate reduction can be correlated with MRE in order to verify that metal removal was predominantly occurring via a sulfate reduction mechanism, rather than by other removal processes such adsorption to substrates or precipitation of metal oxy-hydroxides or carbonates. The metrics for identifying the extent of sulfate reduction include the following:

- Decrease in sulfate concentrations from the untreated raw water to the final treated water

- Increased alkalinity as a byproduct of the sulfate reduction process and from limestone and other alkaline materials used in the substrate
- Generation of sulfide from the sulfate reduction and formation of metal sulfide
- Circumneutral or alkaline pH, low DO, and negative ORP

1.3.2 Bench-Scale Principal Study Questions and Information Inputs

As presented in the bench-scale treatability study SAP (CDM Smith 2013a), the principal study questions and information inputs for the bench-scale study included the following:

1. *What is the water quality of the Danny T adit water used in the bench test?*

   This requires collection of a raw water sample for total and dissolved metals, anions, acidity, and field parameters prior to testing.

2. *What dosages of alkaline reagents are required to raise the pH to 4.5 su for pretreatment?*

   This requires titration of the untreated water to the target pH endpoint using reagents with known concentrations and collection of samples for metals, anions, alkalinity, and field meter measurements (pH, oxidation/ ORP, ferrous iron, DO, conductivity, and temperature) at the end.

3. *What dosages of alkaline reagents would be required to raise the pH to 9.5 su to simulate treatment in a conventional water treatment plant?*

   This requires titration of the untreated water to 9.5 su with alkaline reagents with known concentrations, with collection of samples for metals, anions, alkalinity, and field meter measurements at the end.

4. *How much sludge is generated during alkaline addition treatment?*

   This requires measurement of the settled volumes of sludge generated from a known volume of raw water, as well as measurement of the settling rate.

5. *Does further oxidation of the raw water promote precipitation of solids?*

   This requires oxidation of the raw water (stirring, bubbling air through the water), measurement of DO, and sample collection if precipitation is observed.

6. *What pre-treatment steps are necessary to condition the water for the BCR?*

   Two tiers of pre-treatment are planned. The first entails pretreatment with an alkaline reagent to pH 4.5 su, followed by an ORP reducing step prior to the BCR. The second tier entails addition of water directly to a successive alkalinity producing system (SAPS). This type of treatment will reduce the oxidation state and add alkalinity, without metering in a reagent. The substrate will consist of an organic layer of compost, manure, and wood chips to reduce the oxidation state, followed by a bed of limestone. This test will evaluate a passive pre-treatment approach that does not require electrical power for alkaline addition. Samples and field meter readings will be collected after the pre-treatment steps ahead of introduction of the water into the BCR.

7. *Are the pre-treatment methods implementable in the field?*

   This requires research into equipment available to meter alkaline reagents into the MIW without power (e.g., water wheel, solar power), equipment costs, reliability and experience with such equipment, settleability of the solids, and ease of maintenance of the system

8. *What is the MRE achieved for various elements and the extent of sulfate reduction in the BCR?*

   This requires sample collection for dissolved metals, alkalinity, anions, sulfide, and water quality measurements at the end of testing, then comparison to metal concentrations entering the reactor.

9. *For design of the pilot scale test, what are the pore volumes of the various media?*

   This requires packing various media into columns of known volume, and determining the quantity of water required to fill the void spaced. Retention time can then be estimated for various flow rates.

1.3.3 Pilot-Scale Treatability Study Principal Study Questions and Information Inputs

As presented in the pilot-scale treatability study SAP addendum (CDM Smith 2013b), the principal study questions and information inputs for the pilot-scale study included the following:

1. *What is the water quality of the Danny T adit water used in the pilot-scale test?*

   Influent MIW collected from the Danny T adit will be characterized based upon analytical results of samples collected during the study. Influent MIW samples will be collected from the treatability study system feed tank and analyzed as specified in the SAP addendum. Variability in the influent MIW water quality through the course of the study will be evaluated against the treatment effectiveness metrics described in the objectives below.

2. *What pre-treatment steps are necessary to condition the water for the BCR treatment?*

   Due to the very low pH and high metals concentrations in the Danny T adit water, pre-treatment is expected to be a necessary component of any passive treatment process. The study will evaluate three types of pre-treatment for effectiveness and implementability, very similar to the bench-scale study. A fourth BCR without a pre-treatment step will also be tested. The pre-treatment steps to be investigated are:

   - Pre-treatment with an alkaline reagent (magnesium hydroxide) to approximately pH 4.5 to 5.5. This is similar to the pre-treatment conducted during the bench-scale testing, but with a different alkaline reagent. Operation of the alkaline addition pre-treatment will require a small chemical metering pump, battery, and solar panel. Magnesium hydroxide ($Mg(OH)_2$) may have the following advantages in implementability as compared to sodium hydroxide or lime (Barnes and Gold 2008):
     - $Mg(OH)_2$ buffers to a maximum pH of about 9.0 standard units (su) in solution, so an overdose in the treatment train or spill in the environment does not result in high pH excursions such that could occur with lime or sodium hydroxide

  - $Mg(OH)_2$ is safer and easier to handle than lime or sodium hydroxide because of the lower maximum pH
  - $Mg(OH)_2$ does not cause scaling potential scaling issues like lime (i.e., formation of calcium sulfate or gypsum scale)
  - High concentration solutions of sodium hydroxide can freeze at moderate temperatures
- Addition of water directly to a SAPS, similar to the test conducted during the bench-scale study.
- Addition of water directly to a ChitoRem SC-20® (Chitorem) barrel. Similar to the SAPS pre-treatment, this treatment will reduce the oxidation state and add alkalinity, without metering in a reagent. Chitorem is a proprietary product designed for passive treatment.

3. *What pre-treatment dosage of magnesium hydroxide reagent is required to achieve the optimal pH range?*

   The optimal pH range targeted in the pretreatment step for the study is 4.5 to 5.5 su. $Mg(OH)_2$ was not tested during the bench-scale study, but research indicates it may be advantageous for a passive or very low energy application. Analytical results from the bench testing will be utilized to estimate a dosage and chemical quantities required. A titration test will be conducted in the field to the target pH endpoint to better determine the dosage required. This dosage rate will then be scaled up to the design flow rate for implementation of the alkaline addition pre-treatment barrel test.

4. *What is the nature of the sludge and the sludge volume generated during alkaline addition pre-treatment?*

   The settled volumes of sludge generated from a known volume of raw water will be measured during the study. An initial estimate of sludge volume generated per liter of MIW will be made based upon the titration test described in Study Question 3. In addition, sludge depth/volume will be measured in the alkaline addition pre-treatment barrel periodically during the treatability study and at the end of the study.

5. *What is the effectiveness of the alkaline addition pre-treatment?*

   The alkaline addition pre-treatment efficiency will be based upon analytical results of samples collected from the effluent of the alkaline addition pre-treatment barrel and influent raw water quality per Study Question 1. Pre-treatment efficiency is based upon removal of a subset of metals, and on improvement of effluent pH and alkalinity. MRE will be measured by calculating the percent difference of concentrations in the effluent versus the influent.

6. *What is the effectiveness of the SAPS pre-treatment?*

   The SAPS pre-treatment efficiency will be based upon analytical results of samples collected from the effluent of the SAPS pre-treatment barrel and influent water quality per Study Question 1. Pre-treatment efficiency is based upon removal of a subset of metals, improvement of effluent pH and alkalinity, and decrease in ORP and DO. MRE will be measured by calculating the percent difference of concentrations in the effluent versus the influent.

7. *What is the effectiveness of the Chitorem pre-treatment?*

   The Chitorem pre-treatment efficiency will be based upon analytical results of samples collected from the effluent of the Chitorem pre-treatment barrel and influent water quality per Study Question 1. Pre-treatment efficiency is based upon the same metrics as defined in Study Question 6. MRE will be measured by calculating the percent difference of concentrations in the effluent versus the influent.

8. *What is the MRE achieved for various elements in the BCR treatment barrels?*

   MRE is the primary metric to determine treatment effectiveness. Consistently high MRE of target metals (i.e., focusing on cadmium, copper, lead, and zinc) is quantified as a specific goal of the treatability study. The targeted MRE for the BCR barrels is a value equal to or greater than 90 percent. The actual target MRE for some metals will vary based on the chemical-specific endpoint values as provided in Study Question 10 below and variable influent concentrations throughout the study. Samples will be collected from the effluent sampling ports for each BCR treatment barrel. Analytical results will be used to calculate MRE by comparison of the metals concentrations in BCR barrel effluent versus the influent MIW concentrations collected from the system feed tank. MRE for BCR barrels that first receive a pre-treatment step will be calculated by comparison to the pre-treatment barrel effluent concentrations, rather than the treatment system influent MIW.

9. *What is the extent of sulfate reduction in the BCRs?*

   Sulfate reduction and metal sulfide formation are the main biochemical reactions used for removal of metals by the BCR treatment process. Therefore, measurement end points are established to understand the extent of sulfate reduction as part of overall treatment effectiveness evaluation. The extent of sulfate reduction in the BCR treatment barrels will be assessed using the following metrics:

   - Sulfate concentration changes between MIW influent and BCR effluent directly quantifies the extent of sulfate reduction. Generally, a decrease on the order of 100 milligrams per liter (mg/L) sulfate or greater is desired, but the value is site-specific to the influent water sulfate concentration. The sulfate reduction rate will be empirically calculated over time as the average decrease in sulfate concentration measured during each sampling event times the system flow rate per substrate volume BCR barrels. Reported literature values vary, but generally a sulfate reduction rate of 100 to 800 millimoles sulfate/meter^3/day have been reported for solid substrate BCRs (Gusek and Figueroa 2009; Younger et. al., 2002). The sulfate reduction rate measured during the pilot-scale study is a parameter for evaluating costs and design of future, larger scale systems.

   - Alkalinity concentration changes between MIW influent, pre-treatment effluents, and the BCR effluents will be measured and quantified as an indicator of SRB activity. Alkalinity is produced as a byproduct of the sulfate reduction process by SRB, and should increase from the influent MIW concentrations. In addition, alkalinity can increase from the limestone present in the BCR and pre-treatment substrate materials (i.e., limestone or Chitorem). The contribution of alkalinity increases by either limestone dissolution or microbial activity can be difficult to decipher, although typically contributions by limestone are constant or slowly decreasing over time, whereas sudden increases in alkalinity can be interpreted as a result of biological activity, in correlation with other metrics (i.e., good sulfate reduction and excess sulfide generation). Generally, the range of targeted BCR effluent alkalinity should be at 50 mg/L or greater.

- Sulfide is generated during sulfate reduction and soluble sulfide will be quantified by analyses of BCR effluent. The values will be used as an indicator of successful sulfate reduction resulting in metals removal by formation of metal sulfides. Generally, excess sulfide measured on the order of 5 mg/L is desired. Excess sulfide can be metabolized by SRB and generate hydrogen sulfide gas. The presence of hydrogen sulfide odor at the BCRs (rotten egg odor) is empirical evidence of sulfate reduction.

- Field parameters, including pH, conductivity, temperature, DO, and ORP will be documented as indicators of effective treatment. A target pH at 6.5 to 9 su is desired for effective treatment. Observations of ORP less than approximately -150 millivolts (mV) and falling and DO less than 2 mg/L in the treated effluent is indicative of the appropriate reducing environment necessary for sulfate reduction to occur. The optimum influent water temperature for incubation and system startup is generally desired to be within 5 to 15 degrees Celsius.

10. *What are the chemical-specific endpoint values to evaluate test effectiveness?*

As one measure of test effectiveness, the treated effluent will be compared to the DEQ-7 human health and chronic aquatic life criteria. However, filtered effluent concentrations will be compared to the standards, not the total fraction. Table 1-1 provides the site-specific values to be used as comparison criteria for metals. Criteria for additional metals and analytes will be researched and utilized for data analysis as applicable. Study Questions 8 and 9 identify the metrics to evaluate effectiveness of the BCR treatment tests. MRE equal to or greater than 90 percent is a treatment goal; however, the test-specific MRE that correlates closest to the endpoint values will vary for each metal and each sampling event because the concentrations of metals in the influent may change over time.

Table 1-1. Targeted Endpoint Values

Contaminant	DEQ-7 Chronic Aquatic Life Criteria (micrograms per liter [µg/L])*	DEQ-7 Human Health Standards (µg/L)
Arsenic (As)	150	10
Cadmium (Cd)	0.27	5
Copper (Cu)	9.3	1,300
Lead (Pb)	3.2	15
Nickel (Ni)	52	100
Zinc (Zn)	120	2,000

* DEQ-7 standards (October 2012). Hardness-based standards for Cd, Cu, Pb, Ni, and Zn are shown at 100 mg/L hardness for illustration; standards will be calculated at the hardness of the sample.

11. *What is the effect of seasonal weather changes on treatment effectiveness?*

The pilot-scale treatability study is planned to be started in early summer and continue through October or early November 2013. Weather effects to metrics identified in Study Questions 7 through 9 including precipitation, colder ambient air, and colder influent MIW, will be evaluated by documenting site-specific weather conditions using data from the temporary weather station installed at the nearby Moulton mine (less than 1 mile away). The system will be constructed to prevent any percolation of precipitation water into the process flow; however, precipitation may result in percolation into the underground mine and may have an effect on the influent MIW chemistry to the treatment system, as described in Study Question 12 below.

12. *How does treatment effectiveness vary in responses to potential changes in the Danny T adit MIW chemistry?*

    Through the course of the study, MIW influent will be sampled and the analytical results compared to the analytical results of treated effluent. This comparison will allow observation of changes to influent MIW chemistry if they occur and assessment of changes in treatment effectiveness. Measurement of changes in influent MIW chemistry as a result of precipitation or other affects are limited to the bi-weekly sampling frequency of the study. Changes in chemistry between these periods cannot be evaluated.

13. *What effect does pre-treatment of MIW have on the BCR treatment efficiency?*

    To evaluate the possible benefits of the three pre-treatment methods, raw influent MIW will also be fed to a BCR barrel. The substrates tested in the BCR barrels will be the same for either the pre-treated tests or the non pre-treated test. Therefore, a direct comparison of BCR substrate treatment effectiveness can be conducted for each of the different scenarios.

14. *What is the BCR residence time for contact between BCR substrate and MIW flow?*

    An initial design flow rate was defined in the SAP addendum (CDM Smith 2013b) and is presented in Section 2.2. The treatability study will begin at this flow rate. The initial flow is considered the minimum rate for targeted effectiveness goals. If the treatments are effective based on study questions above as evaluated from study data, then system flow rates may be increased. If implemented, the timing of increasing flow rates will be specific to observations during the study. Increasing flow rate is desired to maximize treatment efficiency for the substrate volume utilized.

15. *What constituents are leached by the BCR materials themselves?*

    The substrate materials used in BCRs can sometimes leach arsenic or metals or other constituents into the water during treatment. A modified synthetic precipitation leaching procedure (SPLP) will be conducted on all substrate materials to identify constituents that may leach and be measured in the effluents. In addition, all substrate combinations will be analyzed for total metals using the standard EPA digestion methods for soils.

16. *Is aeration of the BCR effluent sufficient to oxidize BOD, residual sulfide, and ammonia?*

    As part of the anaerobic processes in the BCR that facilitate the formation of sulfides, constituents such as ammonia and BOD are generated that are themselves toxic to aquatic life.

Thus, aeration of the BCR effluent is required prior to discharge. Simulation of this process in the field has been difficult to conduct at low flow rates (water may pond or not cascade, or may freeze in the open air). Thus, aeration will be tested by collection of a separate aliquot of the BCR effluent, which will be aerated through stirring, pouring the sample back and forth between two containers, or air sparging to quantify the removal of these other constituents.

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Section 2

Study Methods and Sampling

2.1 Bench-Scale Treatability Study

The bench-scale treatability study was conducted from late February through April 2013 in CDM Smith's Denver, Colorado treatability laboratory. The bench-scale treatability study included titrations, comparative container tests, and column tests utilizing various amendments and methods. MIW from the Danny T adit was collected from the Site in December 2012 and was utilized in the bench-scale treatability study. MIW was collected using 5-gallon cubitainers (total of 15 gallons collected) and shipped to the Denver laboratory for refrigerated storage until use in the study. In addition, a MIW sample was collected for laboratory analysis using appropriate containers and preservatives as described in the SAP (2013a) and shipped to the EPA Region 8 laboratory and Energy Laboratories in Helena, Montana for analysis. This sample documented the initial water chemistry at the start of the testing.

Because of the important factors listed in Section 1.3.1, pre-treatment of the MIW was a key focus of the bench-scale treatability study. The testing strategy included pre-treatment of the Danny T adit water by a combination of methods, followed by BCR treatment. Flow-through packed columns were utilized to test the pre-treatment methods, while the subsequent BCR treatments were tested using static containers. For the bench-scale treatability study, the MIW was tested as follows:

- *Step 1. Test the Effects of Oxidization:* Determine the effect of oxidation on the MIW metals concentrations prior to other treatment methods.
- *Step 2. Test the Effects of Increased pH:* Test pre-treatment by pH increase to 4.5 standard units (su) and conventional treatment by pH increase to 9.5 su with different alkaline materials using titrations.
- *Step 3. Conduct Hydraulic Testing of Substrates:* Test to determine the approximate porosity of materials utilized in the pre-treatment columns.
- *Step 4. Test Pre-treatment Options of Oxidized Water Prior to Treatment in the Biochemical Reactor:* Compare four variations of pre-treatments that included either alkaline addition to pH 4.5 su and/or reduction in oxidation state using flow-through columns.
- *Step 5. Test the Effectiveness of the BCR:* Test the effectiveness of BCR treatment in static container tests using the effluent from the four pre-treatment flow-through columns. The BCR substrate is identical for all four pre-treatments.

A schematic of the bench-test protocol is provided in Exhibit 2-1. Details of each testing step are provided in the following sections.

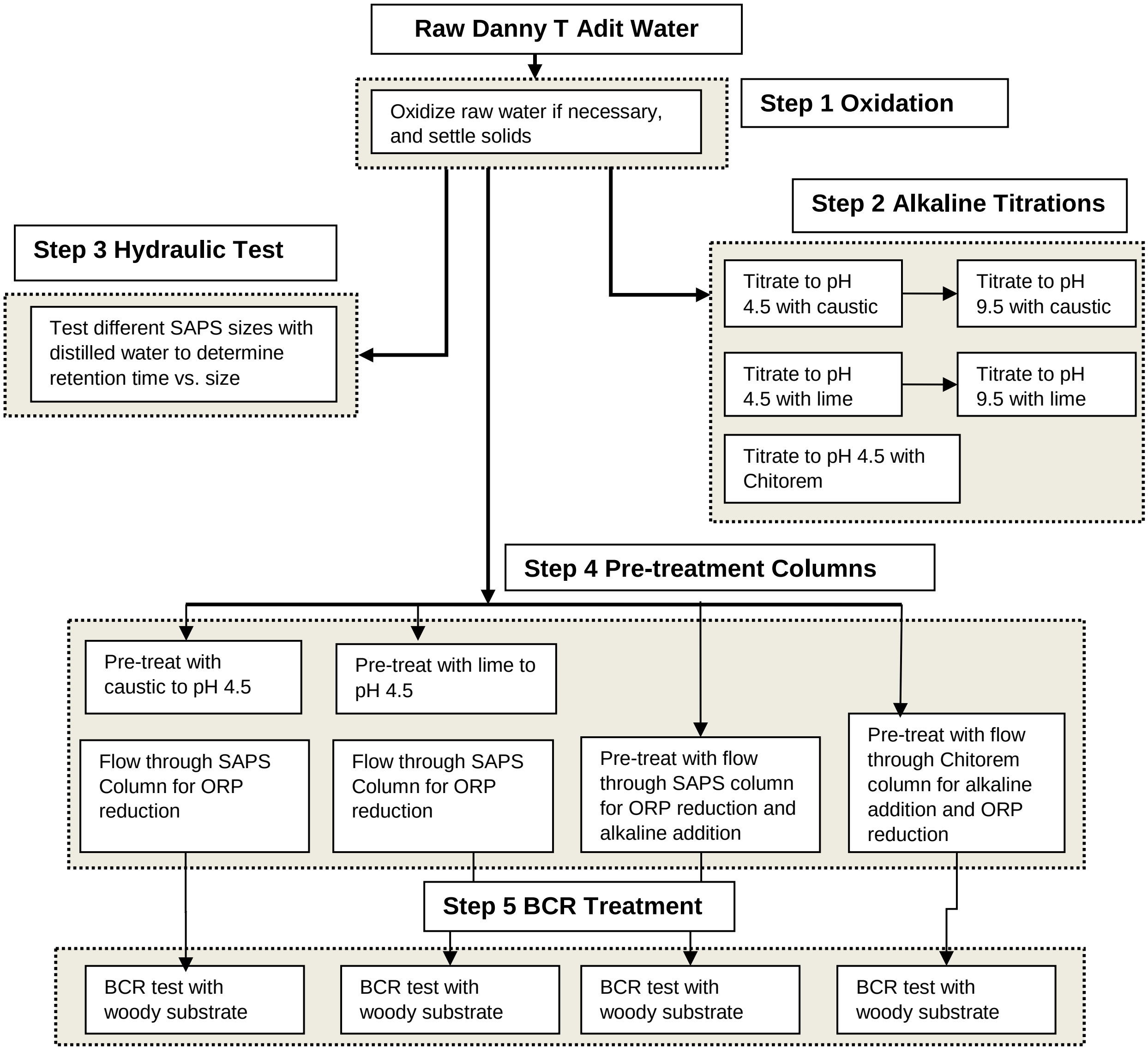

Exhibit 2-1. Schematic of Bench-Scale Protocol

2.1.1 Step 1 - Test the Effects of Oxidation

The first step of the bench test is oxidation of Danny T adit water (Exhibit 2-1). Danny T adit water pH was measured during startup of bench-scale work at 2.75 su. Although this pH is below the 3.0 su threshold for iron to significantly precipitate, an oxidation test was still conducted. Oxidation was completed by adding the water to an open-topped 1 liter (L) beaker placed on a magnetic stir plate. A magnetic stir bar was used to stir the solution. An aquarium pump was also used to bubble ambient air into the water. The stirring and air bubbling was conducted for approximately 2 hours. Temperature, specific conductivity pH, DO, and ORP were measured prior to and at the end of the oxidation test.

Following oxidation, the MIW was allowed to stabilize in the beaker without agitation to settle any iron precipitates that may have formed during oxidation. After settling, the water was filled directly into the sample containers using a peristaltic pump and submitted for laboratory analysis of total and dissolved metals, acidity, alkalinity, and anions. The sample for dissolved metals was filtered through a 0.45 micron in-line filter using a peristaltic pump. Metals, alkalinity, and anions were measured at the Region 8 EPA Environmental Services Assistance Team (ESAT) laboratory in Denver, Colorado. Acidity was measured by Energy Laboratories in Helena, Montana.

2.1.2 Step 2 – Test the Effects of Increased pH

Titration tests were performed on the oxidized MIW to increase pH to approximately 4.5 su Using sodium hydroxide (NaOH), calcium hydroxide ($Ca(OH)_2$), and Chitorem. Tests were also performed raising the pH to 9.5 su using NaOH and $Ca(OH)_2$ (lime). The objective was to reduce iron and aluminum concentrations and raise pH prior to BCR testing.

2.1.2.1 Pre-Treatment Alkaline Addition Via Titration

Pre-treatment with alkaline titrations was conducted as shown in Step 2 on Exhibit 2-1. Three different alkaline materials were used; a 25 percent by weight NaOH solution, 10 percent by weight $Ca(OH)_2$ solution, and Chitorem solid flakes.

Test titrations were conducted to determine the approximate amount of alkaline material required for the desired pH endpoint. For titration testing, 1 L of the adit water was added to a 1 L beaker and the alkaline material was added incrementally by mechanical pipet (for fluids) or spatula (for solids). For example, 20 to 30 microliter (μL) increments were common liquid doses throughout the titration testing. For the Chitorem dosing, an average of approximately 1.3 grams (g) of Chitorem were added for each increment. The titration solution was continuously stirred with a stir bar on a magnetic stir plate. The pH of the solution was measured continuously throughout the test as the alkaline material increments were added. After each increment addition, pH was observed until a stable value was achieved. The stable pH was then recorded and utilized to develop the titration curve for each reagent. Titration testing was considered complete when the pH value of each solution reached approximately 4.5 su. A photograph of the bench-scale titration setup is shown in Exhibit 2-2.

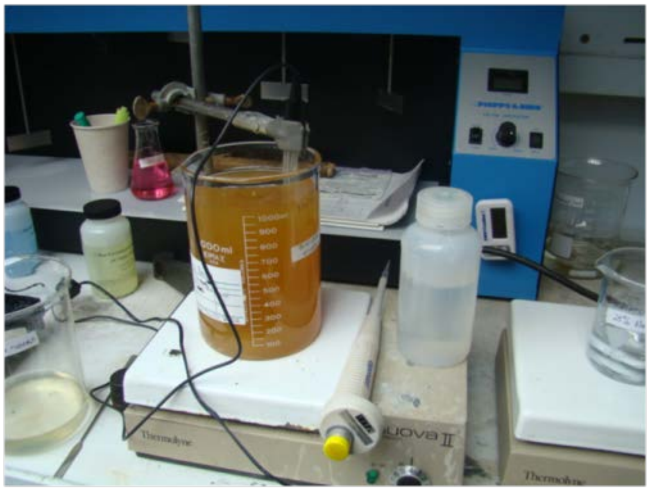

Exhibit 2-2. Titration bench test setup.

The SAP (CDM Smith 2013a) specified completion of two titrations for each alkaline material, each using a different amount of time between each titration increment. This approach was intended to test the effectiveness of Al and Fe removal at different reaction times. As a result of the limited total MIW volume available for the study, this duplicate titration step was not conducted. In addition, the procedure was modified to allow for adequate time between each increment for the pH to stabilize.

The sludge volume produced from the titration tests was measured using an Imhoff cone settling test. The solution was maintained on the stir plate until the cone was ready, and then the suspended solution was poured directly into the cone as quickly as possible. Solids were allowed to settle for 1 hour and then the sludge volume was recorded. After measurement of sludge, the settled water was pumped from the cone into appropriate sample bottles for laboratory analysis. Each of the three titration solution test samples were analyzed for total and dissolved metals, acidity, alkalinity, and anions. After sample collection the remaining settled sludge and water volume was allowed to remain in the cone for several hours to days to observe the compaction of sludge within the cone. Additional volume measurements were recorded periodically. Metals, alkalinity, and anions were measured at the Region 8 EPA ESAT laboratory in Denver, Colorado. Acidity was measured by Energy Laboratories in Helena, Montana.

The SAP (CDM Smith 2013a) indicated that the total suspended solids (TSS) sample would be collected from the titration test solution; however, due to limited sample volume this sample was not be collected. Therefore, TSS samples for the pre-treatment methods to pH 4.5 su by NaOH and $Ca(OH)_2$ were later collected from the larger 8 L pre-treatment batches that were created as part of Step 4 (see Exhibit 2-1).

2.1.2.2 Conventional Alkaline Addition via Titration

Identical titration tests were performed on the oxygenated adit water using a 25 percent NaOH solution and a 10 percent $Ca(OH)_2$ solution and a target endpoint pH of 9.5 su. This titration was intended to simulate the metal removal that could be obtained through a conventional treatment process for an acidic MIW. Sludge production was recorded and the settled water was sent for the same laboratory analysis as for pre-treated samples.

2.1.3 Step 3 - Conduct Hydraulic Testing of Substrates

The approximate porosity of the SAPS substrate to be tested as a pre-treatment, was measured. Columns were constructed and filled with a known volume of substrate material and then a measured volume of water was added to the columns until the material was completely saturated within minimal air voids. Two columns were tested with different volumes of substrate material (one twice as much volume as the other) to test the effect of the volume change on the porosity measurement. The SAPS substrate composition is presented in Section 2.1.4.3.

Columns to measure approximate porosity were constructed of 1.5 inch diameter clear plastic tubes with steel top and bottom plates, rubber gaskets to provide a water tight seal against the steel plates, and a threaded rod secured with nuts and washers to the top and bottom plates. Two tube lengths were used, approximately 10 inches and 15 inches in length. After filling the tubes with equivalent percentage volumes of SAPS substrate materials, the columns were sealed by tightening the nuts on each threaded rod (total of four rods used). The bottom steel plate was also fitted with a small ball valve and tubing. The top layer of the SAPS substrate was marked with a sharpie marker in anticipation of floating of the substrate after water addition and to determine the total volume of water to add.

Initially attempts were made to saturate the columns using only gravity fed water; however, the suction pressure created by the small diameter column tubes prevented saturation. A peristaltic pump was used to pump water into the columns. After connection of appropriate tubing to the columns, the effluent valve (on the column bottom) was opened, and the pump was turned on to force water through the column. Effluent water was collected in a beaker and recycled with the pump until saturated conditions were observed (limited visible air pockets) at a water level up to the original marked substrate layer. The total water used to saturate the column was measured to provide a total volume balance and calculate approximate porosity.

The SAP (CDM Smith 2013a) indicated that a hydraulic drain test would also be conducted to record the amount of time required to drain the columns by gravity. Upon completion of the porosity test the effluent valve was opened; however, likely due to the suction pressure of the columns water would not drain by gravity.

Exhibit 2-3. Large batch neutralization pre-treatment test setup.

2.1.4 Step 4 – Test Pre-treatment Options Prior to Treatment in the BCR

Pre-treatment of the Danny T water was conducted prior to the BCR tests using a combination of alkaline pre-treatment and/or SAPS columns as follows:

- Pre-treatment first with NaOH solution to pH 4.5 su, followed by flow through a SAPS column (Column #1)
- Pre-treatment first with $Ca(OH)_2$ solution to pH 4.5, followed by flow through a SAPS column (Column #2)
- Flow though the SAPS column with raw oxidized Danny T adit water (Column #3)
- Flow through a Chitorem column (Column #4)

2.1.4.1 Liquid Alkaline Addition Pre-treatment

Prior to SAPS columns #1 and #2, raw oxidized Danny T adit water was pre-treated with both the NaOH and $Ca(OH)_2$ reagents. The liquid alkaline reagent dosages determined for the 1 liter (L) titrations in Step 2 were applied to large 8 L batches mixed in 5 gallon buckets with a mechanical stirrer. Eight-liter batches pre-treated to approximately pH 4.5 su were created for both liquid reagents. pH was recorded after sufficient reaction time had occurred. A photograph of the large batch neutralization process is shown in Exhibit 2-3.

As discussed in Section 2.1.2.1, samples for TSS were collected from these large batch pre-treatments. The TSS samples were collected at the end of the titration after pH had stabilized and while the mechanical mixer was still in operation to suspend solids.

2.1.4.2 SAPS and Chitorem Column Setup

SAPS and Chitorem columns for the bench-scale treatability study were constructed with 5.5-inch inner diameter (ID) by 12-inch tall clear plastic columns. Columns consist of a central clear plastic cylinder and a sealed top and bottom plate. The top and bottom sealed plate (with a rubber gasket) both contain a central 3/8-inch female pipe threaded inlet and a radial distribution plate to distribute influent flow and collect effluent flow. The top and bottom plates are the same design, to allow operation of upflow or downflow columns as desired. For the bench-scale study, columns were operation as upflow. A photograph of a pre-saturated SAPS column is shown in Exhibit 2-4 (prior to addition of MIW).

Influent MIW was stored in 5-gallon buckets and pumped into the columns using a cartridge pump. The cartridge pump was capable of a wide range of flow rates and was capable of operating 8 separate flow lines at the same time. Silcone microtubing was used to operate the pump MIW flow. The microtubing was converted to 1/4-inch poly tubing using poly adapters to the feed buckets and to the column inlets. The column inlet and outlet consisted of 3/8-inch male pipe thread to barbed fittings. All threaded connections were sealed with teflon tape and all tubing connections were secured with hose clamps.

Exhibit 2-4. Pre-saturated SAPS column.

The effluent line (at the top of the columns) was fed into a 2 L plastic wide mouth sample collection bottle as shown in Exhibit 2-5. The bottles were modified to allow flow to passively move through the bottle or fill up to 2 L of sample during the column operation, while maintaining an inert atmosphere above the sample with argon gas. Inlet and outlet holes were drilled through the top cap and bottom of the bottle and 3/8-inch male pipe thread to barb fittings were installed. The male pipe thread end of the fittings were inserted into the holes and secured on all sides with waterproof silicone sealant. The outlet fittings (on the bottom) were connected to a ball valve to allow the sample container to fill as necessary. An additional hole was drilled through the top of the bottle and a ¼-inch tubing line was inserted that was connected to an argon gas tank. A gas line manifold was connected to the argon tank which allowed the argon flow to feed four lines simultaneously into each bottle throughout the duration of the column operation.

2.1.4.3 SAPS and Chitorem Substrates

SAPS substrate consisted of a compost and dairy cow manure mixture followed by a limestone layer as shown in Exhibit 2-4. The limestone utilized was screen reject product from a limestone quarry in Townsend, Montana, thus it contained mostly ¼-inch minus fragments and a large quantity of crusher fines. To reduce the over-reactivity of the columns from the crusher fines, the limestone material was further sieved through a 10 mesh (2 millimeter) sieve to remove fines. The larger particles were retained and utilized for the study. The manure was obtained from a small private dairy near Helena, Montana. The compost utilized was EKO Compost Original obtained from a local hardware store in Denver, Colorado. A compost product from the Helena area was intended for the project; however, the supplier did not ship the materials to the Denver laboratory in time for the study.

Prior to loading materials into the columns, material densities were measured. A quantity of each substrate material was added to an open top tared beaker and the weight was recorded. Because of variable densities, variable volumes were added to beakers ranging from 125 ml up to 1 L. Densities of materials used in the SAPS columns and Chitorem column are provided in Exhibit 2-6.

The ratio of organic materials (compost and manure) to limestone was designed to be approximately 15 percent to 85 percent by weight or 25 percent to 75 percent by volume. Columns #1, #2, and #3 were each filled with a mixture of 450 grams (g) each of compost and manure. The compost and manure were added to a bowl and mixed thoroughly and then packed into the column. Following the compost and manure, 5,011 g of limestone was added to each column. The total height of the materials within the column was approximately 10.0 inches. The compost/manure mixture height in the 3 columns was approximately 2.5 inches and the limestone layer was approximately 7.5 inches.

Exhibit 2-5. Effluent sample collection bottle.

Exhibit 2-6. Calculated Densities for Column Substrate Materials

Substrate	Calculated Density (g/ml or kg/L)
Compost	0.68
Dairy Manure	1.12
10-mesh plus limestone	1.54
Chitorem	0.80
Construction sand	1.88

Chitorem substrate consisted of a mixture of Chitorem and an inert construction sand. Construction sand was obtained from a local hardware store in Denver, Colorado. The ratio of Chitorem to sand was designed to be approximately 20 percent to 80 percent by weight based on recommendations by the manufacturer. For Column #4, 1,236 g Chitorem and 4,944 g construction sand were mixed together in a bowl and added to the Column. However, out of the total 6,180 g mixture, only 4,920 g were added to the column. The height of the dry Chitorem/sand mixture within the column was 8.25 inches.

2.1.4.4 Column Operation and Sampling

A photograph of the completed and operational column test setup is provided in Exhibit 2-7. After addition of the substrate materials, the top plates were securely installed into the gaskets and the threaded rods were tightened. Columns could not be saturated using the cartridge pump due to the back pressure within the sealed columns; therefore, a peristaltic pump was utilized. The peristaltic

Exhibit 2-7. Completed and operational column test setup.

pump was operated on high flow initially to overcome the pressure and then at a slower flow rate to saturate the columns. Effluent was discharged for a few minutes once the columns were initially full and then the cartridge pump inlet lines were reconnected.

The columns were operated for a total of approximately 20 hours at a steady state flow rate with the cartridge pump. Given the short duration schedule of operation and volume of water to pump through each column, the columns were operated at the highest possible flow rate attainable with the cartridge pump. Prior to connection to the columns, a flow rate test indicated the micro tubing size and type of cartridge pump provided a maximum flow rate of 9 millimeters/minute (ml/min).

At approximately 12 hours after flow through with the cartridge pump, a flow rate test was conducted on each effluent line. The flow rate test indicated a flow rate range of 7.0 to 8.0 ml/min between the different columns. Three flow rate tests were conducted for each column to obtain an average value as shown in Exhibit 2-8 below.

After approximately 17 to 18 hours after flow through, samples were collected from each column. CDM Smith laboratory measurements were collected first which included pH, specific conductivity, temperature, ORP, and DO. Samples for offsite laboratory analysis were then collected for total and dissolved metals, acidity, alkalinity, and anions. Metals, alkalinity, and anions were measured at the Region 8 EPA ESAT laboratory in Denver, Colorado. Acidity was measured by Energy Laboratories in Helena, Montana.

Exhibit 2-8. Column Effluent Flow Rate Test

Column #	Flow 1 (ml/min)	Flow 2 (ml/min)	Flow 3 (ml/min)	Average (ml/min)
1	7.4	7.2	7.4	7.33
2	7.0	7.4	7.4	7.27
3	7.8	8.0	7.8	7.87
4	7.2	7.6	7.6	7.47

After 20 hours of flow through, approximately 2.5 L of pre-treated water was drained from the sample collection bottles into each of the four BCR test containers.

Based on the column dimensions and measured height of SAPS substrate materials, the total volume of materials placed in the SAPS columns #1, #2, and #3 was approximately 238 cubic inches (in^3). For the Chitorem Column #4 the volume was 196 in^3. Using these volumes, the column flow rate, and porosities, the retention time of water moving through the columns was calculated. As indicated in the hydraulic test results, the SAPS substrate effective porosity was measured at approximately 53 percent. A hydraulic test on the Chitorem/sand mixture was not conducted. However, a recent study by EPA's Office of Research and Development (ORD) performed a bromide tracer porosity test on the standard 20/80 Chitorem/sand mixture. This study indicated an effective porosity of 29 percent (Al Abed 2013). Variability between the types of sand utilized and Chitorem lot batches are expected; however, this measured effective porosity is a reasonable estimate in lieu of other available data.

For the SAPS columns #1, #2, and #3 the hydraulic retention time was calculated to be approximately 4.6 hours. This calculation utilized an average flow rate of 7.5 ml/min, the 238 in^3 substrate volume, and 53 percent porosity. For the Chitorem Column #4 the hydraulic retention time was calculated to be approximately 2.1 hours. This calculation utilized the same flow rate, the 196 in^3 substrate volume, and 29 percent porosity.

2.1.5 Biochemical Reactor Testing (Step 5)

The last step in the MIW treatment process was static BCR container tests. A total of 4 tests were completed for BCR treatment, one for each of the pre-treatment approaches described in step 4. Each BCR container test contained the same type and quantity of substrates. These substrates were selected based on literature research and CDM Smith's experience with testing at other sites. The following BCR substrate mixture was implemented (on a weight basis):

- 10 percent sawdust
- 20 percent wood chips
- 10 percent well-decomposed organic compost
- 20 percent hay
- 30 percent ¼-inch limestone chips (screened out less than 10 mesh fines)
- 10 percent fresh dairy manure

The same compost, manure, and limestone sources were utilized for the BCR substrate as described above the SAPS. Sawdust and wood chips materials were obtained from a lumber company in Clancy, Montana. Hay was obtained from a local farm and ranch supplier in Denver, Colorado.

Static BCR tests were conducted using 1 gallon plastic carboys with spigot caps. The substrate components were mixed thoroughly in large bowls and placed into the carboys. Approximately 2.5 L of pre-treated water was added to each container. Following introduction of the pre-treated water, argon gas was bubbled into each container to minimize oxygen presence. The containers were then collapsed to minimize air space and sealed.

After 1 week of incubation, significant gas development was observed within the carboy containers. To prevent further expansion of the containers, gas was vented by opening the spigots and recompressing the containers. The containers were not opened again until sample collection. Samples for analysis of CDM Smith laboratory parameters were collected after exactly 5 weeks of incubation. Samples were analyzed for pH, specific conductivity, temperature, ORP, DO and HACH sulfide.

One week later (after 6 weeks of incubation), the same laboratory parameters were collected along with HACH alkalinity. At this time, offsite laboratory samples were also collected for dissolved metals, acidity, alkalinity, anions, sulfide, biological oxygen demand (BOD), and TSS. Samples were submitted to Energy Laboratories in Helena, Montana, for analysis.

2.2 Pilot-Scale Treatability Study

This section addresses the pilot-scale construction and operations, including collection and routing of MIW, pilot-scale treatment description and process flow design, system startup and shutdown, and sampling and maintenance activities. The pilot-scale treatability study was conducted from June through September 2013. The treatment system was constructed in mid-June 2013 and system startup completed in mid-July. The treatment system operated through the end of September 2013 but the final sample collection occurred on September 16, 2013. A final sample collection scheduled for the first week of October was canceled due to the partial government shutdown.

2.2.1 Collection and Routing of MIW

MIW was collected from the Danny T adit for use in the pilot-scale treatability study. A small collection basin approximately one to two feet deep was constructed by creating an earthen and rock berm just down gradient of the adit portal. As shown in Exhibit 2-9, a 2-inch diameter by 10-foot long polyvinyl chloride (PVC) pipe was installed through the earthen berm to collect the ponded MIW. Additional 2-inch PVC overflow pipes were installed through the berm to provide a pathway for water in the case of higher flow or stormwater event. Overflow pipes were installed at approximately 3 inches (middle) and 6 inches (upper) above the treatment system inlet pipe. A small spillway was constructed in the earthen berm at an elevation above the two overflow pipes. At the time of installation in June, all of the collected adit flow was entering the treatment system collection pipe.

The berm was constructed of local fill materials adjacent to the adit portal. Powdered bentonite was incorporated around each of the pipe penetrations to provide added water detention and minimize leakage. The earthen berm was lined with boulders and cobbles on the outside for structural support.

A 2-inch PVC ball valve was installed on the end of the 2-inch PVC pipe to control flow to the treatment system. Approximately 80 feet of 2-inch high density polyethylene (HDPE) pipe was connected to the ball valve to route MIW to the feed tank. All piping up to the feed tank followed the natural downslope topography which was more than adequate to ensure gravity flow.

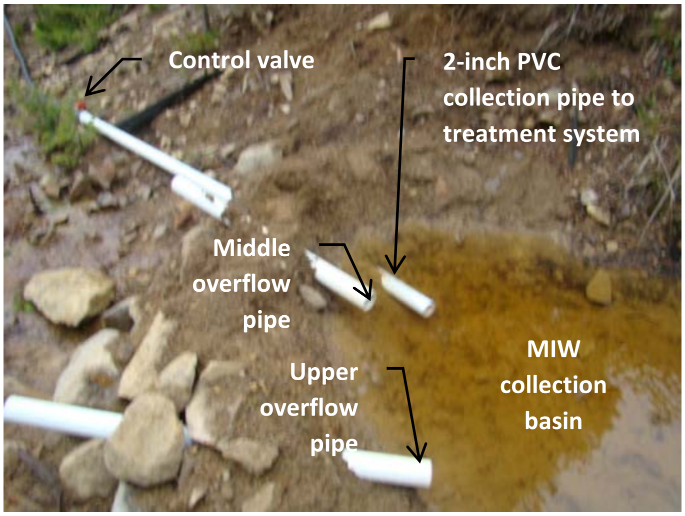

Exhibit 2-9. MIW collection basin at Danny T Adit.

The 2-inch HDPE pipe was connected to the feed tank using a bulkhead fitting, short pipe nipple, and a threaded coupling as shown in Exhibit 2-10. The feed tank supplied MIW to the treatment system, settled some of the iron precipitates in the raw water, and overflowed excess water not used in the treatability study. The MIW tank outlet to the treatment system was a 1-inch HDPE pipe connected to a bulkhead fitting, short nipple and threaded

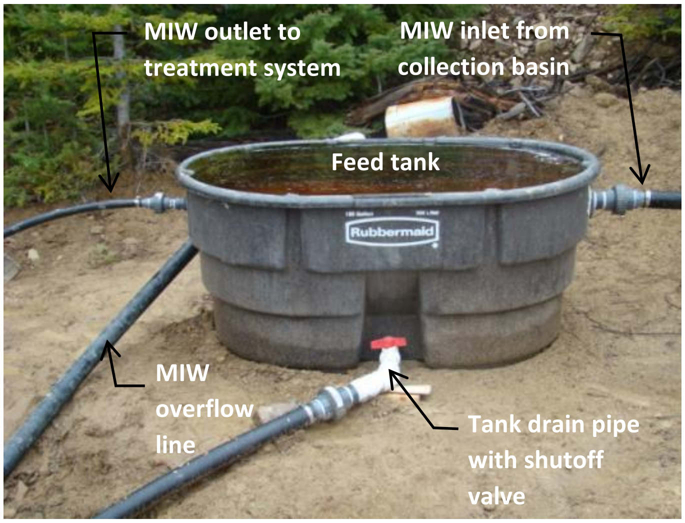

Exhibit 2-10. MIW overflow tank.

coupling. The tank overflow consisted of 2-inch PVC pipe installed in a bulkhead fitting near the tank bottom. This location was chosen to improve circulation within the tank and avoid stagnation.

The 2-inch PVC overflow consisted of two elbows, a riser pipe, a horizontal pipe, and transition fittings to 2-inch HDPE pipe. The horizontal section of the overflow assembly was set at an elevation of approximately 2 inches above the MIW outlet to the treatment system. Exhibit 2-11 shows the overflow pipe connection.   Although not shown on the exhibit, the top of the tank was covered with ¾-inch oriented strand board (OSB) to minimize rain infiltration during the study.

The tank drain was a 1 ½-inch PVC ball valve installed in a pre-tapped hole near the tank bottom. The tank can be drained if necessary for maintenance or during system winterizing. All penetrations through the tank wall, except the drain valve, were installed using threaded bulkhead fittings. Large hole saws and a ½-inch electric drill were used to drill the bulkhead fitting holes. Piping connections were made using threaded PVC pipe nipples, threaded couplings, and thread by hose barb adaptors. Stainless steel worm drive hose clamps were used to attach the HDPE pipe to the hose barb fittings. All threaded connections were sealed with Teflon® tape.

The drain and overflow pipes were routed into a 6-inch PVC pipe culvert buried under the access road. The culvert was installed to maintain equipment access for other site activities near the adit portal. At the culvert outlet, overflow water is diverted into a small channel that empties over the lip of the waste rock dump. The 1-inch HPDE supply pipe is routed alongside the access road to the treatment system.

2.2.2 Pilot-Scale Treatment Description and Process Flow Design

This section provides the process flow details of the pilot-scale treatment system. A process flow diagram is shown as Figure 2.2-1. The basic process flow consists of a feed tank with overflow as described above, a MIW influent timer valve, head tanks, head tank outlet timer valves, 35-gallon or 55-gallon pre-treatment barrels, pre-treatment effluent timer valves where applicable, pre-treatment effluent lines and sample ports, 55-gallon BCR barrels, and

Exhibit 2-11. MIW overflow tank showing overflow pipe.

BCR effluent lines and sample ports. To achieve gravity operation, head tanks and pre-treatment barrels were constructed on raised scaffold planks. The BCR barrels were installed on a wood platform at ground level. Timer valves on the main feed tank and head tanks opened at regular intervals throughout the day to provide a batch of MIW to each pre-treatment or BCR barrel.

As described in the SAP Addendum (CDM Smith 2013b), the design for the pilot study was based on a 24-hour hydraulic retention time for the BCRs. The Darcy's Law equation was utilized to calculate the target flow rate using the assumed retention time, assumed substrate porosity, and designed volume of substrate to be utilized in each barrel. The batch volume contained in each head tank was originally set at approximately 9 L and the timer valves were set to open on 4 hour intervals. This equates to an average MIW flow rate of 54 L per day (9 L per batch times 6 batches per day) or 37.5 ml/min. As the study progressed, batch volume modifications were made. These modifications and other activities and system changes are described in Section 2.2.4.2 Operations and Maintenance.

2.2.2.1 Scaffold and Platform Construction

A steel scaffold assembly, 5-foot wide by 7-foot long by 5-foot tall, was field installed to support the treatment system. A photograph of the constructed scaffold and platforms is shown in Exhibit 2-12. A suitably sized area adjacent to the existing road was cleared and leveled using a track excavator in conjunction with other site work. The scaffold was placed on two 2-inch by 8-inch wood planks to reduce potential settling. Approximately 2-inch deep trenches were hand dug and leveled with pea gravel before setting the wood planks. The scaffold was installed on the wood planks and further leveled by adjusting the threaded rods on each baseplate.

Two standard scaffold planks were installed on the lowest cross bar, one to support the pre-treatment barrels, and one to provide personnel access for construction, sampling, and maintenance. To support the pre-treatment barrels (potentially over 1,000 pounds), one scaffold plank was reinforced with a truss structure. The truss structure consisted of a 2-inch by 4-inch wood box frame and vertical supports placed on 8-inch centers across the length of the scaffold plank. The truss structure was built on 4-inch by 4-inch wood footers set and leveled on bare ground. Construction was completed with 3-inch framing nails.

Exhibit 2-12. Completed scaffolding and platforms during treatment system construction.

To install a roof over the scaffolding, four 2-inch by 6-inch boards were bolted to each of the scaffold frame corners. Two of the vertical boards were 6-inches taller to provide a sloped roof. Two horizontal boards were screwed to the vertical boards to support the roof rafters. Cleats were screwed to the vertical boards as added support for the horizontal boards. The roof was pre-assembled on the ground from 8-foot long 2-inch by 4-inch rafters. The roof panel was sheeted with two 4-foot by 8-foot sheets of 1/2-inch OSB. The center seam was sealed with silicone caulking on the upper surface.

The roof frame was manually hoisted into place and attached to the horizontal boards using galvanized "hurricane" clips, nails, and screws. Diagonal 2-inch by 4-inch bracing was added on each end for support. For wind protection, the roof was secured at all four corners with ratchet tie-down straps. The straps attached to either adjacent trees or were secured with 2-foot long rebar stakes driven into the ground.

On the upper scaffold cross bar, a head tank support platform was constructed using 2-inch by 4-inch boards nailed to two 8-foot long 4-inch by 4-inch beams. The platform frame provides spaces between supports for pipe connection into the bottom of the head tanks. Timer valves were installed below the head tank supports.

A platform of wood 4X4's was constructed outside the scaffold to support the BCR barrels. After hand excavating a shallow trench, pea gravel was added as necessary, and the two 4x4 footers were installed and leveled. The BCR barrels were placed directly on the footers.

2.2.2.2 Head Tanks

Exhibit 2-13 shows the installed head tanks and associated piping, valves, and fittings. The 1-inch HDPE feed line supplies flow to the treatment system. The feed line between the feed tank and pilot equipment was routed along the ground surface. Near the scaffold, 90 degree elbows route the feed line to the upper scaffold platform. On the platform, the feed line connects to a 1-inch PVC ball valve for manual shutoff and flow control. Downstream of the valve, the feed line converts to 1/2-inch schedule 40 PVC pipe, which tees for a raw water sample tap. The sample tap consists of a 1/2-inch PVC ball valve. Downstream of the sample tap tee, transition fittings connect the PVC pipe to a 3/4-inch hose thread adaptor and the inlet timer valve, a battery powered Rainbird® garden irrigation valve. To control treatment system flow in batches, this timer valve was set to open automatically every 4 hours. It remained open for 15 minutes, long enough to fill the head tanks to overflowing.

The timer valve outlet is an adaptor that converts back to 1/2-inch PVC pipe to form a supply header. The inlet pipe header spans the length of the platform and supplies all four head tanks. PVC ball valves and slip unions were installed prior to each head tank to provide manual shutoff should it be necessary to disconnect a head tank.

The overflow line for each head tank was located 10-inches from the bottom, approximately 1 inch higher than the inlet, to maintain a flooded inlet condition. The overflow consists of 1-inch PVC pipe connected to a male thread adaptor. The male adaptor was inserted through a hole in the tank wall and secured with a plastic jam nut. A female threaded adaptor was glued to the overflow pipe stub and a thread by hose barb adaptor was installed to transition to the 1-inch HDPE pipe. To keep the area around the pilot dry and uncontaminated, the overflow tubing was routed down the side of the scaffold and into a 4-inch corrugated HDPE carrier pipe. The carrier pipe parallels the road for approximately 100 feet and discharges bypassed water down the steep hillside at the same location where the MIW was previously discharging. This configuration allows each head tank to fill completely and overflow each time the inlet timer valve opens. Once the feed tanks are full, additional water overflows out of the head tanks until the timer valve closes.

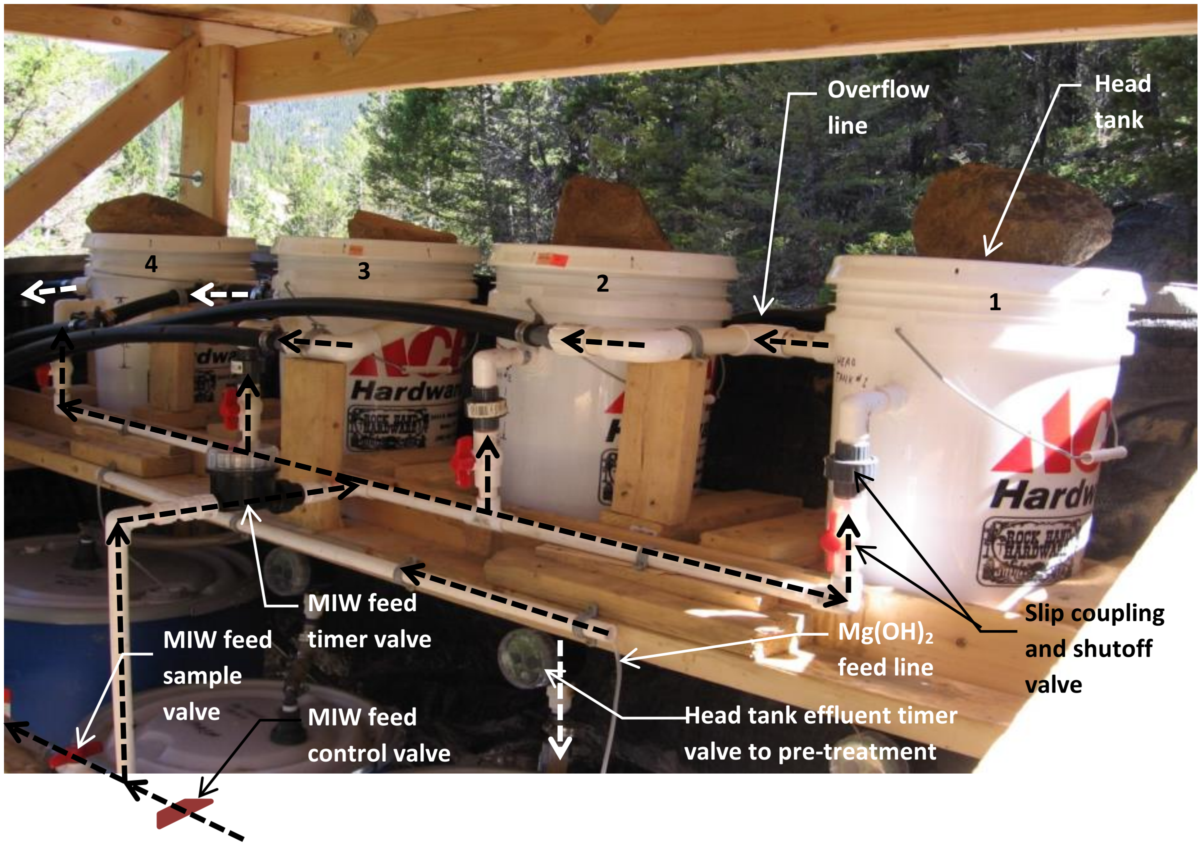

Exhibit 2-13. Head tanks and appurtenances.

Head tank effluent piping was connected to 1/2-inch bulkhead fittings installed in the bucket bottoms. Short lengths of 1/2-inch PVC pipe and hose thread adaptors provide the transition to the head tank outlet timer valves. To provide the correct batch volume, 3.75-inch long riser pipes were threaded into the bulkhead fittings inside the buckets. The riser length was adjusted so each head tank contained 9 L of water between the overflow elevation and the riser outlet elevation. The head tank outlet timer valves were programmed to open 15 minutes after the feed inlet timer valve closed to make sure the head tanks were completely full prior to discharging the 9 L batch of MIW into each pre-treatment or BCR barrel. The head tank outlet timer valves were set to remain open for 15 minutes on four hour intervals which provides an average flow rate of 37.5 ml/min.

The head tanks were made from 5-gallon plastic buckets fitted with plastic lids. All penetrations through the buckets were made by drilling with an appropriate size hole saw. Side penetrations for the MIW inlet and overflow were secured with threaded PVC conduit jam nuts. All threaded connections were sealed with Teflon® tape. Bucket penetrations were sealed with silicone waterproof sealant.

2.2.2.3 Pre-treatment Barrels

Pre-treatment components and system implementation are described in the following sections. Pre-treatment was provided for three of the four treatment trains. As shown on Figure 2.2-1, alkaline addition pre-treatment was installed downstream of head tank 4 (flow line 4), Chitorem pre-treatment was installed downstream of head tank 3 (flow line 3), and SAPS pre-treatment was installed downstream of head tank 2 (flow line 2). Flow from head tank 1 (flow line 1) was fed directly into BCR1 without pre-treatment. The head tank locations and numbers are shown in Exhibit 2-13. The pre-treatment test design generally mirrors the bench-scale test design but at a larger scale and using the continuously draining water from the mine adit. Based on the bench-scale results, it was determined that alkaline pre-treatment prior to a SAPS was not a necessary step, and therefore not tested in the pilot study. Line 1 with no pre-treatment provides a control to compare each of the pre-treatments trains.

Alkaline Addition Pre-Treatment

Alkaline addition was conducted using a magnesium hydroxide ($Mg(OH)_2$) solution. The complete pre-treatment system required the use of a solar charger and battery-powered dosing pump, timer switch, slurry mixer, a $Mg(OH)_2$ stock tank, and associated piping and tubing. This section focuses on the alkaline addition system. Further details on the solar power system are provided in Section 2.2.2.5. The process operated sequentially with a batch of $Mg(OH)_2$ solution fed into the 55-gallon pre-treatment barrel, followed by a batch flow of influent MIW at timed intervals, a set reaction time inside the reactor (static flow condition), and an effluent timer valve that drained the treated water into a subsequent BCR barrel.

A 60 percent concentration by weight $Mg(OH)_2$ solution was purchased in liquid form, diluted in batches at a rate of 1 part solution to 15 parts distilled water, and placed in the stock tank. This dilution equates to approximately 6.2 percent by weight solution. The stock tank was made from a 5-gallon plastic bucket. The metering pump was a Masterflex C/L® variable speed peristaltic pump. A short length of suction tubing was connected to the metering pump and secured near the bottom of the stock tank inside a length of 1/2-inch PVC pipe. The pipe was secured to the tank wall using a male threaded adaptor and conduit jam nut. The metering pump fed the $Mg(OH)_2$ solution through 2.79 millimeter Tygon® tubing to the 55-gallon pre-treatment barrel.

Because $Mg(OH)_2$ solution is a slurry, the solution must be mixed to keep the solids in suspension. The mixer was purchased from Cole Parmer (item number T-50402-10). The mixer was equipped with a 12-inch long 316 stainless steel shaft and two blade propeller-type impeller. Initially, the mixer was operated continuously 24 hours per day at a speed setting of 4 on a scale of 1 to 10 to maintain the solution in suspension. This approach was later modified to save power consumption as described in Section 2.2.4.2.

The target feed rate of $Mg(OH)_2$ was designed to achieve a pre-treatment pH of approximately 4.5 to 5.5 su. During startup, 2 L of the influent MIW was titrated with the $Mg(OH)_2$ solution to the target pH (approximately 5.5 su). The titration was conducted in the field using a 2 liter bottle and mechanical pipet. Increments of the $Mg(OH)_2$ solution were added slowly over time, the solution stirred, and pH recorded until the target pH is reached. Following the titration, the solution was suspended and immediately poured into a 1 L Imhoff cone to measure the sludge volume production. The volume of sludge produced after a 1-hour settling was recorded, and the volume was scaled up to determine the approximate sludge volume that may be generated in the $Mg(OH)_2$ pre-treatment during the course of the pilot-scale treatability study.

The metering pump, controlled by the timer switch, operated every 4 hours, starting 5 minutes before the head tank outlet timer provided the MIW batch to the pretreatment barrel. The titration test indicated that a target dose of 120 ml of $Mg(OH)_2$ 15:1 diluted stock solution was needed for every 9 L batch of MIW. Since the minimum timer interval was one minute, the timer switch was initially set to operate the metering pump for 2 minutes at a flow rate of 60 ml/min. This set up delivered an approximate dose of 120 milliliters of solution for each 9 L batch of MIW. Changes to the $Mg(OH)_2$ mixing and dosing operation were implemented later and are summarized in Section 2.2.4.2.

The influent MIW enters the pre-treatment barrel through a 1/2-inch bulkhead fitting installed in the center of the 55-gallon barrel lid. The $Mg(OH)_2$ solution was fed into the barrel using 2.79 millimeter Tygon® tubing dripping into the 2-inch threaded opening in the barrel lid. Mixing of influent MIW and the $Mg(OH)_2$ solution was implemented passively, using a cascading effect from the batch of MIW entering the barrel. An upward-facing 2-inch PVC pipe and elbow were suspended near the top of the tank to collect the $Mg(OH)_2$ solution pumped prior to each MIW batch. The influent MIW was directed into the open-topped elbow causing a cascade of water to contact the $Mg(OH)_2$ solution, creating a passive mixing process. The purpose of the open-topped 2-inch PVC pipe and elbow is to isolate the dose of $Mg(OH)_2$ solution from contacting the remaining static water/sludge remaining in the tank in between each batch interval of MIW flow.

The pre-treatment barrel effluent assembly is shown in Exhibit 2-14. A 1/2-inch bulkhead fitting, piping, and timer valve were installed in the side of the barrel as the system effluent control. The bulkhead was 14 inches from the drum bottom to provide a sludge accumulation zone. PVC piping was attached to the bulkhead fitting, followed by a tee and sampling port, and then the outlet timer valve. The sampling port consists of a PVC tee and ball valve. The effluent timer valve was set to open 1 hour after the influent MIW entered the barrel to provide reaction and sludge settling time prior to discharge of the treated water to BCR 4. When the 9 liter batch of influent MIW enters the pre-treatment barrel, the water level in the barrel would rise and fall by this volume with each batch through the system. This maximum water elevation (with the 9 liter batch) was set in the field to be above the elevation of the BCR influent but high enough in the barrel to allow settling capacity of sludge. Following the timer valve, sufficient 1/2-inch braided PVC tubing was installed to reach the BCR barrel.

During operation, maintenance of the alkaline addition pre-treatment system was conducted. Maintenance activities and observations are provided in Section 2.2.4.2 below.

Chitorem Pre-Treatment

A Chitorem pre-treatment system was installed in a 30-gallon barrel. The barrel was filled with approximately 17.5 gallons of substrate material. Chitorem is a proprietary material from JRW Bioremediation, LLC which contains 30 percent by weight calcium carbonate, 40 percent protein, and 20 percent chitin (processed crab shell). The Chitorem also contains its own bacteria and over time the material disintegrates into tiny particles that produce carbonates (adds alkalinity).

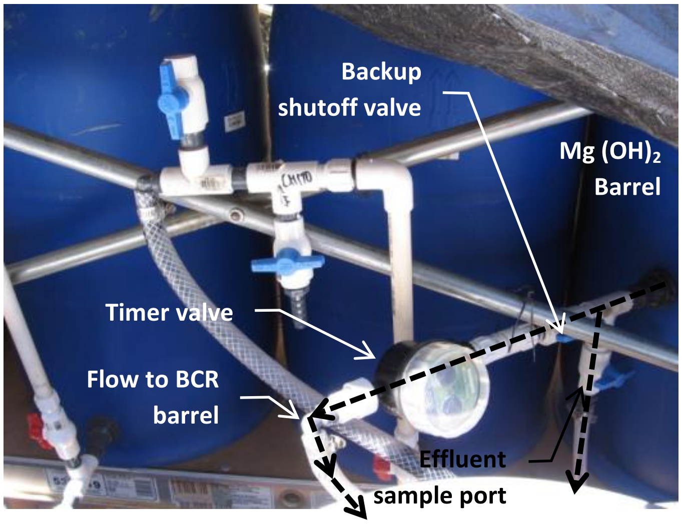

Exhibit 2-14. $Mg(OH)_2$ pre-treatment effluent assembly.

The Chitorem media was mixed with standard construction sand and pea gravel at a ratio of approximately 30 percent sand, 30 percent pea gravel, and 40 percent Chitorem by volume. The construction sand and pea gravel were purchased from a local hardware store. In addition, approximately 3.75 gallons of inert gravel was placed in the bottom of the barrel as the drainage layer. The mixture ratios are based on volume percent rather than mass percent during the bench-scale study. The volume percentages presented for the pilot-study are the same as the bench-scale mass percentages when converting using as-measured densities, except that gravel was substituted for one-half of the sand quantity to provide a greater porosity for the substrate. Percentages and volumes for the Chitorem pre-treatment are presented in Exhibit 2-16 below.

Standard dimensions for a plastic 30-gallon barrel used in the study are 18.6-inch inner diameter (ID) by 29.5 inches tall, with a total volume capacity of 32 gallons. However, the barrels have a beveled top and bottom, making the diameter slightly smaller at the top and bottom. Therefore, a direct correlation of barrel height to volume cannot be calculated across the entire barrel. Based on the ID along the center of the barrel, 17.5 gallons is equivalent to approximately 15 inches of substrate within the barrel. Including the bottom 3.75 gallons of inert gravel (approximately 3.4 inches), approximately 10.6 inches (10.8 gallons) remained available at the top of the barrel to provide a free water surface and headspace. Adequate headspace is necessary to allow room for the influent distribution gallery piping described below and to allow for additional free board for each batch of influent MIW.

MIW enters through a 1/2-inch bulkhead fitting installed in the barrel lid. The MIW influent flows through a pipe gallery to distribute flow across the substrate surface to limit preferential pathway formation and short-circuiting. The gallery consists of perforated 1/2-inch PVC pipe connected with a four-way cross in an X shape, with 3/32-inch to 1/4-inch holes drilled in the PVC pipe. Smaller holes were drilled closer to the inlet while larger holes were drilled near the outer ends of the pipe. No holes were drilled within the last 2 inches from the barrel wall. The intent of this method is to distribute MIW as evenly as possible across the barrel surface area.

The effluent pipe was installed through the side wall near the bottom of the Chitorem barrel. The effluent assembly is illustrated in Exhibit 2-15. An effluent pipe gallery similar to the influent pipe gallery was installed inside the barrel and embedded in the inert gravel drainage layer. The pipe gallery was connected to a 1/2-inch bulkhead fitting through the barrel side wall and connected to 1/2-inch PVC pipe and fittings. The effluent pipe array consists of a short run of PVC pipe, followed by an elbow, a backup shutoff ball valve (flow control valve for maintenance),

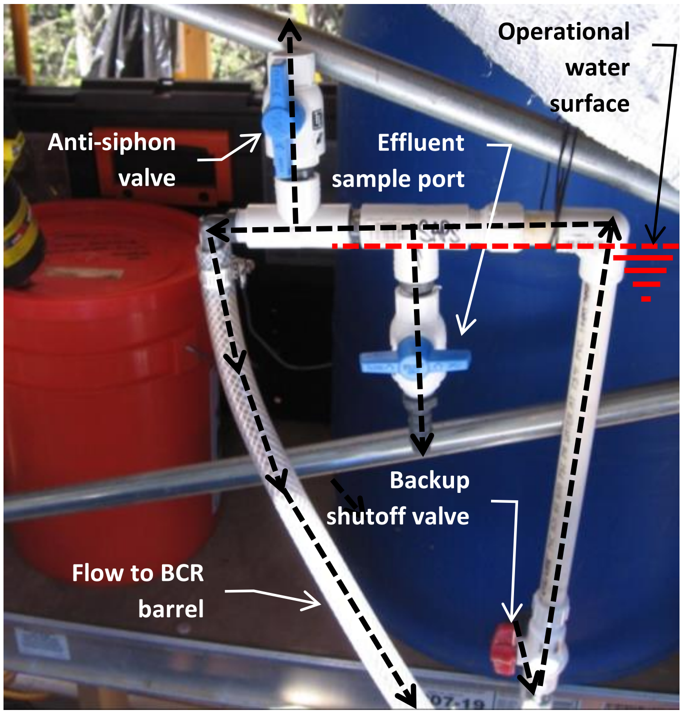

Exhibit 2-15. Pre-treatment effluent assembly.

and a vertical riser pipe that reaches the top of the operational water surface. This elevation was set at approximately 22 inches, which provides 7 inches of space for the influent MIW batch and space for the influent distribution gallery. This design provides a constant water surface elevation of about 3-4 inches above the substrate layer (at approximately 18 to 19 inches), ensuring that anaerobic and saturated conditions remain throughout the treatability study. At the 22 inch height, the vertical riser pipe has an elbow to route flow horizontally, followed by a sampling port (PVC tee and ball valve), an anti-siphon port (PVC tee and ball valve), and then converts to braided PVC hose connected to the BCR barrel influent. The anti-siphon valve remains open during treatment system operation. Without the anti-siphon valve, each barrel would drain itself through a siphon effect.

SAPS Pre-Treatment

The SAPS pre-treatment system was the same as the Chitorem pre-treatment system, except the Chitorem substrate was replaced with the SAPS substrate mixture. The SAPS substrate consists of 0.75-inch to 1.5-inch size limestone gravel, overlain by a manure and compost layer. By volume percent, the manure/compost layer consists of approximately 25 percent of the volume (5.4 gallons), and the limestone consists of approximately 75 percent of the volume (13.1 gallons). The compost and manure mixture was split evenly based on volume (2.2 gallons for each material). In addition, approximately 3.75 gallons of inert gravel was placed on the bottom of the SAP reactor as the drainage layer. Percentages and volumes for the SAPS pre-treatment are presented in Exhibit 2-16 below.

2.2.2.4 BCR Barrels

This section presents the substrate composition and BCR barrel construction.

Substrate Composition

The BCR substrate percentages and the SAPS and Chitorem pre-treatment substrate percentages are provided in Exhibit 2-16. Based on the bench-scale study results, it was decided to utilize a similar BCR substrate composition, but without the use of hay. Previous research by Hiibel et al., 2008 and Reisman (personal communication 2013) have shown that hay is not as readily degradable as once thought, and may not be an effective component of the BCR woody substrate mixture. Based on this research and designer preference, hay was removed from the BCR mixture and replaced with increased limestone, manure, and wood chip/sawdust percentages.

Based on experience at other sites, it was decided to implement the design and mixing of the substrates using a volume percentage basis. Calculations performed for bench-scale studies relied on laboratory-measured density of materials, percent calculations by weight, and conversion to a volume. Because densities and porosities of different materials are widely variable, a weight basis design can lead to uncertainties in the planning and purchasing of required materials. Planning and implementing the BCR treatment on a volume basis allows for more accurate prediction of the actual material volumes required, and makes subsequent scaling to a larger treatment system much easier.

The key component of the BCR treatment is the substrate utilized as an electron donor for the SRB. Additionally, a suitable source of SRB must be present; often the bacteria are contained within the organic material to be used as a partial substrate (such as manure), but other sources (such as soils from the mine site) may provide SRB plus additional bacteria necessary for breakdown of organic materials (e.g., cellulosic degradation). A common mixture of substrates was selected based on literature research and CDM Smith's experience with testing at other sites.

Exhibit 2-16. BCR and SAPS Barrel Substrate Percentages and Volumes

	BCRs 1 through 4			Chitorem Pre-Treatment		SAPS Pre-Treatment		Volume Totals	
	Substrate Mix (v/v percent)	Volume (gallon)	Total Volume (gallon)	Substrate Mix (v/v percent)	Volume (gallon)	Substrate Mix (v/v percent)	Volume (gallon)	Total Volume (gallon)	Total Volume (CF)
Substrate									
Sawdust	16.5	5.25	21.00					21.00	2.81
Wood chips	33.1	10.50	42.00					42.00	5.61
Compost	22.1	7.00	28.00			12.50	2.19	30.19	4.04
Fresh dairy manure	12.6	4.00	16.00			12.50	2.19	18.19	2.43
3/4 to 1.5-inch limestone chips	15.7	5.00	20.00			75	13.13	33.13	4.43
Inert gravel	--	7.50	30.00	--	3.75	--	3.75	37.50	5.01
ChitoRem® SC-20				40	7.00			7.00	0.94
Pea Gravel				30	5.25			5.25	0.70
Construction sand				30	5.25			5.25	0.70
Total:	100	39.25		100	21.25	100	21.25		

Note: The inert gravel is not included in the substrate volume percentage

v/v = volume fraction per volume total

This variety of substrates and percentages has been selected for a number of reasons. A combination of wood chips and sawdust is proposed to provide a long-term source of carbon (large wood chips) as well as an attachment surface for the microbial community and small particle source (sawdust) that may be more readily degradable due to greater exposed surface area. Well-decomposed compost is readily degraded and can provide an abundance of anaerobic fermenting bacteria for the BCR degradation of substrates. The dairy manure provides these fermenters, as well as SRB and other microbes to form a microbial consortium to inoculate the system, and readily available carbon as an electron donor. Lastly, the limestone gravel provides structure to the system to reduce long-term compaction effects and provides an alkalinity source for buffering the system. Similar to the SAPS, inert gravel was placed on the bottom of each BCR barrel as a drainage layer.

BCR organic substrate materials were obtained from local Montana suppliers. Sawdust and wood chips were obtained from a lumber mill in Clancy, Montana. Raw wood materials utilized to create the sawdust and wood chips were likely a mixture of Douglas fir and lodgepole pine. Organic compost was obtained from a nursery in Helena, Montana. The manure was obtained from a small private dairy farm near Helena, Montana. Limestone chips were obtained from a wholesale distributor in Denver, CO. The quarry source of the limestone is unknown. The limestone used was a 3/4-inch to 1.5-inch sized gravel with a small amount of fine dust. Inert gravel utilized as the drainage layer was a landscape granite gravel product obtained from a home improvement store.

Percentages and volumes presented in Exhibit 2-16 are as-built quantities. Field modifications were made from the designed percentages in the SAP Addendum for the BCR and Chitorem pre-treatment barrels. The Chitorem pre-treatment substrate composition was modified to include pea gravel. This change reduced the amount of sand but the Chitorem volume remained the same. The addition of pea gravel was intended to increase the substrate porosity and flow-through characteristics.

For the BCRs, a shortage of manure and limestone materials were available onsite for construction to meet the designed quantities in the SAP Addendum. Only 4 gallons of manure and 5 gallons of limestone were utilized for each BCR, rather than 7 gallons of each as originally designed. Due to the lack of manure, the compost quantity was increased from 5.25 gallons as designed to 7 gallons for each BCR. Wood chips and sawdust volumes remained the same. As a result, the total volume of reactive substrate was reduced from the 35 gallon design volume to 31.75 gallons.

Barrel Construction

A photograph of the BCR barrels and effluent piping is shown in Exhibit 2-17. Nominal 55-gallon open top plastic barrels were utilized for the testing (57 gallon capacity). The BCR influent pipes were installed through the side of the barrels near the top using 1/2-inch bulkhead fittings. For BCR 1, a threaded fitting was installed on the outside of the bulkhead fitting and connected to the head tank timer valve (flow line 1). For BCR 2, 3 and 4, the influent pipes were connected to the pre-treatment barrel effluent assemblies using 1/2-inch braided PVC tubing. A threaded fitting was also installed on the inside of the bulkhead and connected to an influent pipe gallery. The galleries were constructed similar to the pre-treatment Chitorem and SAPS pipe galleries, except for being slightly larger to fit the larger barrels. A second difference was the BCR pipe gallery inlets entered through the side of the barrel rather than the through the lid. Although the BCR barrels are not likely completely airtight once closed, the threaded bung caps in the barrel lids were left slightly loose to provide venting of biogenic gases during operation of the treatment system.

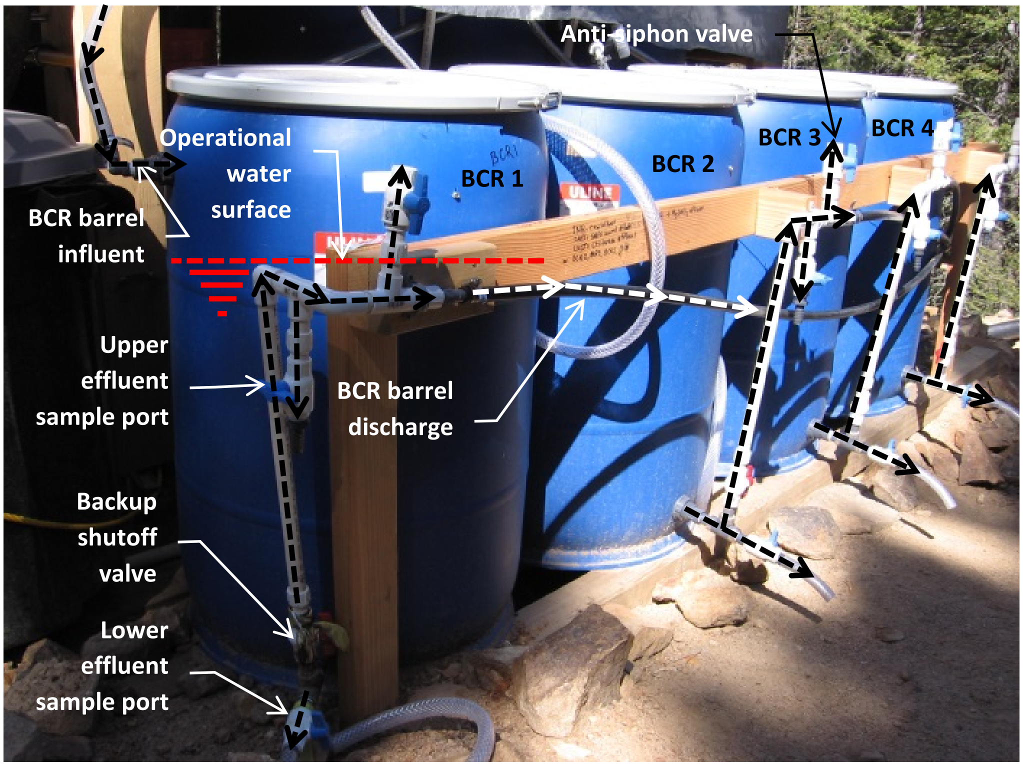

Exhibit 2-17. BCR barrels and effluent assemblies.

The effluent opening is located at the bottom sidewall of each BCR barrel and was constructed using a 1/2-inch bulkhead fitting. An effluent water collection pipe gallery was installed similar to the influent pipe gallery. The collection pipe gallery was connected to the bulkhead fitting via a threaded connection. The 55-gallon BCR barrels were filled with approximately 7.5 gallons of inert drainage gravel on the barrel bottom around the collection gallery piping, followed by approximately 31.75 gallons of reactive substrate.

The barrel effluent was routed through an effluent assembly constructed of PVC piping, fittings, and valves. The effluent assembly is illustrated in Exhibit 2-17 and consisted of a lower effluent sample port, a backup shutoff valve, an upper effluent sample port, an anti-siphon valve, and effluent discharge line. The lower effluent sample port was located at the bottom of the effluent assembly to collect samples that were sensitive to oxygen influence such as DO and ORP field parameters. Effluent water collected from this area of the barrel was always submerged and not affected by oxygen influx from the anti-siphon valve. Laboratory samples were also collected from the lower effluent sample port. Similar to the pre-treatment barrels, the top elevation of the vertical riser pipe determines the operational water surface. This elevation was set at approximately 27-inches, which provides 9-inches of space for the influent MIW batch and space for the influent distribution gallery.

The effluent discharge line converted to 1-inch HDPE pipe. Each of the four BCRs had the same effluent assemblies and all four discharge lines drain by gravity into a 4-inch corrugated HDPE pipe for discharge downgradient of the treatment system area.

2.2.2.5 Solar Power System

The metering pump, slurry mixer, and timer switch were operated on low voltage using a solar power system to recharge the batteries. A photograph of the power equipment is shown in Exhibit 2-18. The pump, timer, clock and inverter were secured to a plywood board and placed in a plastic tool box. The toolbox was in turn screwed to a scaffold plank. Holes were drilled into the toolbox sides for ventilation, but the toolbox lid was left intact to keep precipitation out.

Two group 31 90 amp-hour 12-volt deep-cycle marine batteries in covered plastic battery boxes were located on the ground under the scaffold. The batteries were connected in parallel and charged from two 60 watt Dasol model DS-A18-60 solar panels. The solar panels were originally mounted on the scaffold platform roof. As discussed later in Section 2.2.4.2, Operation and Maintenance, the panels were later moved to a location that received more sun. The panels were wired to a Morningstar Sunsaver SS charge controller to regulate battery charging, and prevent overcharging. The charge controller was located in a water tight plastic storage bin on the ground next to the batteries to minimize system wiring. Besides regulating battery charging, the charge controller also had a dedicated circuit used to control the load relay, which in turn controlled the inverter, pump, mixer and timer. The load relay was purchased from an automotive supply store and was a general replacement single pole double throw 12-volt relay. Charge rate with full sun on the panels was measured at 6 amps using a clamp-on digital ammeter.

The metering pump operated on 12-volt direct current (DC) from the batteries. The pump was initially set at the maximum 300 revolutions per minute (rpm) to deliver 60 milliliters per minute of solution. The 12-volt DC Brazix waterproof timer switch was set to activate the metering pump every 4 hours for a period of 2 minutes to inject 120 milliliters of $Mg(OH)_2$ solution into the alkaline pre-treatment barrel. Changes made to the pump setting and tubing type during pilot operation are described in Section 2.2.4.2, Operation and Maintenance.

The 0 to 2000 rpm motor on the $Mg(OH)_2$ solution stock tank mixer required 120-volt 60 hertz alternating current (AC). The 12 volt DC battery voltage was converted to 120 volt AC using a 300 watt Morningstar Sure Sine 300 sine wave inverter. The AC inverter output was wired to a 120-volt cube tap where the mixer was plugged in. A digital alarm clock was also plugged into the cube tap. The digital clock was synchronized with the 12-volt DC timer switch readout and functioned as an elapsed time meter, which provided an inexpensive way to monitor the solar system performance.

As described above, the load relay was wired to the charge controller. If battery voltage dropped below 11.4 volts, the charge controller would open the load relay to disconnect the AC inverter, timer switch, and metering pump to protect the battery from damage. Draining a deep cycle battery below 50% capacity shortens the useful battery life. When the load relay opened, power to the clock would be disconnected, and the clock would no longer be in sync with the timer readout.

For example, if the panels did not receive enough sunshine during the day to replace the energy used during the night, battery voltage would gradually decrease, the load relay would open, and the pump and mixer system shut down. Once the sun came back up, the panels might recharge the batteries to normal operating voltage, the load relay would close, and the pump and mixer system would start again. Without the elapsed time meter there would be no way for the operator to know the system had been offline during the night.

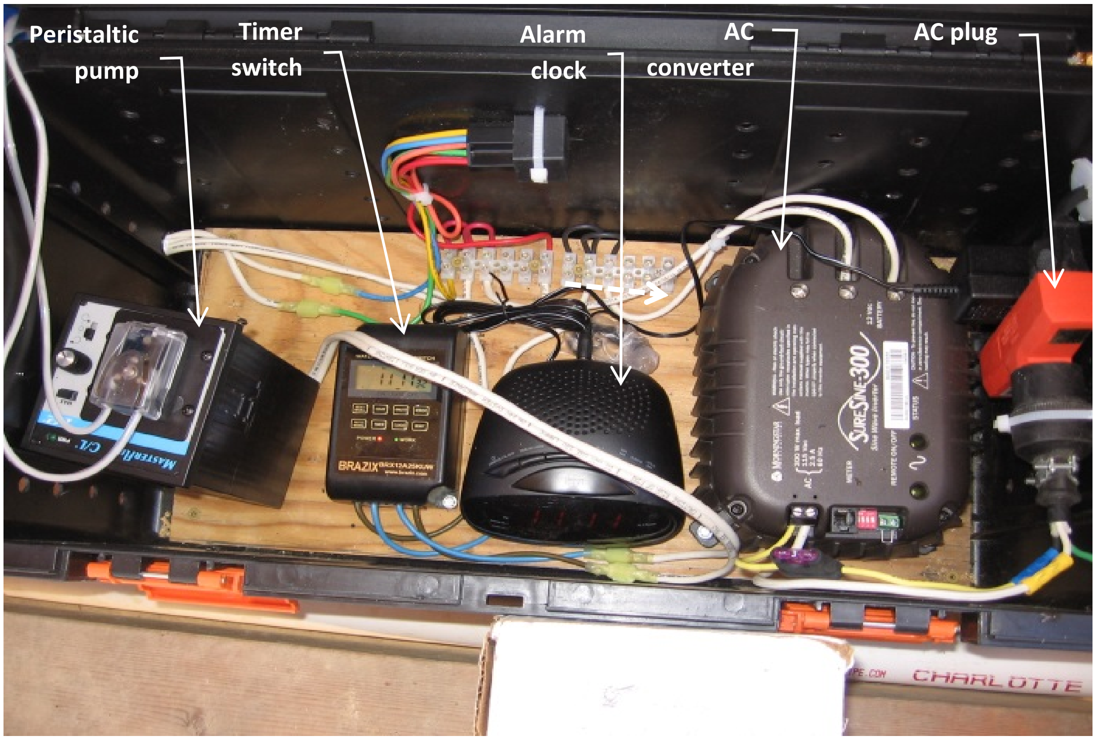

Exhibit 2-18. Electrical power system.

2.2.2.6 Post-Treatment

A post-treatment oxidation test was implemented during the study to evaluate if oxidation could reduce concentrations of BOD, ammonia, and sulfide. The test was conducted on BCR barrel effluent water during the last five sampling events. Only one of the four BCR effluents was selected for the test for each sampling event. Additional sample volume was collected from the selected BCR barrel effluent on each event and the volume was split. One split of the sample volume was submitted for the standard laboratory analysis for effluent samples prescribed in the SAP addendum (CDM Smith 2013b). The other sample volume split was oxidized to test removal effectiveness for BOD, ammonia, and sulfide. Various methods were utilized to conduct the oxidation testing. For the first two sampling events, a more passive approach was implemented by bubbling air into the sample water for approximately two hours. For the third sampling event, the sample was added to a clean gallon jug and vigorously shaken for several minutes. For the last two sampling events, the sample was poured back and forth between two clean buckets at least 10 times. For the latter two methods, the sample was allowed to remain idle for at least an hour to provide settling of solids if present and then a laboratory sample was collected. In some cases, interim DO measurements were taken from the sample as the oxidation process was being implemented.

2.2.3 System Startup and Shutdown

The manure provided was a mixture both wet and dry. In order to rewet and acclimate the manure, it was incubated overnight prior to mixing with other materials and loading into the barrels. The incubation consisted of first placing approximately 1/2-gallon of limestone fines each into two 5-gallon buckets and filling the buckets with approximately 4 to 5 gallons of Danny T adit water. The water was stirred several times and allowed to react for at least 2 hours. The pH of the water was tested and confirmed at approximately 5 to 6 su. Then the manure was split evenly into several 5-gallon buckets, and each bucket was filled with the partially neutralized adit water. This process was intended to condition the manure with consistent moisture and adapt the bacteria to the metals present in the mine water.

Exhibit 2-19. Mixing of a batch of BCR substrate.

After the incubation period, the organic substrate and limestone materials were mixed using hand tools on a plastic tarp. Similar textured materials such as a manure and compost were mixed first, followed by mixing in sawdust, then wood chips, and lastly limestone. A rake and shovel were used to mix the materials. The tarp was also used to tumble the materials together with two people positioned on either side of the tarp. Each BCR mixture or pre-treatment mixture was completed in batches and the materials were loaded into the barrels. A photograph of mixing a BCR substrate batch is shown in Exhibit 2-19.

The sequence of loading the barrels consisted of the SAPS and Chitorem pre-treatments first, followed by the BCRs. When loading the material into the pre-treatment SAPS, Chitorem, and BCR barrel 1 (no pre-treatment), influent MIW was added as the material was placed in the barrels to aid in saturating the substrate. The substrate was mixed using a stick of PVC pipe during filling of MIW and substrate material. The substrate was added to BCR barrels 2 through 4 without saturating since these barrels were to receive pre-treated water only. MIW was added manually up to near the top of the pre-treatment SAPS and Chitorem barrels and the effluent valves to the BCR barrels were opened. This process allowed the MIW to drain through the pre-treatment barrels and into the BCR barrels. MIW was periodically added to the pre-treatment barrels to keep them near full and the substrate saturated. Both pre-treatment barrels were slow to drain at first, and the barrels were left full overnight. The following day, the sequential process of adding MIW into the pre-treatment barrels was continued until sufficient water was added to the BCR barrels up to the operational water surface.

For the alkaline addition pre-treatment, MIW was added to the pre-treatment barrel up to the operational water level at the effluent, followed by an additional volume adequate to fill BCR barrel 4. The additional volume was estimated based on the approximate porosity of the BCR substrate, plus additional water above the substrate surface. Based on the volume of water added to the barrel above the effluent level, the MIW was batch treated with the volume of $Mg(OH)_2$ solution scaled up from titration testing. The barrel was periodically mixed with a piece of PVC pipe and tested with a pH meter to allow time for reaction and to ensure the target pH range was reached. The final pH of the pre-treatment batch was confirmed to be 5.5 su and then the effluent valve was opened to drain the water into BCR 4 after a period of settling.

Once the operational water surface was reached in all BCR barrels, approximately 8 ounces of soured whole milk was added to each BCR. The milk was added to provide a readily available liquid carbon source for SRB during incubation. Utilizing milk was not originally in the SAP addendum, but was later added based on past research.

The initial construction was completed on June 14, 2013. The first sample was collected on July 11 from each of the barrels and the influent, after four weeks of incubation. At this time, the system was not running with flow through due to malfunction of the timer valves. Therefore, the samples collected were representative of incubation water. The following week on July 16, timer valves were replaced and flow through operation commenced. Full operation of the alkaline addition system also commenced at this time. Sampling was conducted the following week on July 23 and continued bi-weekly (every other week) until September 16.

Shut down was delayed by the federal government budget issues and closure that began on October 1, 2013. Pilot shut down finally occurred on October 22nd. Pilot equipment was partially disassembled, the roof removed, and the treatment tanks winterized by draining until the water level just covered the media. Most of the connecting piping was removed to avoid freeze damage during the winter. The solar system was removed and placed in secure storage. Surprisingly, no freeze damage was observed despite several weeks of freezing weather prior to shut down.

2.2.4 Sampling and Maintenance Activities

This section discusses the field sampling schedule, procedures, and locations, and system maintenance activities during operation.

2.2.4.1 Sampling Activities

Water samples were collected from the Chitorem and SAPS pre-treatment barrel lower effluent sampling ports, from the alkaline addition drain valve, from the four BCR barrel lower effluent sampling ports, and from the influent MIW sampling port. Each of these 8 samples was collected bi-weekly throughout the testing period. A total of 6 sampling events were conducted from July 11 through September 16 consisting of 8 samples each, for a total of 48 normal samples. As noted above, the July 11 sampling event was representative of incubation water inside the barrels, rather than flow through treatment water.

In addition to the BCR effluent sampling, the post-treatment oxidation test was conducted during five of the six sampling events (7/23, 8/7, 8/19, 9/4, and 9/16), as described in Section 2.2.2.6. Only one BCR effluent was subjected to the test during each sampling event. BCR2 was tested on 7/23, 8/19 and 9/16 while BCR3 was tested on 8/7 and 9/4. Post-treatment oxidation samples were submitted for laboratory analysis of BOD, ammonia, and sulfide.

During each sampling event, the system was inspected and maintenance conducted as necessary. Field parameters (pH, specific conductivity, temperature, ORP, and DO) were collected using a multi-parameter YSI meter. Laboratory samples for each of the 8 locations were analyzed for dissolved metals, acidity, alkalinity (total, bicarbonate, carbonate, and hydroxide), orthophosphate, anions (chloride, fluoride, and sulfate), and TDS. Due to funding limitations for analysis, total metals were only analyzed for the first and fifth sampling events. Filtration for dissolved metals analysis was conducted in the field using a 0.45 micron filter and peristaltic pump. Each BCR barrel effluent sample was also analyzed for sulfide, along with the post-treatment oxidation samples. BOD and ammonia were also analyzed for the post-treatment oxidation tests.

All laboratory analysis of pilot study water samples was conducted by Energy Laboratories in Helena, Montana. All samples were securely packaged and hand-delivered to the laboratory for analysis, following the procedures outlined in the SAP addendum (CDM Smith 2013b). Sample volumes were minimized to the extent possible because of the low treatment flow rates of the system. The minimal sample volumes required for analysis were as recommended by Energy Laboratories.

In addition to treatability study water samples, samples of the organic substrates and Chitorem material used in the barrels were collected and submitted for modified SPLP testing. Samples were submitted to Energy Laboratories. A total of four samples were submitted for SPLP analysis: wood chips, sawdust, compost, and Chitorem. Rock materials were not submitted for SPLP analysis.

2.2.4.2 Operations and Maintenance

Pilot system operation was routinely checked every two weeks during each sample collection site visit. Routine operation checks included the following:

- The elapsed time meter (digital alarm clock) readout was checked against the 12-volt timer readout to make sure the system had been in continuous operation since the last sampling event.
- The charge controller indicator lights were observed to check for low battery voltage.
- Solar panel output amperage was measured using a clamp-on digital ammeter.
- Timer valve operation was observed to make sure the timing sequence had not changed.
- Timer valve indicator lights were observed to check for low timer battery voltage.
- The amount of $Mg(OH)_2$ solution in the stock tank was observed as a measure of whether the dosing system had functioned properly.

- The stock tank mixer was observed to check for proper mixing. The metering pump was started manually to test the $Mg(OH)_2$ dosing system.
- The metering pump tubing was replaced with new tubing and the flow calibrated.
- During the August 7 site visit, the timer valve batteries were replaced. The removed batteries were checked with a volt-ohm meter and voltages were all at or above 1.5 volts.

Operational problems occurred during pilot operation that required non-routine procedures. These procedures included any action necessary to remedy the malfunctions. Non-routine procedures and general observations included the following:

- A large amount of $Mg(OH)_2$ solution was observed remaining in the stock tank during most routine biweekly site visits and the pump tubing was plugged. The amount remaining in the stock tank varied, but was clear evidence that the dosing system had not functioned correctly over the prior two weeks. Based on these observations, a bulk dose of solution was added during each site visit and some non-routine site visits as described below. This was typically accomplished by manually operating the metering pump for 22 minutes at 60 milliliters per minute, for a total dose of 1,320 ml. This dose was added to pre-treat the volume present in the barrel for each batch. This volume was estimated at 26 gallons based on the 22-inch barrel diameter and a water height of 16 inches.
- On August 7, the 3.75-inch riser in head tank 3 was replaced with a 6-inch long riser. This reduced the head tank batch volume from 9 liters to 6 liters every 4 hours in an attempt to prevent the Chitorem pre-treatment barrel from overflowing. Flow was reduced to 25 ml/min on average. On previous routine site visits, it was evident that flow through the Chitorem pre-treatment barrel was restricted.
- On August 7, the 12-volt batteries were showing low charge. Recent cloudy weather had reduced the available solar radiation. In addition, the solar panels were now being shaded by several large nearby trees for part of each day, reducing the charging capacity. After unsuccessfully attempting to recharge the batteries using a portable generator and two small battery chargers, the specific gravity of the electrolyte, measured with a hydrometer, was still very low. The solar power system was shut down, and both batteries removed and taken back to town for recharging.
- On August 8, a non-routine site visit was made to re-install the batteries, decrease the $Mg(OH)_2$ solution metering pump flow rate, and increase the dosing time. This change was made to reduce electrical power consumption. The system was put back in full operation and plans were made to move the solar panels to a new location to increase output. The inverter and mixer were wired to the 12-volt timer to operate only when the metering pump operated. The metering pump speed was reduced and the pump flow calibrated to 25 ml/min. The timer interval was increased to 5 minutes to obtain a 125 milliliter dose every 4 hours. Mixer speed was also increased to the maximum setting of 10 (2000 rpm). Field tests confirmed that at this higher speed, the mixer would quickly and fully re-suspend the settled $Mg(OH)_2$ solution. The mixer change was done to reduce battery drain.

- On August 14, a non-routine site visit was made. The solar panels were moved from the pilot scaffold roof to the historic load-out area on the mine waste dump, 200 feet uphill and closer to the adit. The batteries were left in place under the pilot scaffold, and 200 feet of 4/0 aluminum electrical cable was installed along the road edge to connect the panels to the pilot batteries. Charge rate was measured at 6 amps using a clamp-on digital ammeter.
- In addition, on August 14, inert gas was bubbled backward through the Chitorem tank in an attempt to improve flow-through. The gas was a mix of 75% argon and 25% CO_2. Gas was injected at a pressure of less than 10 pounds per square inch. When the gas hose was removed from the drain valve, no measureable flow was observed out of the barrel effluent.
- In addition, on August 14, the peristaltic pump tubing was replaced. The peristaltic pump tubing was often plugged with solid $Mg(OH)_2$ and the tubing section within the pump rollers collapsed. Potential causes included excessive pump speed, improper tubing selection, or the tendency of $Mg(OH)_2$ to settle if not continuously mixed. The Tygon® tubing was replaced with 0.1-inch diameter PharMed®, a more robust tubing.
- On August 19, the water level in the Chitorem pretreatment tank appeared normal.
- On August 19, the head tank water levels were observed to be full prior to the inlet timer valve scheduled opening. This condition indicated that the timer valve was leaking and filling the head tanks continuously and ahead of schedule. The leakage rate was not determined, but if large enough, could potentially increase the head tank batch volume. The inlet timer valve was replaced with a spare.
- During the September 4th routine site visit, the water level in the Chitorem pre-treatment tank was at the tank lip. Inert gas (75% argon and 25% CO_2) at low pressure was bubbled backwards through tank while stirring the media with a short length of 1/2-inch PVC pipe. No improvement in flow was noted.
- On September 4, the 3.75-inch risers in head tanks 1, 2 and 4 were all replaced with 6-inch risers to make all batch volumes equal at 6 liters every 4 hours.
- On September 11, the field team travelled to the site to troubleshoot the lack of flow through the Chitorem media barrel. First, a small amount of the Chitorem substrate (Chitorem, sand, and gravel mixture) was removed and samples used to conduct a quick column test in a clear tapered plastic cone. For the first test, 1 part of substrate was mixed with 1 part fresh pea gravel, and the mixture was placed in the cone. The cone was filled with water but no flow was observed after five

Exhibit 2-20. Mixing of pea gravel with the original Chitorem substrate.

minutes. For the second test, 1 part substrate was mixed with 2 parts pea gravel, placed in the cone, and the cone was filled with water. Flow through the column was immediate. A mix of 1 part original substrate to 1.5 parts pea gravel was chosen as the replacement substrate for the pre-treatment Chitorem barrel. Seven gallons of original substrate were mixed with 10.5 gallons of pea gravel in a 40-gallon stock tank. The tank was flooded with inert gas (75% argon and 25% CO_2) during mixing to reduce oxidation. The argon is heavier than air and would settle on the media in the tank. After placing the media back in the pretreatment barrel, the barrel was filled to operating level with MIW. When dosed from the head tank, flow was observed at the effluent sampling valve nearly immediately.

- In addition September 11, tubing was replaced and a batch dose of $Mg(OH)_2$ solution was added to the $Mg(OH)_2$ barrel.
- September 16 was the last routine site visit for sample collection.
- During the week of September 30, a site visit was not possible due to early winter-like weather.
- Due to the federal government shutdown beginning October 1, the final site visit was delayed until October 22.
- October 22, the pilot was partially disassembled and winterized. Surprisingly, no freeze damage was observed despite several weeks of freezing weather.

Section 3

Quality Assurance Summary

This section describes the quality assurance and quality control aspects of the bench-scale and pilot-scale treatability study data. Deviations are presented and how or if they affected the achievement of the DQOs, a summary of field QC activities is presented, and a summary of the data evaluation is presented.

3.1 Bench-Scale Treatability Study

3.1.1 Deviations and Data Quality Objectives

The bench-scale treatability study was conducted in accordance with the quality control (QC) requirements detailed in the SAP (CDM Smith 2013a). In addition, laboratory procedures conducted at the Denver Laboratory were conducted in accordance with the QA protocols outlined in the Laboratory Quality Assurance Plan for the CDM Smith Denver Treatability Laboratory (CDM Smith 2007). Laboratory and sampling procedures did not deviate from the requirements of these plans during the bench-scale treatability study, with the following exceptions:

- As indicated in Section 2.1.2.1, TSS samples from the alkaline addition pre-treatment were not collected from the titration batches, rather, samples were collected from the larger pre-treatment batches using the same reagents and same endpoint pH.

- As indicated in Section 2.1.3, an estimate of the time to free-drain the hydraulic columns could not be conducted due to restriction by the suction pressure in the columns.

- A bottle blank of deionized water from the laboratory Milipore water system was not collected and analyzed. The water filtration system produces a deionized water with a resistivity of greater than 1 megaohm-centimeter. The filter is changed regularly in accordance with the manufacturers' recommendations to assure high resistivity purified water.

- Samples collected for offsite laboratory analysis for Steps 1 through 4 were analyzed by the Region 8 EPA ESAT laboratory in Denver, Colorado and by Energy Laboratories in Helena, Montana (for acidity only). All analytes for Step 5 (treated BCR effluent) samples were analyzed by Energy Laboratories. Only acidity, BOD, and sulfide were originally planned to be analyzed by Energy Laboratories; however, because of the need for a faster turnaround time to plan the pilot-scale treatability study, metals, alkalinity, and anions samples were also submitted to Energy Laboratories instead of Region 8 EPA ESAT.

These deviations listed above did not have an effect on the overall data quality or usability of the data generated. All DQOs developed for the investigation were met.

3.1.2 Field Quality Control Summary

CDM Smith Denver Laboratory QC procedures were followed. The laboratory uses a Milli-DI® water filtration system to create high resistivity purified water. This laboratory grade water was utilized for making alkaline solutions for titrations, cleaning measurement probes (pH, conductivity, ORP, etc.), and cleaning and rinsing glassware, buckets, columns, and other instruments and containers.

Laboratory glassware and other miscellaneous items were cleaned after each use with tap water and Alconox® powdered detergent, and rinsed with the deionized water.

Titrations were conducted with a mechanical pipet and disposable pipet tips. All pipet tips were disposed after use. Alkaline solutions were made on a weight basis using a laboratory balance measureable up to one-thousandth of a gram. Liquid solutions were measured using volumetric flasks. All measurement probes were calibrated daily and notes were recorded in a laboratory log book. All samples were collected in certified clean containers obtained from the laboratory or from a supplier.

Field QC samples (i.e., field or matrix spike duplicates) were not collected during the bench-scale treatability study due to the lack of additional volume for each step in the treatability study process. Only limited test volumes were utilized and collected for analysis. This was done in accordance with the SAP (2013a)

3.1.3 Data Evaluation

A data evaluation review was conducted on the bench-scale and the pilot study data. Data were evaluated on the precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS) criteria. Field duplicates were not collected during the bench scale testing because of limited sample volume. However, the laboratories performed matrix duplicate and matrix spike and spike duplicate analyses as required by the methods. A level 2A data evaluation was performed on all data as defined in the Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use, EPA January 13, 2009 (EPA 2009). Data were evaluated by checklist format provided in Attachment A. Based on the data evaluation review, all data are considered usable for their intended purpose. Laboratory data packages are provided in Appendix B.

3.2 Pilot-Scale Treatability Study

3.2.1 Deviations and Data Quality Objectives

The pilot-scale treatability study was conducted in accordance with the QC requirements detailed in the SAP and SAP addendum (CDM Smith 2013a and b). Field and sampling procedures did not deviate from the requirements of these plans during the pilot-scale treatability study, with the following exceptions:

- The Chitorem substrate composition was modified by adding pea gravel to the mixture to increase the permeability and flow-through characteristics of the substrate. This modification was made during construction of the treatment system based on work conducted at a concurrent treatability study at a different site.

- The BCR substrate composition was modified due to a shortage of available manure and limestone onsite. Less limestone and manure were utilized in each BCR than designed. The compost quantity was increased to attempt to compensate for the lower manure quantities. The overall volume of reactive substrate also decreased slightly as a result of this deviation. In addition to the manure and limestone modification, soured whole milk was added to all BCRs to provide a readily available liquid carbon source for SRB during incubation.

- Substrate composition was again modified near the end of the study for the Chitorem pre-treatment barrel due to the lack of flow through the barrel. Even though gravel was present in the mixture, the original composition was suspected to contain too high a fraction of sand and

Chitorem. Along with biofouling of the media, very low substrate permeability resulted in limited flow through the barrel. Substrate media was removed from the barrel and a fraction of the media mixture was re-mixed with fresh pea gravel to reduce the overall percentage of sand and Chitorem. Further description of the substrate change out was described in Section 2.3.4.3.

- Minor modifications were made to the process flow design regarding head tanks, valve locations, and tubing/piping to accommodate field conditions and utilize materials that could be purchased at local hardware stores. These changes were implemented during system construction.

- All effluent samples from the pre-treatment and BCR barrels were collected from the lower sampling ports rather than upper sampling ports as specified in the SAP. The lower sampling port was intended for sampling of redox sensitive field parameters, DO and ORP. The lower sampling port was utilized for all samples due to the slow flow rate and short amount of time that the team was onsite to collect samples.

- On August 7, the head tank volume in treatment process 3 was decreased from 9 liters to 6 liters by replacing the 3.75-inch risers with 6-inch risers to attempt to keep the Chitorem pretreatment barrel from overflowing. On September 4, the 3.75-inch risers in head tanks 1, 2 and 4 were all replaced with 6-inch risers to make all batch volumes equal at 6 liters every four hours.

- On September 4, the head tank volume in treatment processes 1, 2, and 4 were also decreased from 9 liters to 6 liters. This change was done to allow consistency with the Chitorem treatment process 3, and because there were signs of overloading to the BCRs in these systems, so flow rate was decreased.

- The number of sampling events was changed from 9 to only 6, due to a later startup date, site inaccessibility from a snow storm event during September, and the federal government shutdown in October.

- Total metals analysis were only conducted for samples collected during the first (7/11/13) and last (9/14/13) sampling events due to funding limitations for the project. Total metals sample frequency was reduced because the total metal fraction can be influenced by the presence particulates in the sample (e.g., metal precipitates, metals adsorbed to organic matter, etc.). The dissolved fraction is used to determine if the biogeochemical processes in the BCR are effective.

These deviations listed above did not have an effect on the overall data quality or usability of the data generated. DQOs developed for this investigation were met, with the exceptions described in the following paragraphs.

The overall lack of consistent flow through the Chitorem pre-treatment had an effect on achieving the study objectives related to pre-treatment effectiveness (Study Questions 2, 7, and 13) and evaluation of retention time (Study Question 14). Because flow through the Chitorem pre-treatment and subsequent BCR barrel (treatment process 3) was on average much less than the other treatment processes, a direct comparison of treatment effectiveness was difficult to discern. The average hydraulic retention time would be much higher for the treatment process 3 and could have resulted in better treatment effectiveness as a result of the increased contact time with the media.

Regarding the reduced number of sampling events and system operation schedule, this has some effect on achieving the study objectives related to seasonal weather and water quality influent changes (Study Questions 11 and 12) as these changes may not be evident in such a short season. In addition, the shorter operation schedule and smaller data set results in less information to develop conclusions regarding long-term treatment effectiveness.

Regarding changes to the BCR substrate mixture, the shortage of manure and limestone may have had a negative impact on treatment effectiveness in the BCRs. Sufficient limestone is needed to buffer the influent MIW acidity and sufficient manure is needed to provide SRB and soluble organics to initiate and sustain the sulfate reduction process. Additional compost was substituted to provide more soluble organic matter to replace the manure component. In addition, the overall decrease in reactive substrate volume has an effect on the planned hydraulic retention time. Since the flow rate initially implemented was as designed in the SAP Addendum but the substrate volume slightly decreased, the overall average retention time would have theoretically slightly decreased.

3.2.2 Field Quality Control Summary

The YSI meter was calibrated during each sampling event. All field notes, field measurements, and other sampling observations were recorded in field log books. All samples were collected in certified clean containers obtained from the laboratory or from a supplier. Titrations for the $Mg(OH)_2$ solution were completed using a mechanical pipet and disposable tip. Titrations were completed in certified clean containers or containers cleaned with Alconox® powdered detergent and grocery distilled water. $Mg(OH)_2$ solutions were created using a graduated cylinder for measurements and with grocery distilled water.

Field QC samples consisted of field duplicates. One field duplicate was collected for each sampling event, for a total of six field duplicates. A field duplicate was collected from the influent MIW during the first sampling event, followed by duplicate collection from the various BCR effluents during the later sampling events. This meets the minimum 10 percent requirement for collection of field duplicates specified SAP.

3.2.3 Data Evaluation

The same data evaluation approach was implemented for the pilot-scale study data as conducted for the bench-scale study data. A data evaluation checklist was prepared and is included in Appendix A. The only difference from the bench-scale data is that evaluation of PARCCS parameters was completed with respect to field duplicates. Based on the data evaluation review, all data are considered usable for its intended purpose. Laboratory data packages are provided in Appendix B.

Section 4

Results, Analysis, and Discussion

This section describes the results, analysis, and discussion of the treatability study data.

4.1 Bench-Scale Treatability Study

Bench-scale treatability results are presented in the following sections. Table 4.1-1 presents all analytical laboratory and CDM Smith treatability laboratory measurement data (field data). Table 4.1-2 presents the MRE for all dissolved metals and percent removal for select wet chemistry parameters. Finally, Table 4.1-3 presents a comparison of metal treatability study results to state of Montana DEQ-7 acute and chronic ambient water quality standards and human health standards.

The removal efficiency calculations in Tables 4.1-2 were completed by carefully reviewing analytical results (either influent or effluent) near or at laboratory reporting limits. MRE for an analyte (see Tables 4.1-2) was not calculated if the raw water and treated water effluent analytical results were both less than 5 times their respective reporting limits, as comparing percentage results at levels that approach the reporting limit does not produce realistic comparisons. This is consistent with the EPA National Functional Guidelines for Inorganic Superfund Data Review, January 2010 (NFGs) description of duplicate comparisons. In addition, MRE for an analyte was not calculated when both results were below their detection limits (non-detect U flagged data) and/or reported at a concentration less than the reporting limit (J flagged data). Similarly, comparison of water quality to screening criteria (Tables 4.1-3) was not conducted if the sample results were flagged as non-detect (U qualifiers) and the criteria was lower than the detection limit.

Removal efficiency was also qualified with a greater than or less than sign where applicable. If the raw water was non-detect and the treated water effluent was detected at a concentration greater than the raw water reporting limit, then the removal efficiency was flagged as less than the value shown. If the treated water was non-detect and the raw water was detected at a concentration greater than the treated water reporting limit, then the removal efficiency was flagged as greater than the value shown.

4.1.1 Danny T Adit MIW Characteristics

Water quality of the MIW prior to treatment in the bench-scale study is important to understand for the purpose of comparison to the final, treated water quality. This section describes the raw water quality of the MIW from the Danny T adit.

The comparison of the untreated adit water (sample 13BH-DT-BENCH-RAW) metals data to Montana DEQ-7 standards is included in Table 4.1-3. Using the hardness of the sample (324 mg/L as $CaCO_3$), the following dissolved and total metals exceeded the acute aquatic life standard: Cd, Cu, and Zn. The following dissolved and total metals exceeded the chronic aquatic life standard: Cd, Cu, Fe, Pb, and Zn. Dissolved Al exceeded the acute and chronic aquatic life standards. The following dissolved and total metals exceeded the human health standard: Cd, Pb, and Zn. Total concentrations of As and thallium (Tl) exceeded the human health standard and total selenium (Se) exceeded the chronic aquatic standard.

4.1.2 Effects of Oxidation

The following subsections summarize the effects of oxidation on the MIW metals concentrations prior to other treatment methods.

CDM Smith Laboratory Parameters

Oxidation had little to no effect on the pH as the value was 2.75 su pre-oxidation and 2.76 post-oxidation. Also, there was minimal effect on conductivity as it started at 1.722 mS/cm pre-oxidation and 1.697 mS/cm post-oxidation. At the start of the oxidation test, temperature was measured to be 7.67 °C. At the end of the two hours of oxidation, the temperature rose to 16.55 °C as a result of being allowed to sit outside of refrigeration.

Oxidation had an increasing effect on ORP as it started at 563 mV pre-oxidation and 601 mV post-oxidation. DO ranged from 10.77 mg/L pre-oxidation to 7.75 mg/L post-oxidation, resulting in a decrease of DO after oxidation. The decrease in DO concentration in mg/L observed may be a result of the increased temperature and percent saturation of DO should be accounted for. Based on tabulated values of saturation concentrations of DO in water at different temperatures, it is estimated that the DO saturation percentage at the initial and final temperatures was over 95 percent (Lindeburg 2003). Due to uncertainties to correct for temperature, salinity, and barometric pressure, as well as potential inaccuracies in the DO instrument itself, it appears that the adit water started at and remained at DO saturation for the duration of the test.

Metals

Observations of dissolved and total metal trends (Table 4.1-1), MRE ranges (Table 4.1-2), and comparison to water quality standards (Table 4.1-3) of the oxidized MIW are presented below. Overall, limited metals were decreased as a result of oxidation. Some of the MRE ranges presented below are likely within the analytical accuracy and precision of the instruments used to analyze the samples.

- Dissolved and total Al were minimally removed by oxidation with an efficiency of 1.9 and 0.8 percent, respectively. Dissolved Al concentrations exceeded the acute and chronic aquatic life standards. The human health standard was not exceeded.

- Dissolved and total As concentrations did not exceed any standards. As was removed at an efficiency of 7.3 percent for dissolved concentrations and 43.4 percent for total concentrations. Total metal concentrations were greater than dissolved.

- Dissolved Cd concentrations were removed with an efficiency of 2.1 percent; however total Cd concentrations increased by 1.5 percent. Both dissolved and total concentrations exceeded the acute and chronic aquatic life standards and the human health standard.

- Dissolved cobalt (Co) concentrations increased after oxidation by 4.5 percent. The removal of total concentrations was very minimal at 0.4 percent. A standard for Co does not exist in Montana; however, this metal is included in the tables because concentrations are significant enough that removal trends can be observed in later portions of the bench-scale study.

- Dissolved and total Cu concentrations were removed by oxidation with an efficiency of 1.2 and 6.3 percent, respectively. Both dissolved and total concentrations exceeded the acute and chronic aquatic life standards.
- Dissolved Fe concentrations increased after oxidation by 1.5 percent. The removal of total concentrations was minimal at 5.5 percent. Dissolved and total Fe concentrations exceeded the chronic aquatic life standard.
- Dissolved and total Pb concentrations were removed by oxidation with an efficiency of 5.2 and 7.0 percent, respectively. Both dissolved and total concentrations exceeded the chronic aquatic life standard and the human health standard.
- Dissolved manganese (Mn) concentrations increased after oxidation by 1.1 percent. The removal of total concentrations was very minimal at 0.3 percent. Mn does not have a DEQ-7 standard for comparison; however, Mn is a major metal contributing to influent acidity loading along with Al and Fe. Concentrations are significant enough that removal trends can be observed in some of the other portions of the bench-scale study.
- Dissolved and total Ni increased after oxidation by 21.1 and 31.5 percent, respectively. No standards were exceeded.
- Dissolved Tl was not detected in the effluent or the influent MIW. Total Tl concentrations decreased by 80.1 percent after oxidation; however, this concentration was still in exceedance of the low human health standard.
- Dissolved Zn concentrations increased after oxidation by 2.3 percent. The removal of total concentrations was very minimal at 1.0 percent. Both dissolved and total concentrations significantly exceeded the acute and chronic aquatic life standards and the human health standard.
- Other metals that were analyzed include antimony (Sb), barium (Ba), beryllium (Be), chromium (Cr), selenium (Se), silver (Ag), and vanadium (V). Concentrations for all of these were trace to non-detect, with the exception of selenium which exceeded the chronic aquatic life standard for both the dissolved and total concentration.

Wet Chemistry Parameters

Acidity concentration of the oxidized MIW was 340 mg/L, a 10.5 percent decrease from the raw MIW. Sulfate concentration of the oxidized MIW was 841 mg/L, a 0.7 percent increase from the raw MIW. Alkalinity was not detected in the both the raw MIW and oxidized MIW. This is as expected for this type of acidic MIW.

Summary

Post-oxidation, the oxidized sample actually showed a decrease in DO as measured in units of mg/L. However, by correcting for percent DO saturation at the different temperatures, DO actually remained at saturation for the duration of the test. Most metals resulted in low, single-digit percentages of removal efficiency that were likely within the analytical accuracy and precision of the analytical method. Only As had notable removal efficiencies (7.3 and 43.4 percent for dissolved and total, respectively). Some dissolved metals concentrations were higher than total concentrations, which again may be due to the accuracy/precision of the analytical method. Although under oxidizing conditions (high DO and positive ORP), the rate of iron precipitation may be increased, there were no visible precipitates that formed in the water after oxidation.

4.1.3 Effects of Increased pH

The following subsections summarize the effects of pH on the MIW metals concentrations prior to other treatment methods.

4.1.3.1 Pre-Treatment Alkaline Addition Via Titration

As discussed in Section 2.1.2.1, pre-treatment of raw MIW to a pH of 4.5 su was completed using three different alkaline materials. These materials consisted of a 25 percent by weight NaOH solution, a 10 percent by weight $Ca(OH)_2$ solution, and Chitorem. It required 0.730 mL of NaOH to increase 1 L of raw MIW to reach an approximate pH of 4.5 su, and Figure 4.1-1 shows the titration curve used to determine the dosage. It required 2.125 mL of $Ca(OH)_2$ to increase 1 L of raw MIW to an approximate pH of 4.5 su, and Figure 4.1-2 shows the titration curve used to determine the dosage. It required 1.8 g of Chitorem to increase 1 L of raw MIW to an approximate pH of 4.5 su, and Figure 4.1-3 shows the titration curve used to determine the dosage.

CDM Smith Laboratory Parameters

The raw MIW was titrated to a pH of approximately 4.5 su for all three additives. The remaining laboratory parameters were not recorded for the titration test water samples. However, all laboratory parameters were measured for the alkaline addition NaOH and $Ca(OH)_2$ pre-treatment batches created for use in the SAPS columns. These parameters are discussed in the paragraph below in comparison to the raw MIW. Laboratory parameters other than pH were not measured for Chitorem.

Conductivity increased from 1.722 mS/cm raw MIW to 2.557 mS/cm and 2.374 mS/cm for NaOH and $Ca(OH)_2$ pre-treated water, respectively. Differences in temperature are the result of varying periods of refrigeration. Pre-treatment with alkaline addition had a decreasing effect on ORP as it started at 563 mV raw MIW and was reduced to 418 mV and 382 mV for NaOH and $Ca(OH)_2$ pre-treated water, respectively. DO decreased from 10.77 mg/L raw MIW to 9.50 mg/L and 9.80 mg/L for NaOH and $Ca(OH)_2$ pre-treated water, respectively.

Metals

Observations of dissolved and total metal trends (Table 4.1-1), MRE ranges (Table 4.1-2), and comparison to water quality standards (Table 4.1-3) of the three pre-treated MIW samples with alkaline materials are as follows:

- Dissolved Al was removed at an efficiency of between 13.3 and 40.2 percent for the three materials. The Chitorem removed the most dissolved Al. Total Al was removed with a range between 11.6 and 21.9 percent. Dissolved Al concentrations in all cases exceeded the acute and chronic aquatic life standards.

- Dissolved and total As concentrations did not exceed any standards with the exception of the total As for the Chitorem sample, which exceeded the human health standard. Dissolved As was removed at an efficiency of 43.0 and 51.8 percent for NaOH and $Ca(OH)_2$, respectively; however the Chitorem only removed dissolved As at a removal efficiency of 2.5 percent. Total As was removed at an efficiency of 78.3 and 78.7 percent for NaOH and $Ca(OH)_2$, respectively; however the Chitorem only removed total As at a removal efficiency of 29.4 percent. This result may be skewed due to the natural presence of As in Chitorem, which would likely be removed from a system after a period of time.

- Cd removal efficiencies were low or showed small increases. Dissolved Cd concentrations ranged from removal efficiencies of 8.5 percent to gains of 5.0 percent between the materials. Total Cd concentrations ranged from removal efficiencies of 3.0 percent to increases of 3.0 percent between the materials. Both dissolved and total concentrations in all cases exceeded the acute and chronic aquatic life standards and the human health standard.

- Co removal efficiencies were low or showed small increases. Dissolved Co concentrations ranged from 7.9 percent to gains of 3.0 percent. Total Co concentrations ranged from removal efficiencies of 3.5 percent to gains of 2.7 percent.

- Dissolved Cu was removed at an efficiency of between 4.7 and 6.8 percent for NaOH and $Ca(OH)_2$, respectively; however the Chitorem removed dissolved Cu at an efficiency of 27.9 percent. Total Cu was removed at an efficiency of 5.6 and 6.1 percent for NaOH and $Ca(OH)_2$, respectively; however the Chitorem removed total Cu at a removal efficiency of 22.3 percent. Both dissolved and total concentrations in all cases exceeded the acute and chronic aquatic life standards.

- Dissolved Fe concentrations were non-detect and did not exceed any standards and were removed with an efficiency of greater than 99 percent. The removal of total Fe concentrations was 85.6 percent for NaOH, 74.6 percent for $Ca(OH)_2$, and 50.5 percent for Chitorem.

- The removal of dissolved Pb concentrations was 91.4 percent for NaOH, 78.8 percent for $Ca(OH)_2$, and 98.3 percent for Chitorem. Total Pb was removed with efficiencies between 55.4 and 76.1 percent for the three materials. Total concentrations exceeded the chronic aquatic life standard and the human health standard for all three materials. Dissolved concentrations exceeded the human health standard for $Ca(OH)_2$.

- The dissolved Mn concentrations were removed at efficiencies between 1.2 and 3.4 percent Total Mn concentrations were removed at efficiencies between 1.6 and 2.1 percent for the three additive types.

- The dissolved Ni concentrations showed gains of 20.2 percent for NaOH, 15.6 percent for $Ca(OH)_2$, and 0.5 percent for Chitorem. Total Ni concentrations showed gains of between 11.2 and 37.6 percent for the three materials. No standards were exceeded in any case.

- Dissolved Tl was not detected in the effluent or the influent. However, the detection level of Tl was 2.5 µg/L which is greater than the low human health standard. Total Tl concentrations were detected and exceeded the human health standard.

- Zn removal efficiencies were low or showed small increases. Dissolved Zn concentrations ranged from removal efficiencies of 6.3 percent to gains of 0.5 percent between the three materials. Total Zn concentrations ranged from removal efficiencies of 5.1 percent to increases of 0.3 percent between the materials. Both dissolved and total concentrations significantly exceeded the acute and chronic aquatic life standards and the human health standard.

- Other metals that were analyzed include Sb, Ba, Be, Cr, Se, Ag, and V. Concentrations for all of these were trace to non-detect, with the exception of Se which exceeded the chronic aquatic life standard for the total concentrations of the three materials and the dissolved concentration of the NaOH sample.

Wet Chemistry Parameters

Acidity concentrations were reduced by 31.6 percent for NaOH, 71.1 percent for $Ca(OH)_2$, and 36.8 percent for Chitorem. Sulfate concentrations were reduced by 4.3 percent for NaOH, 3.8 percent for $Ca(OH)_2$, and 0.7 percent for Chitorem. Alkalinity in the both the raw MIW and pre-treated MIW was non-detect.

Sludge Volume

After addition of the alkaline solutions, the sludge volume produced was measured using an Imhoff cone settling test. After one hour, the NaOH treated MIW to pH 4.5 su produced 31 mL of sludge, the $Ca(OH)_2$ treated MIW to pH 4.5 su produced 11.5 mL of sludge, and the Chitorem treated MIW to pH 4.5 su produced 5 mL of sludge. Based on this time, the settling rates were 0.52 mL/min for NaOH treated MIW to pH 4.5 su, 0.19 mL/min for $Ca(OH)_2$ treated MIW to pH 4.5 su, and 0.08 mL/min for Chitorem treated MIW to pH 4.5 su.

After one hour, a considerable amount of larger precipitate flocs were still floating in the $Ca(OH)_2$ test, compared to the NaOH test which had mostly visibly settled after 1 hour. Additional measurements were collected from the cone for the NaOH and $Ca(OH)_2$ tests after additional settling time. After approximately 2.75 hours, the NaOH sludge had compacted to 25 ml and after 16.5 hours, the sludge had compacted to 18 ml. For the $Ca(OH)_2$ test the sludge had compacted to 7 ml after 15 hours. Additional measurements for the Chitorem settling tests were not collected.

Summary

For the samples with laboratory parameters other than just pH (NaOH and $Ca(OH)_2$ pre-treated water), conductivity increased between 0.5 and 1.0 mS/cm. Because this has not passed through the any substrates yet, the increase in conductivity is most likely due to the increase in Na or Ca introduced into the samples from the pre-treatment solutions. As shown on Table 4.1-2, dissolved Na increased by approximately 1,400 percent and total Na increased by 2,000 percent in the NaOH pre-treated sample. Dissolved Ca increased by 97.7 percent and total Ca increased by 95.6 percent in the $Ca(OH)_2$ pre-treated sample.

Pre-treatment of MIW to pH of 4.5 su worked effectively at removing concentrations of Fe and Pb. Dissolved Fe was non-detect for all three materials. Even with effective metal removals, total Pb concentrations still exceeded the chronic aquatic life standard as did the dissolved concentration from the $Ca(OH)_2$ test. Al and As also had notable removal efficiencies, but Al still exceeded the acute and chronic aquatic life standards. Chitorem was more effective at removing Al than the other two pre-treatment options, but was less effective at removing As with the total concentration remaining above the human health standard. This is due to the natural occurrence of As in Chitorem. The remaining metals had low removal efficiencies or even some small increases metal concentrations. Chitorem typically performed the best of the three pre-treatment additives at removing metals.

4.1.3.2 Conventional Alkaline Addition Via Titration

Conventional treatment of raw MIW to a pH of 9.5 su was completed using a NaOH solution and $Ca(OH)_2$ solution. It required 1.865 mL of NaOH to increase 1 L of raw MIW to reach an approximate pH of 9.5 su, and Figure 4.1-4 shows the titration curve used to determine the dosage. It required 3.650 mL of $Ca(OH)_2$ to increase 1 L of raw MIW to reach an approximate pH of 9.5 su, and Figure 4.1-5 shows the titration curve used to determine the dosage.

CDM Smith Laboratory Parameters

The raw MIW was titrated to a pH of approximately 9.5 su with the two alkaline materials before being sampled. The remaining laboratory parameters were not recorded on the titrated water samples.

Metals

Observations of dissolved and total metal trends (Table 4.1-1), MRE ranges (Table 4.1-2), and comparison to water quality standards (Table 4.1-3) of the two conventionally treated MIW samples with alkaline materials are as follows:

- Dissolved Al was removed at an efficiency of greater than 98 percent for both materials. Total Al was removed at an efficiency rate of 95.1 percent for NaOH and 98.1 percent for $Ca(OH)_2$. Dissolved concentrations in the NaOH sample exceeded the chronic aquatic life standard. Note that the detection limit for Al (100 µg/L) is greater than the chronic aquatic life standard of 87 µg/L.

- Dissolved and total As concentrations were non-detect in both cases (less than 2.5 µg/L). Dissolved As was removed at an efficiency of greater than 51.8 percent for both materials, and total As was removed at an efficiency of greater than 82.5 percent for both materials.

- Dissolved Cd removal efficiencies were greater than 99 percent for both materials. Total Cd removal efficiencies were 96.6 percent for NaOH and 98.9 percent for $Ca(OH)_2$. Total concentrations in both cases exceeded the chronic aquatic life standards. Note that the detection limit for Cd (0.5 µg/L) is greater than the acute and chronic aquatic life standards.

- Dissolved and total Co was treated to below the detection limit of 0.5 µg/L in both cases. Removal efficiencies were greater than 98 percent in both cases for dissolved and total.

- Dissolved Cu was removed at an efficiency of greater than 97.7 percent for NaOH and $Ca(OH)_2$. Total Cu was removed at an efficiency of 95.0 and 97.6 percent for NaOH and $Ca(OH)_2$, respectively. No standards were exceeded.

- Dissolved Fe concentrations were non-detect and were removed with an efficiency of greater than 99.4 percent. Total Fe concentrations were non-detect for the $Ca(OH)_2$ treated sample, but were 2,180 µg/L for the NaOH treated sample which exceeded the chronic aquatic life standard. The removal of total Fe concentrations was 97.4 percent for NaOH and greater than 99.4 percent for $Ca(OH)_2$.

- Dissolved Pb concentrations were non-detect and were removed with an efficiency of greater than 99.4 percent. No standards were exceeded. The removal of total Pb concentrations was 97.0 percent for NaOH and 99.3 percent for $Ca(OH)_2$.

- The dissolved Mn concentrations were removed at an efficiency of 97.0 percent for NaOH and 96.6 percent for $Ca(OH)_2$. Total Mn concentrations were removed at efficiencies of 93.7 percent for NaOH and 95.8 percent for $Ca(OH)_2$.

- The dissolved Ni concentrations were removed at an efficiency of greater than 88.5 percent for NaOH and 83.7 percent for $Ca(OH)_2$. Total Ni concentrations were removed at efficiencies of greater than 83.7 percent.

- Dissolved and total Tl concentrations were non-detect. However, the detection level of Tl was 2.5 µg/L, which is greater than the low human health standard.

- Dissolved Zn concentrations were removed with an efficiency of greater than 99 percent. The removal of total Zn concentrations was 96.8 percent for NaOH and 99.3 percent for $Ca(OH)_2$. No standards were exceeded for the $Ca(OH)_2$ treated water. For the NaOH treated water, the dissolved concentration was non-detect, but the total concentration exceeded the acute and chronic aquatic life standards.

- Other metals that were analyzed include Sb, Ba, Be, Cr, Se, Ag, and V. Concentrations for all of these were trace to non-detect.

Wet Chemistry Parameters

Acidity concentrations were reduced by 97.9 percent for NaOH and 98.9 percent for $Ca(OH)_2$. Sulfate concentrations were reduced by 0.7 percent for NaOH and 2.2 percent for $Ca(OH)_2$. Alkalinity was non-detect in the raw MIW, but increased by 266 percent in the NaOH treated sample and 182 percent in the $Ca(OH)_2$ sample.

Sludge Volume

After addition of the alkaline solutions, the sludge volume produced was measured using an Imhoff cone settling test. After one hour, the NaOH treated MIW to pH 9.5 produced 95 mL of sludge and the $Ca(OH)_2$ treated MIW to pH 9.5 produced 35 mL of sludge. Based on this time, the settling rates were 1.58 mL/min for NaOH treated MIW to pH 9.5 su and 0.58 mL/min for $Ca(OH)_2$ treated MIW to pH 9.5 su.

Summary

Conventional treatment of MIW to pH of 9.5 su sufficiently removed (greater than 90 percent) concentrations of Al, Cd, Co, Cu, Fe, Pb, Mn, and Zn. Ni was removed at efficiencies above 80 percent. The only dissolved metal which exceeded a standard was Al in the NaOH treated water which exceeded the chronic aquatic life standard. The Al and Tl reporting limits were above the some or all of the standards.

4.1.4 Hydraulic Testing of Substrates

The approximate porosity of the SAPS substrate was measured utilizing columns filled with two different volumes of substrate materials. The columns each had a diameter of 1.5 inches. Column A was 10 inches long and Column B was 15 inches long. They were then filled with known quantities of substrate material which are shown in Exhibit 4-2. The Chitorem substrate was not tested.

After the columns were prepared, the columns were saturated at first using gravity feed, but as discussed in Section 2.1.3, there was too much suction pressure within the columns. Raw MIW was

Exhibit 4-2. Substrate Quantities

Parameter	Column A	Column B
Limestone (kg)	0.19	0.39
Manure (g)	17.5	17.5
Compost (g)	29.0	29.0
Limestone Thickness (in)	4.6	9.4
Manure/Compost Mix Thickness (in)	1.6	2.5
Total Thickness (in)	6.2	11.9

Note: Limestone was measured on a scale which read to the nearest hundredth of a kilogram. Manure and compost were measured on a more precise scale.

then pumped into the columns using a peristaltic pump and water was recirculated until the column became fully saturated. The amount of water was measured in a beaker before adding to the column and then the effluent was measured after saturation. From this, the volume of the void (V_V) can be measured as shown in Exhibit 4-3.

Exhibit 4-3. Volume of the Void

Parameter	Column A	Column B
Initial Volume (mL)	250	500
Final Volume (mL)	162	340
Volume of the Void (mL)	88	160

During water addition, the finer compost and manure fractions had migrated into the limestone voids. This led to an overall loss in fines of the compost/manure layer. The limestone also further compacted during water addition. The volume of the void represents the volume after compaction of the materials from the addition of the water. The saturated thicknesses of each column were re-measured after compaction, and the results were total thicknesses for Column A of 5.625 in and Column B of 10.75 in. The total volume (V_T) of the columns can be calculated using the following equation:

$$V_T = \pi r^2 * L * 16.39$$

Where: r = radius of the column, in
L = total thickness of column, in
16.39 = conversion factor from in^3 to mL

The porosity of the columns can then be determined using the following equation:

$$n = \frac{V_V}{V_T} * 100$$

Where: n = porosity, percent
V_V = volume of void, mL
V_T = total volume, mL

The estimated porosity of the columns is shown in Exhibit 4-4. Possible sources of minor error include the inability to fully saturate the columns and some water loss due to spills or leaks from the columns. Retention time was not measured due to the suction pressure of the columns which would not allow draining by gravity.

Exhibit 4-4. Porosity

Parameter	Column A	Column B
Volume of the Void, mL	88	160
Total Volume, mL	162.8	311.2
Porosity	54.1%	51.4%

4.1.5 Results of Alkaline Addition and SAPS Pre-Treatment

The following subsections summarize the MIW metals concentrations after pre-treatment methods through substrate-filled columns. Pre-treatment of the Danny T water was conducted prior to the BCR tests using a combination of alkaline pre-treatment and/or SAPS columns as follows:

- Pre-treatment first with NaOH solution to pH 4.5 su, followed by flow through a SAPS column (Column #1)
- Pre-treatment first with $Ca(OH)_2$ solution to pH 4.5, followed by flow through a SAPS column (Column #2)
- Flow though the SAPS column with raw oxidized Danny T adit water (Column #3)
- Flow through a Chitorem column (Column #4)

CDM Smith Laboratory Parameters

Each of the columns produced neutral to slightly basic pH values. Columns #1 and #2 which included pre-treatment to pH 4.5 had the lowest pH values of the columns at 7.32 su and 7.41 su, respectively. Column #3 pH was slightly higher at 7.55 su, while Column #4 pH was the highest at 8.89 su.

Conductivity increased from the raw MIW of 1.722 mS/cm to a range of 4.050 to 4.649 mS/cm in Columns #1, #2, and #3. The greatest increase was in Column #4, which increased to 7.459 mS/cm. This increase is likely due to the flushing of soluble components from the substrates, which is expected during startup.

The increase in temperature from the raw water is a function of refrigeration of the raw water versus the treated water from the columns warming up to room temperature of the CDM Smith Laboratory.

ORP decreased in all four columns from the raw MIW ORP of 563 mV. Columns #1 and #2 which included pre-treatment to pH 4.5 had the lowest ORP decreases of the columns at 198 mV. Column #3 ORP decrease was slightly larger at 163 mV and Column #4 ORP decrease was the largest at 141 mV.

DO decreased significantly in all four columns from the raw MIW DO of 10.77 mg/L. The DOs for Columns #1, #2, #3, and #4 were 0.71, 0.65, 0.52, and 1.20 mg/L.

Metals

Observations of dissolved and total metal trends (Table 4.1-1), MRE ranges (Table 4.1-2), and comparison to water quality standards (Table 4.1-3) of the four pre-treatment column effluents are as follows:

- Dissolved Al was removed at an efficiency of greater than 96.9 percent in all four columns to non-detect concentrations (200 µg/L). Total Al was removed at an efficiency rate between 92.5 and 93.6 percent for Columns #1, #2, and #3, and Column #4 removal efficiency was greater than 96.9 percent (to non-detect). Note that the laboratory Al detection limit (200 µg/L) was greater than the chronic aquatic life standard (87 µg/L).

- As concentrations increased from the raw MIW concentrations of 5.19 J µg/L for dissolved and 14.3 µg/L for total. Columns #1, #2, and #3 had dissolved and total concentrations between 23.8 and 35 µg/L, but Column #4 had a dissolved concentration of 127 µg/L and a total concentration of 104 µg/L. Dissolved and total As concentrations were in exceedance of the human health standard in all four columns. Removal efficiencies were not calculated for Columns #1, #2, and #3 because both the raw water and treated water effluent had results that were less than 5 times their respective reporting limits. In Column #4, dissolved As increased by 2,347 percent and total As increased by 627.3 percent. As described previously, these high As values are a result of leaching from the Chitorem substrate.

- Dissolved and total Cd removal efficiencies were greater than 99 percent for Columns #1, #2, and #3. Dissolved and total Cd removal efficiencies in Column #4 were 98.3 and 98.2 percent, respectively. Both dissolved and total concentrations in Column #4 exceeded the chronic aquatic life standard. Columns #1, #2, and #3 were non-detect, but the detection limit of 1.0 µg/L is greater than chronic aquatic life standard.

- Dissolved Co decreased to concentrations between 5.4 µg/L and non-detect (less than 1.0 µg/L) and removal efficiencies from 79.6 to greater than 96.2 percent. Total Co decreased to concentrations between 5.72 µg/L and non-detect and removal efficiencies from 77.6 to greater than 96.1 percent. The removal effectiveness of Co followed the column numbers (i.e., Column #1 was least effective and Column #4 was the most effective).

- Dissolved Cu was removed at an efficiency of 91.8, 93.8, 91.6, and 81.3 percent for Columns #1, #2, #3, and #4, respectively. Total Cu was removed at an efficiency of 88.1, 88.8, 84.8, and 88.3 percent for Columns #1, #2, #3, and #4, respectively. Concentrations exceeded the chronic aquatic life standard except for the dissolved concentration in Column #2. The total concentration in Column #3 and the dissolved concentration in Column #4 also exceeded the acute aquatic life standard.

- Dissolved and total Fe concentrations were non-detect (1,000 µg/L) and were removed with an efficiency of greater than 98.0 percent. Note that the Fe detection limit is equal to the chronic aquatic life standard (1,000 µg/L).

- Dissolved and total Pb concentrations were trace to non-detect (less than 1.0 µg/L) and did not exceed any standards. Dissolved and total Pb concentrations were removed with an efficiency of greater than 95.0 percent.

- Dissolved Mn was removed at an efficiency of 91.9, 80.2, 85.3, and 99.98 percent for Columns #1, #2, #3, and #4, respectively. Total Cu was removed at an efficiency of 91.8, 80.0, 85.5, and greater than 99.9 percent for Columns #1, #2, #3, and #4, respectively. Column #4 was reduced to non-detect (less than 20 µg/L) for both the total and dissolved concentrations.

- Dissolved and total Ni concentrations did not exceed any standards. Removal efficiencies were not calculated because both the raw water and treated water effluent had results that were less than 5 times their respective reporting limits.

- Dissolved Tl was not detected in the effluent or the influent. Total Tl was also not detected, however, the RL of 5.0 µg/L is greater than the low human health standard.

- Dissolved and total Zn concentrations were removed with an efficiency of greater than 99.0 percent. No standards were exceeded.

- Other metals that were analyzed include Sb, Ba, Be, Cr, Se, Ag, and V. Concentrations for all of these were trace to non-detect.

Wet Chemistry Parameters

Acidity concentrations were reduced by greater than 98.9 percent for all four columns to non-detect concentrations (less than 4 mg/L). Sulfate concentrations were reduced by 3.2, 5.0, 4.1, and 6.9 percent for Columns #1, #2, #3, and #4, respectively. Alkalinity was non-detect in the raw MIW, but increased by 4,180, 3,820, 4,600, and 11,380 percent for Columns #1, #2, #3, and #4, respectively.

Summary

The pH values of the columns were neutral to slightly basic. The effluent conductivity of the columns increased between two and three times the raw MIW due to flushing of soluble components of the substrates. DO decreased to approximately 1 mg/L or below in the column effluents.

Results of MRE using the four pre-treatment columns sufficiently removed (greater than 90 percent) concentrations of Al, Fe, Pb, and Zn. Of these metals, only Al had concentrations which exceeded a standard, the chronic aquatic life standard. Overall, there was no apparent improvement in metal removal between the SAPS with alkaline addition pre-treatments (Columns #1 and #2) and the SAPS alone (Column #3). Column #4 had some improvement in metal removal such as Al and Zn, but less efficient at removal of Cd and Cu. Columns #1, #2, and #3 removed dissolved Cd to non-detect concentrations, however Column #4 had detected concentrations that exceeded the chronic standard. Columns #1, #2, and #3 sufficiently removed dissolved Cu concentrations but total concentrations were just below 90 percent. Column #4 dissolved and total Cu concentrations MREs were in the 80 percent range. As concentrations in each of the column effluents increased from the raw MIW sample and exceeded the human health standard, with the greatest increase in the Column #4 (Chitorem). These results indicate that the As was naturally occurring in the various substrate materials. For Column #4, the Chitorem was produced from benthic marine animals most likely exposed to arsenic-laden waters and sediment. Other metals were removed to concentrations below water quality standards or at detection levels.

The acidity was sufficiently removed, and slight increases in sulfate were detected. Because sulfate reduction has not occurred in this short period, it is likely that removal of metals occurred as a result of sorption and oxy-hydroxide and/or carbonate precipitation reactions within the substrate media.

Had the study been continued for a longer period, removal of these metals is not suspected to be maintained because the organic substrate sorption sites become saturated. Each column had an increase in alkalinity, with the greatest from Column #4. Since the alkaline addition pre-treatment steps did not produce alkalinity, all of the measured alkalinity in these samples resulted from the column substrates.

4.1.6 Results of Biochemical Reactor Testing

The following subsections summarize the MIW metals concentrations after 6 weeks of incubation in the BCRs for each of the columns.

CDM Smith Laboratory Parameters

The pH of the MIW in the BCRs decreased to around 5.0 su from the pre-treatment columns. Specifically, the pH values were 4.95, 4.93, 4.99, and 5.13 su for BCR #1, #2, #3, and #4, respectively.

The conductivity increased from the pre-treatment columns to between 5.62 and 6.23 mS/cm for BCRs #1, #2, and #3 and to 7.63 mS/cm in Column #4. The increases are likely due to the increase of soluble components from the substrates within the BCRs.

The increase in temperature from the raw water is a function of refrigeration and room temperature in the CDM Smith Laboratory.

ORP was negative in all four BCRs. The ORPs were -13.8, -35.9, -35.0, and -55.1 mV for BCRs #1, #2, #3, and #4, respectively.

The lower detectable DO test kits were not used, but from the upper range test kits, it is known that all four BCRs had DO less than 1.0 mg/L.

Alkalinity and sulfide kits were also utilized during the BCR sample collections. The alkalinity was 4,250, 4,250, 4,080, and 5,610 mg/L for BCRs #1, #2, #3, and #4, respectively. The sulfide was 0.26, 0.32, 0.26, and 0.28 mg/L for BCRs #1, #2, #3, and #4, respectively.

Metals

Figures 4.1-6a and -6b, 4.1-7a and -7b, 4.1-8a and -8b, and 4.1-9a and -9b show the dissolved metals concentrations progression from the raw MIW through incubation within the BCR. Total metals were not analyzed from the BCRs. The “a” series of figures show results for As, Cd, Co, Cu, Pb, Ni, and Tl. The “b” series of figures show results for Al, Fe, Mn, and Zn. The raw water (RAW) sample was discussed in Section 4.1.1, the pre-treated to pH 4.5 samples (PH45) were discussed in Section 4.1.3, and the pre-treatment/SAPS column (SPS/CHI) samples were discussed in Section 4.1.5. The BCR (BCR) sample observations of dissolved and total metal trends (Table 4.1-1), MRE ranges (Table 4.1-2), and comparison to water quality standards (Table 4.1-3) of the four Columns’ BCR effluent are as follows:

- There was either a slight increase or no change in the dissolved Al concentrations from the pre-treatments to the BCRs, although the pre-treatment columns were all non-detect so the full increase is unknown. This conclusion is shown on the “b” series of Figures 4.1-6 through 4.1-9. Dissolved concentrations in all four columns exceeded the chronic aquatic life standard. Some leaching of Al from the substrates could have occurred.

- As concentrations decreased from the pre-treatment column samples but still show an increase from the raw MIW as shown on the "a" series of Figures 4.1-6 through 4.1-9. The dissolved As concentrations were in exceedance of the human health standard for BCRs #1 and #4, and only 1 µg/L below that standard in BCRs #2 and #3.

- Dissolved Cd remained non-detect (less than 1.0 µg/L) for BCRs #1, #2, and #3. For BCR #4, the Cd concentration from Column #3 was removed to non-detect for BCR #4.

- Dissolved Co concentrations increased to between 16.0 and 19.0 µg/L. Since very little suspended Co was measured in the effluent from the columns, the increase in Co is a result of substrate leaching.

- Dissolved Cu concentrations decreased to between 15.0 and 23.0 µg/L. No standards were exceeded.

- Dissolved Fe concentrations increased in the BCRs by at least an order of magnitude to between 12,600 and 14,400 µg/L, although the pre-treatment/SAPS columns were all non-detect so the full increase is unknown. All four BCR samples exceeded the chronic aquatic life standard for dissolved Fe. Given dissolved and total Fe were removed to non-detect in the pre-treatment columns, the observed increase in Fe is a result of substrate leaching.

- Dissolved Pb concentrations were trace (2.0 and 3.0 µg/L) and did not exceed any standards. These results are similar to the pre-treatment columns, which indicate that the BCRs did not polish the remaining dissolved Pb concentrations remaining after leaving the columns. The slight differences between the pre-treatment effluent and BCRs are most likely within the analytical accuracy and precision of the instruments used to analyze the samples.

- Dissolved Mn concentrations increased to between 4,940 and 19,200 µg/L. The largest increase was in BCR #4 which went from non-detect to 4,490 µg/L. Given the dissolved and total concentrations were nearly identical in the pre-treatment/SAPS columns (very little suspended solids), the observed increase in Mn is a result of substrate leaching.

- Dissolved Ni concentrations increased to between 67 and 78 µg/L but did not exceed any standards. Given the dissolved and total concentrations were nearly identical in the pre-treatment/SAPS columns (very little suspended solids), the observed increase in Ni is a result of substrate leaching.

- Dissolved Tl concentrations were non-detect, as in the raw MIW. However, the Tl detection level of 5.0 µg/L is greater than the low human health standard.

- Dissolved Zn concentrations increased to between 450 and 470 µg/L. All results exceeded the acute and chronic aquatic life standards. Given that dissolved Zn was removed with an efficiency of greater than 99.0 percent and both total and dissolved concentrations were similar, the observed increase in Zn is a result of substrate leaching.

- Other metals that were analyzed include Ba, Be, Cr, Se, and Ag. Concentrations for all of these were trace to non-detect, with the exception of Ba which exceeded the human health standard for the dissolved concentration. Because Ba was non-detect in all previous steps, the observed increase in Ba is a result of substrate leaching.

Wet Chemistry Parameters

Acidity concentrations greatly increased from below the detection limit of 4.0 mg/L in the pre-treatment column effluents to within the range of 550 and 1,200 mg/L in the BCR containers. The increase in acidity may be due to acidity released from the substrates. Sulfate concentrations increased in each of the four BCRs to within the range of 950 to 1,000 mg/L. This is an approximate increase of between 150 to 250 mg/L sulfate from the pre-treatment column effluents. Alkalinity increased by an order of magnitude in each of the BCRs from the pre-treatments. Sulfide was measured for the BCRs at Energy Laboratories at concentrations of 13, 3, 11, and 8 mg/L for BCRs #1, #2, #3, and #4, respectively. The increase in alkalinity and detectable sulfide indicate that some small amount of sulfate reduction may have occurred at some point in the BCR containers.

Summary

The pH of the MIW in the BCRs decreased to around a pH of 5.0 su which is below the target pH of 6.5 to 9.0 su for effective treatment. Although ORP was negative in all four BCRs, ORPs low enough to have sustained sulfate reduction were not measured. The target DO of less than 2 mg/L was achieved as DO decreased to around 1 mg/L and below in the BCRs.

Al, Cd, Pb, and Tl saw little to no change in the dissolved concentrations from the pre-treatment columns to the BCRs because they were already removed in the columns. As, Ba Co, Fe, Mn, Ni, and Zn dissolved concentrations increased from the column effluents, which suggests leaching from the substrates. Only Cu saw additional polishing of metal concentrations as a result of the BCRs. Both Al and Fe exceeded the chronic aquatic life standard in each BCR. Zn exceeded both the acute and chronic aquatic life standards in all four BCRs, and As exceeded the human health standard in BCR #1 and #4.

Sulfate and acidity concentrations increased after treatment within the BCRs. These observations suggest that both sulfate and acidity were leached from the BCR substrates. Some sulfate reduction may have occurred because of the increase in total alkalinity and detected sulfide; however, any decrease in sulfate as a result of sulfate reduction was not observed as a result of the leaching from the substrates.

4.2 Pilot-Scale Treatability Study

Pilot-scale treatability results are presented in the following sections. Table 4.2-1 presents all analytical laboratory results for the pilot-scale study, including field duplicate samples. Table 4.2-2 presents all field measurement data. Table 4.2-3 presents the MRE for all dissolved metals and percent removal for select wet chemistry parameters. Finally, Table 4.2-4 presents a comparison of results to DEQ-7 aquatic water quality criteria. Tables 4.2-5 and 4.2-6 present the oxidation test data and SPLP data, respectively.

The MRE calculations in Table 4.2-3 considered analytical results (either influent or effluent) near or at laboratory reporting limits. MRE for a metal was not calculated if the raw water and treated water effluent results were both non-detect (U flagged data). Similarly, comparison of water quality to screening criteria in Table 4.2-4 was not conducted if the sample results were non-detect (U flagged). Reporting limits provided by Energy for the pilot-scale data set were consistently the same throughout the study period and estimated data (J flagged) below the reporting limits were not provided. As a result, MRE calculations were not subject to same limitations as with the bench-scale data set (see introduction to Section 4.1). As shown on Table 4.2-4 MRE calculations are qualified by a less than or greater than sign if applicable. If the raw water is non-detect and the treated water effluent is greater than the reporting limit, then the MRE is less than the percent shown. In contrast, if the treated water effluent is non-detect and the raw water is greater than the reporting limit, then the MRE is greater than the percent shown.

Pilot-scale data from the system influent, pre-treatment effluents, and BCR barrel effluents are also presented in a series of figures to aid in data analysis and discussion. Figures 4.2-1 through 4.2-3 present time-based charts of pH, ORP, and DO results, respectively. Figures 4.2-4 through 4.2-15 present time-based charts of dissolved Al, As, Ba, Cd, Co, Cu, Fe, Pb, Mn, Ni, Tl, and Zn, respectively. Figures 4.2-16 through 4.2-19 present time-based charts of sulfate, sulfide, acidity, and total alkalinity, respectively.

4.2.1 Danny T Adit MIW Influent

The following subsections summarize the MIW influent water quality.

Field Parameters

As shown in Table 4.2-2 and Figure 4.2-1, influent MIW water remained relatively consistent even into the later summer in September. The pH ranged from 2.72 to 2.94 su throughout the pilot-scale study period. Conductivity of the influent MIW ranged from 1,332 to 3,394 µS/cm, with no obvious trend over the range observed. Temperature ranged from 15.19 ^{0}C to 25.14 ^{0}C. ORP (Figure 4.2-2) ranged from 382.6 to 492.7 mV. DO (Figure 4.2-3) ranged from 2.19 to 6.48 mg/L. The lowest DO values were recorded at the end of the study; however, ORP remained relatively constant through the study.

Metals

Observations of dissolved metal trends (Table 4.2-1 and Figures 4.2-4 through 4.2-15), MRE ranges (Table 4.2-3), and comparison to water quality standards (Table 4.2-4) of the MIW influent are as follows:

- Dissolved Al concentrations ranged from 15,600 µg/L at the beginning of the study to 8,710 µg/L at the end of the study. Concentrations were significantly in exceedance of the chronic and acute water quality standards throughout the study. Al steadily decreased through the study period, with a concentration measured during the last sampling event at nearly half of the initial concentration.

- Dissolved As concentrations ranged from 311 µg/L at the beginning of the study to 93 µg/L at the end of the study. Concentrations always exceeded the human health standard and exceeded the chronic aquatic standard during the beginning of the study. A large decrease in As was observed by the end of the study.

- Dissolved Be concentrations were low (6 to 8 µg/L); however, these concentrations were still in exceedance of the low human health standard of 4 µg/L.

- Dissolved Cd concentrations ranged from 316 µg/L at the beginning of the study to 154 µg/L at the end of the study, again steadily decreasing throughout the study similar to Al and As. Concentrations were significantly in exceedance of the human health, chronic, and acute water quality standards throughout the study.

- Dissolved Co concentrations ranged from 58 µg/L at the beginning of the study to 36 µg/L at the end of the study. A standard for Co does not exist in Montana; however, this metal is included in the time charts because concentrations are significant enough that removal trends can be observed in the BCR effluent data.

- Dissolved Cu concentrations ranged from 2,160 µg/L at the beginning of the study to 924 µg/L at the end of the study, again steadily decreasing throughout the study similar to Al, As, and Cd. Concentrations were significantly in exceedance of the chronic and acute aquatic water quality standards throughout the study and in exceedance of the human health standard at the beginning of the study.

- Dissolved Fe concentrations ranged from 180,000 µg/L at the beginning of the study to 112,000 µg/L at the end of the study, again steadily decreasing throughout the study similar to the other metals above. Concentrations exceeded the chronic aquatic water quality standard throughout the study.

- Dissolved Pb concentrations ranged from 252 µg/L at the beginning of the study to 122 µg/L at the end of the study, again steadily decreasing throughout the study similar to the other metals above. Concentrations always exceeded the human health and the chronic aquatic standard during the throughout the study.

- Dissolved Mn concentrations ranged from 128,000 to 98,400 µg/L, again showing a similar decreasing trend throughout the study. Mn does not have a DEQ-7 standard for comparison; however, Mn is a major metal contributing to influent acidity loading along with Al and Fe.

- Dissolved Ni concentrations ranged from 28 to 39 µg/L, again showing a similar decreasing trend throughout the study. No exceedances of standards were observed.

- Dissolved Tl concentrations were low (1.8 to 2.3 µg/L); however, these concentrations were still in exceedance of the low human health standard (0.24 µg/L).

- Dissolved Zn concentrations ranged from 69,100 µg/L at the beginning of the study to 44,500 µg/L at the end of the study, again steadily decreasing throughout the study similar to the other metals above. Concentrations were significantly in exceedance of the human health, chronic, and acute water quality standards throughout the study.

- Other metals that were analyzed include barium, chromium, and silver. Concentrations for all of these were trace to non-detect throughout the study period.

A comparison of dissolved metals to total metals in the influent generally shows a good correlation between the two, indicating the metals are largely in the dissolved phase. Some dissolved metals concentrations were greater than total concentrations, where the differences may be within the analytical accuracy and precision of the instruments used to analyze the samples.

Wet Chemistry Parameters

Sulfate (Figure 4.2-16) concentrations in the influent MIW ranged from 1,600 to 2,500 mg/L. Acidity (Figure 4.2-18) concentrations in the influent MIW ranged from 460 to 820 mg/L. Alkalinity (Figure 4.2-19) concentrations in the influent MIW was non-detect throughout the study as expected for this type of acidic MIW.

Summary

Steadily decreasing metals concentrations were observed through the end of the study along with decreasing DO. These data illustrate the relationship of the adit discharge to seasonal weather. During the drier summer less precipitation infiltrates into the underground workings resulting in contact with the mineralized workings and evidence of a larger bedrock groundwater source for the adit discharge. Decreases in DO also illustrate that the adit discharge may be more related a bedrock groundwater source during the summer season rather than infiltration recharge of high DO precipitation recharge.

4.2.2 BCR1

BCR1 had no pre-treatment. The following subsections summarize the BCR1 effluent water quality.

Field parameters

The field parameters of pH, conductivity, ORP, temperature, and DO are broad indicators of the BCR performance. BCR 1 raised the pH to between 5.60 and 6.14 su, however, the discharge pH was not within the range of 6.5 to 9.0 su set forth by DEQ[1].

Conductivity ranged from 1,992 to 3,505 µS/cm. Effluent conductivity was greater than the influent initially due to the flushing of soluble components from the substrates, which is expected in BCRs during startup. After startup, conductivity was similar to the influent.

ORP ranged from -163.0 mV initially to 57.6 mV at the end of the study. ORP varied between negative and positive values throughout the study but never reached reducing conditions sufficient to promote the sulfate reduction reaction process (i.e., consistently -150 mV or less).

DO ranged from 0.02 mg/L initially to 2.31 mg/L at the end of the study. DO values at the end of the study were essentially the same as the influent MIW.

Metals

The following includes observations of dissolved metal trends (Table 4.2-1 and Figures 4.2-4 through 4.2-15), MRE ranges (Table 4.2-3), and comparison to water quality standards (Table 4.2-4). Dissolved metals are the focus of the discussion since the total metals data set is limited to only two sampling events. Total metals data are presented and discussed where relevant.

- Dissolved Al was removed by BCR1 with an efficiency of greater than 92 percent consistently; however, concentrations (90 to 840 µg/L) remained in exceedance of the chronic aquatic standards. The acute aquatic standard was also exceeded during one sampling event (840 µg/L). Total metals concentrations where measured were greater than dissolved and also had an MRE of greater than 92 percent.

- Dissolved As was removed by BCR1 with an efficiency of greater than 92 percent consistently. Total metal MRE was only 71.0 percent during the first sampling event and 92.3 percent near

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[1] Administrative Rules of Montana, Title 17, Chapter 30 – Water Quality, Sub-Chapter 6 – Surface Water Quality Standards, Section 17.30.628 Classification Standards.

the end of the study. Dissolved As concentrations ranged from 6.0 to 15.0 µg/L and were occasionally in exceedance of the human health standard.

- Dissolved Ba concentrations were elevated in the incubation sample (550 µg/L) and gradually declined to non-detect during the last sampling event. Ba is non-detect in the influent MIW; therefore, the detected concentrations are attributed to leaching from the substrates. This phenomenon has been observed in other studies during the initial startup phase with BCRs that contain woody substrate materials; however, the concentrations quickly decline.

- Dissolved Be was removed by BCR1 with an efficiency of greater than 83 percent consistently, with concentrations non-detect or at the reporting limit (1 µg/L).

- Dissolved Cd was removed by BCR1 with an efficiency of greater than 99 percent consistently, with concentrations non-detect or at the reporting limit (1 µg/L). However, note that the reporting limit was not low enough for direct comparison against the chronic standard (typically 0.75 µg/L at the hardness of the samples). The one detected concentration of 1 µg/L exceeded the chronic aquatic standard. In the incubation sample, total Cd was much greater than dissolved at 21 µg/L. The later measurement of total Cd was the same as the dissolved concentration (non-detect).

- Dissolved Co was removed by BCR1 in the incubation sample by 91.4 percent, followed by a decline in MRE through the remainder of the study. The last three sampling events had a negative or zero MRE with concentrations essentially the same as the influent MIW. This type of response is indicative of initial removal through adsorption followed by breakthrough (e.g., adsorption capacity of the sorbent material has been exceeded). These results indicate Co is not likely removed via a chemical reaction to precipitate Co as a carbonate, oxy-hydroxide, or sulfide. Co is discussed because of the potential adsorption removal mechanism, although it does not have a water quality standard for comparison.

- Dissolved Cu was removed by BCR1 with an efficiency of greater than 99 percent consistently. Cu was detected in the incubation sample at 6 µg/L, followed by non-detect concentrations for the remainder of the study (less than 5 µg/L). In the incubation sample, total Cu was much greater than dissolved at 191 µg/L. The later measurement of total Cd was the same as the dissolved concentration (non-detect).

- Dissolved Fe was removed by BCR1 in the incubation sample by 97.2 percent, followed by a decline in MRE through the remainder of the study. The last three sampling events ranged from 23.4 to 33.7 percent MRE. Dissolved Fe concentrations exceeded the chronic aquatic standard throughout the study. The decline in Fe removal is likely due to the lack of sulfate reduction in the substrate, as discussed below.

- Dissolved Pb was removed by BCR1 with an efficiency of greater than 96 percent consistently, with all concentrations non-detect (less than 1 µg/L). In the incubation sample, total Pb was much greater than dissolved at 60 µg/L. The later measurement of total Pb was at 9 µg/L.

- Dissolved Mn was removed by BCR1 in the incubation sample by 82.5 percent, followed by a decline in MRE through the remainder of the study. The last four sampling events had a slightly negative MRE, indicating that Mn was leaching from the substrate or re-dissolving from precipitates. Removal of Mn is not expected in a BCR since Mn does not form a stable sulfide precipitate. Mn is typically removed by carbonate precipitate formation or adsorption.

- Dissolved Ni MRE ranged from 78.4 to -13.8 percent. Ni removal followed a similar breakthrough curve as Co. Generally Ni removal was poor in BCR1 and effluent concentrations were similar to influent MIW concentrations for all August and September sampling events; however, effluent concentrations did not exceed any of the standards.
- Dissolved Tl was removed by BCR1 with an efficiency of greater than 72 percent consistently, with all results non-detect (less than 0.5 µg/L). However, note that the reporting limit was not low enough for direct comparison against the lower human health standard (0.24 µg/L).
- Dissolved Zn was removed by BCR1in the first two samples by greater than 99.9 percent, followed by a decline in MRE through the remainder of the study. After the first two sampling events, dissolved Zn concentrations greatly exceeded the chronic and acute aquatic standards and human health standard. Zn concentrations in BCR 1 show a typical adsorption breakthrough curve similar Ni, with initial removal due to adsorption, then effluent Zn concentrations approaching influent concentrations.

Wet Chemistry Parameters

Figure 4.2-20 illustrates the acidity and alkalinity relationship for BCR1. This relationship is important because it shows whether or not the net acidic influent MIW was treated to the desired net alkaline condition. Acidity concentrations in BCR1 ranged from non-detect (less than 4 mg/L) in the incubation sample to a high of 450 mg/L. The incubation sample had greater alkalinity (1,400 mg/L), followed by a decrease to less than 100 mg/L for the remainder of the study. Ideally, a neutral treated effluent from a BCR should have no acidity; however, BCR 1 did not generate enough alkalinity to neutralize the acidity in the influent MIW.

Sulfate concentrations ranged from 240 mg/L in the incubation sample to a high of 1,400 mg/L. Sulfate removal efficiency ranged from 85 percent (incubation sample) to a low of 36.4 percent. Some sulfide generation occurred during the beginning of the study (4 mg/L in the incubation sample), followed by non-detect concentrations during the last 3 sampling events.

All of these data together suggest that some sulfide reduction was occurring during the incubation period. Alkalinity and sulfide are generated by the sulfate reduction reaction while sulfate is consumed and acidity is neutralized. The pH observed above 6.0 and the negative ORP observed also correlate with this conclusion. After this period however, the sulfate reduction could not be maintained for any number of reasons such as acidity overloading, low retention time, or lack of the correct substrate nutrients to sustain sulfate reduction.

Summary

At the beginning of the study, BCR1 MREs for all metals were very good. However, conditions in BCR 1 changed quickly after incubation resulting in a lack of sulfate reduction, lack of buffering of acidity/pH with alkalinity production, and insufficient removal of Fe, Mn, Ni, and Zn. Other metals were removed to concentrations at or near water quality standards or below detection levels consistently. These observations indicate that BCR1 was overloaded with influent acidity. After decreasing the average flow rate on 9/4, no significant change in metal removal was observed in the sample collected on

9/16. Insufficient time remained in the study to evaluate the treatment effectiveness of this modification.

Since sulfate reduction did not occur after the incubation period, removal of these other metals such as Cd, Cu, and Pb were likely by sorption and oxy-hydroxide/carbonate precipitation reactions within the substrate media. Had the study been continued for a longer period, removal of these metals is not expected to be maintained because the organic substrate sorption sites become saturated with these metals. This phenomenon has been observed recently at other similar pilot tests when sulfate reduction is not the dominant removal mechanism. These results also support the need for pre-treatment of this high acidity MIW ahead of the BCR.

4.2.3 SAPS Pre-treatment and BCR2

The SAPS pre-treatment was followed by BCR2. The following subsections summarize the SAPS and BCR2 effluent water quality.

Field Parameters

The SAPS raised pH to a range between 5.11 and 6.38 su, while BCR2 further increased pH to a range between 5.91 to 6.32. With exception to the incubation sample, BCR2 further increased pH by 0.7 to 0.9 su from the SAPS effluent. However, effluent pH from BCR2 was not within the DEQ standard range (6.5 to 9.0 su).

Conductivity ranged from 1,996 to 2,434 µS/cm in the SAPS and from 2,019 to 4,954 µS/cm in BCR2. Effluent conductivity was greater than the influent initially in both barrels due to the flushing of soluble components from the substrates, which is expected during startup. After startup, conductivity was similar to the influent.

ORP ranged from -157.6 mV initially to a high of 178.30 mV in the SAPS and from -153.8 mV initially to a high of 19.4 mV in BCR2. ORP in the SAPS remained positive after the incubation sample, while ORP in BCR2 varied between negative and positive values throughout the study. Sufficiently negative ORP values were never reached to promote the sulfate reduction reaction process.

The SAPS DO ranged from 0.09 mg/L initially to 4.14 mg/L at the end of the study, while the BCR2 DO ranged from 0.05 mg/L initially to 8.52 mg/L at the end of the study. DO values for both barrels at the end of the study were greater than the influent MIW. The reason for the increased DO is unknown, but may be due to instrument error, sampler error, or some unknown chemical or biological reaction.

Metals

The following includes observations of dissolved metal trends (Table 4.2-1 and Figures 4.2-4 through 4.2-15), MRE ranges (Table 4.2-3), and comparison to water quality standards (Table 4.2-4). Dissolved metals are the focus of the discussion since the total metals data set is limited to only two sampling events. Total metals data are presented and discussed where relevant.

- Dissolved Al concentrations in the SAPS ranged from 40 µg/L in the incubation sample to a high of 2,550 µg/L, while the MRE ranged from 99.7 initially to a low of 80.1 percent. For BCR2, dissolved Al concentrations ranged from non-detect (less than 30 µg/L) to 140 µg/L, while the overall MRE was consistently greater than 90 percent. The overall MRE was calculated by comparing the BCR2 effluent to the SAPS MIW influent (influent adit MIW). The chronic aquatic standard was exceeded in the first sampling event (140 µg/L) for BCR2. For all remaining samples, results indicate that BCR2 effectively polished additional Al not removed in the SAPS.

Total Al concentrations were greater than dissolved for both barrels. During the first sampling event, the SAPS removed 98.8 percent of total Al (220 µg/L concentration). In contrast, a significant total Al concentration of 154,000 µg/L was observed in the 9/4 SAPS sample, compared to the 680 µg/L dissolved concentration in the same sample. This SAPS effluent Al concentration was 12 times the influent MIW concentration for this event. These data indicate that a significant amount of suspended Al was being discharged from the SAPS during the latter part of the study. Despite this very high total Al concentration, BCR 2 maintained a 99.0 percent total Al MRE on 9/4.

- Dissolved As concentrations in the SAPS ranged from 3 to 52 µg/L at the end of the study, while the MRE ranged from 98.1 percent to only 44.1 percent at the end of the study. Arsenic removal was greater than 97 percent except for the last sample. For BCR2, dissolved As concentrations ranged from 2 to 20 µg/L, while the overall MRE ranged from 93.6 to 99.3 percent. The human health standard was exceeded only in the incubation sample (20 µg/L) for BCR2. Arsenic was either completely removed by the SAPS or slightly polished by BCR2. Similar to Al, a significant total As concentration was observed in the SAPS effluent on 9/4 (746 µg/L) that was greater than the influent MIW As. Again, this spike in As can be explained potentially as leaching or physical transport of sorbed As from the SAPS during the latter part of the study. Despite this very high total As concentration, BCR 2 maintained a 98.0 percent total As MRE on 9/4.

- Dissolved Ba concentrations were elevated in the incubation samples (300 µg/L in the SAPS and 570 µg/L in BCR2) and then gradually declined. For the SAPS, dissolved Ba was non-detect for the last four sampling events, while in BCR2 dissolved Ba had decreased to 70 µg/L by the last sampling event. Concentrations in BCR2 were similar to those observed in BCR1 as a result of substrate leaching.

- Dissolved Be was removed by the SAPS to low levels (1.0 to 3.0 µg/L) except for the last sampling event (7.0 µg/L). For BCR2, dissolved Be was effectively polished to below the reporting limit (1 µg/L) for all samples. A total Be concentration of 63.0 µg/L was discharged from the SAPS on 9/4; however, this high concentration was polished by BCR2.

- Dissolved Cd concentrations in the SAPS ranged from non-detect (less than 1 µg/L) in the incubation sample to a high of 100 µg/L at the end of the study, while the MRE ranged from 99.7 to 35.1 percent. For BCR2, dissolved Cd concentrations were consistently non-detect (less than 1 µg/L), while the overall MRE was consistently greater than 99 percent. Dissolved Cd was effectively polished by BCR2. Similar to other metals above, a high total Cd (584 µg/L) that was greater than the influent MIW was measured on 9/4 in the SAPS. Despite the high loading, BCR2 still removed this Cd concentration to below the reporting limit.

- Dissolved Co was removed by the SAPS in the incubation sample by 91.4 percent, followed by no removal for the remainder of the study. BCR2 removed Co by 81.0 and 85.4 percent during the first two sampling events, followed by minimal removal for the remainder of the study. The results for BCR2 are similar to BCR1 with a relatively fast adsorption breakthrough for Co.

- Dissolved Cu concentrations in the SAPS ranged from non-detect (less than 5 µg/L) to 780.0 µg/L in the last sample, while the MRE ranged from 99.8 to 15.6 percent in the last sample. For BCR2, dissolved Cu concentrations were either non-detect or at the reporting limit of 5 µg/L, while the overall MRE was consistently greater than 98 percent. Dissolved Cu was effectively polished by BCR2. In the incubation samples for both the SAPS and BCR2, total Cu concentrations were much greater than dissolved. Similar to other metals above, a high total Cu (10,100 µg/L) that was greater than the influent MIW was measured on 9/4 in the SAPS. Despite the high loading, BCR2 still removed this Cu concentration to below the reporting limit for the same sample. The high dissolved Cu concentration detected in the last sample could be related to the large release of total Cu detected in the previous sample. Cu removal by sorption may have reached breakthrough by the time of this last sample event.

- Dissolved Fe concentrations in the SAPS ranged from 2,630 µg/L in the incubation sample to a high of 111,000 µg/L, while the MRE ranged from 98.5 percent initially to 4.5 percent at the end of the study. For BCR2, dissolved Fe concentrations ranged from 5,080 µg/L in the incubation sample to a high of to 77,000 µg/L, while the overall MRE ranged from 97.2 percent initially to a low of 52.2 percent. The chronic aquatic standard was exceeded in all BCR2 samples. BCR2 did provide some additional removal after the SAPS although effluent concentrations were still very high. The decline in Fe removal is likely due to the lack of sulfate reduction in the substrate, as discussed below. Similar to other metals above, a high total Fe (669,000 µg/L) that was greater than the influent MIW was measured on 9/4 in the SAPS. This concentration was reduced by 93 percent in BCR2 (to 45,000 µg/L).

- Dissolved Pb concentrations in the SAPS were non-detect (less than 1 µg/L) to 2 µg/L for the first five sampling events, followed by a high of 184 µg/L during the last sampling event. MRE in the SAPS ranged from 99.6 percent to -50.8 percent at the end of the study. The negative MRE indicates that Pb precipitates or adsorbed species were being re-dissolved from the substrate. For BCR2, dissolved Pb concentrations were all non-detect (less than 1 µg/L), while the overall MRE was consistently greater than 99 percent. Dissolved Pb was effectively polished by BCR2. In the incubation samples for both the SAPS and BCR2, total Pb concentrations were greater than dissolved. Similar to other metals above, a high total Pb (1,950 µg/L) that was greater than the influent MIW was measured on 9/4 in the SAPS. Despite the high loading, BCR2 still removed this Pb concentration to the reporting limit. Similar to Cu, the higher dissolved Pb concentration at the end of the study could be due to breakthrough.

- Dissolved Mn concentrations in the SAPS ranged from 42,400 µg/L in the incubation sample to a high of 135,000 µg/L, while the MRE ranged from 65.8 percent initially to slightly negative at the end of study. For BCR2, dissolved Mn concentrations ranged from 7,260 µg/L in the incubation sample to a high of to 127,000 µg/L, while the overall MRE ranged from 94.1 percent initially to -9.5 percent. Overall Mn was removed only in the incubation sample, followed by either no removal or possibly a small amount of leaching from the substrate.

- Dissolved Ni concentrations in the SAPS ranged from 5.0 µg/L in the incubation sample to a high of 42.0 µg/L, while the MRE ranged from 87.2 percent initially to -23.5 percent. The negative MRE indicates that Ni precipitates or adsorbed species may be re-dissolving from the substrate. Alternatively the values detected may just be within the range of accuracy and precision of the instruments used to analyze the samples for the analysis. For BCR2, dissolved

Ni concentrations ranged from non-detect (less than 5 µg/L) to 35 µg/L, while the overall MRE ranged from 86.5 percent to -10.3 percent. Neither the SAPS nor BCR2 significantly or consistently removed Ni from the influent MIW, although no standards were exceeded due to the low influent concentrations.

- Dissolved Tl concentrations in the SAPS ranged from non-detect (less than 0.5 µg/L) to 2.4 µg/L, while MRE ranged from 78.3 to -33.3 percent. The SAPS removed Tl initially but concentrations increased as the study progressed. For BCR2 dissolved Tl concentrations were all non-detect (less than 0.5 µg/L).
- Dissolved Zn concentrations in the SAPS ranged from 70 µg/L in the incubation sample to a high of 63,200 µg/L, while the MRE ranged from 99.9 percent initially to -19.6 percent at the end of the study. For BCR2, dissolved Zn concentrations ranged from 20 µg/L to 13,700 µg/L, while the overall MRE ranged from 99.9 percent to 69.2 percent. Zn was intended to be treated in the BCR and not the SAPS. Initially, treatment of Zn was good; however, conditions in BCR2 were not reducing enough to sustain sulfate reduction to remove zinc as a sulfide precipitate. BCR2 effluent concentrations exceeded the chronic and acute aquatic standards during the last four sampling events. The human health standard was also exceeded during the last three sampling events. For both the SAPS and BCR2 total metals were much greater than dissolved metals. Similar to some of the other metals mentioned above, a high total Zn (69,800 µg/L) that was greater than the influent MIW was measured on 9/4.

Wet Chemistry Parameters

Figure 4.2-21 illustrates the acidity and alkalinity relationship for the SAPS and BCR2. Acidity concentrations in the SAPS ranged from non-detect (less than 4 mg/L) in the incubation sample to a high of 450 mg/L. Alkalinity concentrations ranged from 750 mg/L in the incubation sample to non-detect (less than less than 1.0 mg/L). These data indicate that the SAPS was overloaded with acidity from the influent MIW and the limestone present in the SAPS was not sufficient to buffer that acidity. In other words the SAPS effluent was net acidic through most of the study, even with the pH increase by 2 to 3 su. Similarly, in BCR2, acidity concentrations ranged from non-detect (less than 4 mg/L) in the incubation sample to a high of 270 mg/L. Alkalinity concentrations ranged from 1,700 mg/L in the incubation sample to 100 mg/L. The BCR2 effluent was net alkaline during the first two samples, followed by net acidic for three samples, and then net alkaline again for the last sample.

The SAPS generally did not reduce sulfate concentrations by much from the influent MIW with percent removal ranging from 62.5 percent in the incubation sample to a low of 22.7 percent. Removal of sulfate by sulfate reduction was not intended in the SAPS, although some sulfate can be removed by precipitation of Al and Fe oxy-hydroxide sulfate precipitates and as calcium sulfate (gypsum). For BCR2 sulfate concentrations ranged from 480 mg/L in the incubation sample to 1,300 mg/L, while overall removal efficiency ranged from 70.0 to 40.0 percent. Removal of sulfate in BCR2 was consistently much greater than in the SAPS.

Some sulfide generation occurred in BCR2; with the greatest concentrations in the incubation sample (11 mg/L) and 7/23 sample (2.4 mg/L). After July, sulfide concentrations ranged from non-detect (less than 0.04 or 0.2 mg/L) to 0.7 mg/L. On 9/4, a 0.15 mg/L concentration was measured compared to the non-detect result from the previous sampling event in August. On the same date, ORP had also decreased to below zero compared to measurement in August. This concentration is low but may have been evidence that the BCR was rebounding from previous overloading. Unfortunately for the last sampling event, sulfide was again non-detect and ORP had again increased greater than zero.

Summary

Overall, in comparison to BCR1 with no pre-treatment, the SAPS and BCR2 combination performed similarly for removal of metals. BCR2 did not sufficiently remove Fe, Mn, Ni, and Zn. Removal of Fe and Zn was much better than for BCR1 alone, although BCR2 effluent still did not meet standards. All other dissolved metals were removed in BCR1 to concentrations below standards or below detection levels. The SAPS/BCR2 consistently removed As to concentrations below the human health standard whereas BCR1 did not. No major improvement in MRE was observed for the 9/11 sample after the average flow rate was decreased on 9/4. Fe MRE slightly increased from 64.3 to 69.9 percent, although this increase may be within the range of accuracy/precision of the measuring instrument.

Despite these positive results for many metals, conditions in BCR2 were not sufficient to sustain sulfate reduction to remove difficult metals such as Fe and Zn and it appears the system was overloaded with acidity. Sulfide was detected and sulfate was reduced; however, BCR2 could not maintain a positive alkalinity balance or consistent reducing conditions. Similar to BCR1, removal of many of the metals appears to have been dominated by adsorption and oxy-hydroxide/carbonate precipitation reactions and removal of metals is not expected to be maintained for an extended period of time without adequate sulfate reducing conditions.

4.2.4 Chitorem Pre-treatment and BCR3

The Chitorem pre-treatment was followed by BCR3. The following subsections summarize the Chitorem and BCR3 effluent water quality.

Field Parameters

The Chitorem barrel raised pH to a range between 6.07 and 6.83 su, while BCR3 effluent pH ranged from 6.17 to 6.81. BCR3 did not always lead to a further increase in pH, with some cases pH slightly decreasing after BCR3. Effluent pH from BCR3 was within the DEQ standard range (6.5 to 9.0 su) for some of the samples.

Conductivity ranged from 2,941 to 60,571 µS/cm in the Chitorem barrel and from 5,154 to 8,162 µS/cm in BCR3. Effluent conductivity was greater than the influent initially in both barrels due to the flushing of soluble components from the substrates, which is expected during startup. Effluent conductivity from the Chitorem barrel was extremely high. This magnitude of concentrations has been observed in other studies performed by CDM Smith with Chitorem, although the concentration in this case may have been above the detectable range of the conductivity instrument. Conductivity values quickly dropped in the Chitorem barrel after the incubation period but remained greater than the influent for the entire study.

ORP ranged from -206.8 mV initially to a high of -57.3 mV at the end of the study in the Chitorem barrel and from -152.5 mV initially to -325.7 in BCR3. ORP in the Chitorem barrel increased after the incubation sample, while ORP in BCR3 decreased to its lowest point (-325.7 mV) on 8/7 followed by an increase to -247.5 mV at the end of the study. Sufficiently negative ORP values were attained in BCR3 to promote the sulfate reduction reaction process. The increase in the Chitorem barrel ORP to -57.3 at the end of the study was likely due to the substrate modification activities conducted on 9/11, just 5 days prior to the final effluent sample. All of the Chitorem, sand, and gravel substrate was removed from the pre-treatment barrel and a portion was mixed with additional gravel to increase permeability. Although care was taken to minimize oxygen exposure by mixing the substrate under a blanket of argon gas, this process likely exposed anaerobic bacteria to oxygen. This can cause SRB spore formation where the bacteria become dormant until conditions become more reducing again. The time needed for SRB to recover from event like this may require a month or more based on research by Perrault et. al. (2009). The barrel may have rebounded somewhat after this maintenance activity given ORP was still slightly negative; however, no further samples were collected due to the onset of winter conditions.

The Chitorem barrel DO ranged from 0.05 mg/L initially to 3.94 mg/L, while the BCR3 DO ranged from 0.04 mg/L initially to 4.34 mg/L.

Metals

The following includes observations of dissolved metal trends (Table 4.2-1 and Figures 4.2-4 through 4.2-15), MRE ranges (Table 4.2-3), and comparison to water quality standards (Table 4.2-4). Dissolved metals are the focus of the discussion since the total metals data set is limited to only two sampling events. Total metals data are presented and discussed where relevant.

- Dissolved Al concentrations in the Chitorem barrel ranged from 300 µg/L in the incubation sample to non-detect (less than 30 µg/L), while the MRE was consistently greater than 98 percent. For BCR3, dissolved Al concentrations ranged from 170 µg/L in the incubation sample to non-detect (less than 30 µg/L), while the overall MRE was consistently greater than 98 percent (comparison of BCR3 effluent to the Chitorem barrel MIW influent). The chronic aquatic standard was exceeded in the first sampling event (170 µg/L) for BCR3. For all remaining samples, Al concentrations were non-detect. Total metals concentrations were greater than dissolved for both barrels. Overall, total metals concentrations were much lower than the SAPS/BCR2 treatment.

- Dissolved As concentrations in the Chitorem barrel ranged from 4,180 in the in the incubation sample to between 24 and 58 µg/L for the rest of the study. After the incubation sample, dissolved As MRE ranged from 91.4 to 63.4 percent. Significant leaching of As was observed in the incubation sample as observed in previous studies with Chitorem; however, the concentration from the barrel quickly diminished for the second sampling event. For BCR3, dissolved As concentrations ranged from 75 to 15 µg/L, while the overall MRE ranged from 86.2 to 75.9 percent. The human health standard was exceeded in all samples for BCR3. For some sampling events As concentrations slightly increased in the BCR3 effluent compared to the Chitorem barrel effluent.

- Dissolved Ba concentrations were elevated in the incubation samples (280 µg/L in the Chitorem barrel and 790 µg/L in BCR3) and then gradually declined. For the Chitorem barrel, dissolved Ba was non-detect for the last two sampling events, while in BCR3 dissolved Ba had decreased to 90 µg/L by the last sampling event. Concentrations in BCR3 were similar to those observed in BCR1 and BCR2 as a result of substrate leaching.

- Dissolved Be was removed by the Chitorem barrel consistently to non-detect (less than 1.0 µg/L). BCR3 maintained this removal to all non-detect concentrations.

- Dissolved Cd concentrations in the Chitorem barrel ranged from 44 µg/L in the incubation sample to non-detect (less than 1 µg/L) for the remainder of the study, while the MRE ranged from 86.1 percent to greater than 99 percent for the remainder of the study. For BCR3, dissolved Cd concentrations were consistently non-detect (less than 1 µg/L), while the overall MRE was consistently greater than 99 percent. A greater total Cd concentration was detected in the incubation sample for BCR3 (7 µg/L); however, the later total Cd sample result was non-detect (less than 1 µg/L).

- Dissolved Co concentrations in the Chitorem barrel ranged from 183 µg/L in the incubation sample to 5 µg/L, while the MRE ranged from -215.5 percent to greater than 87.5 percent. For BCR3, dissolved Co concentrations ranged from 24 µg/L in the incubation sample to non-detect (less than 5 µg/L), while the overall MRE ranged from 58.6 to 90.9 percent. Based on the incubation sample data dissolved Co leached from the Chitorem, although concentrations quickly dissipated. BCR3 effectively polished the remaining Co not removed by the Chitorem barrel to non-detect concentrations.

- Dissolved Cu concentrations in the Chitorem barrel ranged from 430 µg/L in the incubation sample to non-detect (less than 5 µg/L) for the remainder of the study, while the MRE ranged from 80.1 percent to greater than 99 percent for the remainder of the study. For BCR3, dissolved Cu concentrations ranged from 8 µg/L in the incubation sample to non-detect (less than 5 µg/L) for the remainder of the study, while the overall MRE was consistently greater than 99 percent. A greater total Cu concentration was detected in the incubation sample for BCR3 (169 µg/L); however, the later total Cu sample result was non-detect (less than 5 µg/L).

- Dissolved Fe concentrations in the Chitorem barrel ranged from 820 to 39,400 µg/L, while the MRE ranged from 99.5 to 64.8 percent. For BCR3, dissolved Fe concentrations ranged from 8,710 µg/L in the incubation sample to non-detect (less than 30 µg/L), while the overall MRE ranged from 95.2 percent initially to greater than 99 percent for the remainder of the study. The chronic aquatic standard was exceeded only in the incubation sample from BCR3. BCR3 effectively removed a significant amount of Fe that was discharged from the Chitorem barrel.

- Dissolved Pb concentrations in the Chitorem barrel ranged from 7 µg/L in the incubation sample to non-detect (less than 1 µg/L) for the remainder of the study, while the MRE ranged from 97.2 percent to greater than 99 percent for the remainder of the study. For BCR3, dissolved Pb concentrations ranged from 1 µg/L in the incubation sample to non-detect (less than 1 µg/L) for the remainder of the study, while the overall MRE was consistently greater than 99 percent. A greater total Pb concentration was detected in the incubation sample for BCR3 (74 µg/L); however, the later total Pb sample result on 9/4 was 3 µg/L.

- Dissolved Mn concentrations in the Chitorem barrel ranged from 3,110 µg/L in the incubation sample to a high of 113,000 µg/L, while the MRE ranged from 97.5 percent initially to -9.7 percent. For BCR3, dissolved Mn concentrations ranged from 1,720 µg/L in the incubation sample to a high of to 61,300 µg/L, while the overall MRE ranged from 98.7 to 37.7 percent. Overall Mn was removed efficiently only in the July samples, followed by gradual decrease in efficiency.

- Dissolved Ni concentrations in the Chitorem barrel ranged from 1,060 µg/L in the incubation sample to a low of 5 µg/L, while the MRE ranged from -2,618 percent initially to 82.1 percent.

For BCR3, dissolved Ni concentrations ranged from 66 µg/L in the incubation sample to non-detect for the last three sampling events, while the MRE ranged from -69.2 percent to greater than 83 percent. Based on the incubation sample data, dissolved Ni leached from the Chitorem, although concentrations quickly decreased. BCR3 effectively polished the remaining Ni not removed by the Chitorem barrel.

- Dissolved Tl concentrations in the Chitorem barrel and BCR3 were consistently non-detect (less than 0.5 µg/L).
- Dissolved Zn concentrations in the Chitorem barrel ranged from 1,040 µg/L in the incubation sample to a range of 20 to 60 µg/L for the remainder of the study, while the MRE was consistently greater than 98 percent. For BCR3, dissolved Zn concentrations ranged from non-detect (less than 10 µg/L) to 40 µg/L, while the overall MRE was consistently greater than 99 percent. A greater total Zn concentration was detected in the incubation sample for BCR3 (620 µg/L); however, the later total Zn sample result was 30 µg/L.

Wet Chemistry Parameters

Figure 4.2-22 illustrates the acidity and alkalinity relationship for the Chitorem barrel and BCR3. Acidity concentrations in the Chitorem barrel and BCR3 were consistently non-detect (less than 4 mg/L). Alkalinity concentrations in the Chitorem barrel ranged from 23,000 mg/L in the incubation sample to 620 mg/L at the end of the study. Alkalinity concentrations gradually decreased throughout the study. In BCR3 alkalinity concentrations ranged from 1,300 mg/L to 2,600 mg/L. The BCR3 effluent was net alkaline throughout the course of the study as a result of the alkalinity generated by the Chitorem barrel. Even as the Chitorem barrel alkalinity continued to decrease, BCR3 was generating additional alkalinity greater than the Chitorem barrel effluent, some of which may have been created by the sulfate reduction processes.

The most significant reduction in sulfate concentration occurred in the Chitorem barrel compared to BCR3. Sulfate increased in the incubation sample compared to the influent, followed by a percent removal ranging from 45.0 to 79.2 percent (concentrations ranged from 520 to 1,100 mg/L). For BCR3 sulfate concentrations continued to decrease by 130 to 430 mg/L compared to the Chitorem barrel effluent. Sulfate reduction continued to occur in BCR3, although the magnitude of the concentration decrease was less than with the Chitorem barrel.

The effluent from the Chitorem barrel was analyzed once for sulfide in the incubation sample with a result of 29 mg/L. This data indicate that the Chitorem substrate was generating sulfide as a result of sulfate reduction and most likely contributing sulfide to BCR3. The reason for the increase in sulfate in the incubation sample may be due to initial leaching from the Chitorem substrate. For BCR3 sulfide concentrations ranged from 1.3 to 112 mg/L. The high of 112 mg/L sulfide on 8/7 corresponded with the most significant reducing conditions measured in the barrel (-325.7 ORP). These data together indicate that the combination of the Chitorem barrel and BCR3 promoted sulfate reducing conditions necessary to sustain metal removal by precipitation.

Summary

Overall, in comparison to BCR1 alone and the SAPS/BCR2 treatment, the Chitorem/BCR3 treatment performed the best for metal removal and sulfate reducing conditions. MRE of Al, Be, Cd, Cu, Pb, and Tl was similar for both the SAPS/BCR2 and Chitorem/BCR3. Fe and Zn MRE in the Chitorem/BCR3 had greatly improved, while As MRE was not as good compared to the SAPS/BCR2. This MRE reduction may have been due to the As leaching from the Chitorem substrate. Conditions suitable for sulfate reduction were present in both the Chitorem barrel and BCR3 as shown by the consistently net alkaline condition, pH greater than 6.0 su, low DO and increasing negative ORP, sulfate reduction, and sulfide generation. As a result of these conditions, Fe and Zn removal was sustained throughout the study. These two metals are predominant in the influent MIW and are particularly sensitive to removal by the sulfate reduction process unless adequate conditions exist. After the decrease in average flow rate on 8/7, no significant change in MRE was observed in the Chitorem/BCR3 treatment train. Sulfide and alkalinity generation also did not change. The magnitude of sulfate reduction in BCR3 varied after this flow change, with no clear improving trend.

Despite the positive analytical results with the Chitorem/BCR3 combination, significant hydraulic problems occurred during the study in the Chitorem barrel. Because of the low permeability of the media and biofouling, draining the batch MIW by gravity through the Chitorem barrel became increasingly difficult as the study progressed. Influent MIW was often overflowing out of the Chitorem barrel or not all of the MIW was draining from the head tank in the allotted time that the head tank timer valve was open. One benefit may have been that the hydraulic retention time (contact time with the substrate) would be much greater and flow rate through the treatment train would much lower than other treatments. Therefore when comparing the data to the other barrel test data, one must use some caution. Collection of adequate sample volumes was difficult and sometimes took several hours for sample collection from the Chitorem barrel. Several remedies were attempted to improve hydraulic performance. These steps included reduction of flow rate to one-third of the original flow on 8/7, re-programming the head tank timer valve to remain open longer, tightly sealing the Chitorem barrel lid and installing a pressure relief riser pipe, and bubbling of inert gas through the barrel substrate (i.e., back-flushing). None of these remedies provided much improvement to the hydraulic condition and ultimately the substrate had to be removed and augmented with more pea gravel to improve permeability on 9/11. The substrate modification improved hydraulic performance; however, this work was conducted only one week prior to the last sampling event. Insufficient time followed to evaluate treatment performance after the substrate modification.

These challenges make direct comparison of performance to other barrels difficult. The SAPS was adequately draining and BCRs 1 and 2 drained their batch of flow quite quickly. Based on these observations and lack of key metal removal (i.e., Fe and Zn), a conclusion could be made that these systems treated more MIW, had less hydraulic retention time, were overloaded with acidity and could not maintain sulfate reduction. It appeared that the hydraulic retention time was insufficient, coupled with too high of a flow rate. On the other hand, the Chitorem/BCR3 treatment train had too much retention time and too little flow for a direct comparison to the other treatments.

4.2.5 Alkaline Addition Pre-treatment and BCR4

The alkaline addition pre-treatment ($Mg(OH)_2$ barrel) was followed by BCR4. The following subsections summarize the $Mg(OH)_2$ barrel and BCR4 effluent water quality.

Field Parameters

The $Mg(OH)_2$ barrel raised pH to a range between 3.05 and 5.94 su, while BCR4 increased pH to a range between 6.25 and 7.02. As discussed in Section 2.2.4.2, significant problems occurred with the $Mg(OH)_2$ solution dosing. The peristaltic pump tubing was collapsing as a result of the suspended $Mg(OH)_2$ particles which resulted in inconsistent dosing and pH adjustment. For most of the sampling events, batch doses of pre-treated water were created in the barrel and added to BCR4 and tubing was replaced. Despite the low influent pH on some of the sampling events, effluent pH from BCR4 was consistently the highest of any other barrel. BCR4 effluent was greater than 6.5 su standard for 3 of the 6 sampling events.

Conductivity ranged from 1,930 to 3,022 µS/cm in the $Mg(OH)_2$ barrel and from 1,101 to 4,001 µS/cm in BCR4. Effluent conductivity was greater than the influent initially in both barrels due to the flushing of soluble components from the substrates, which is expected during startup. After startup, conductivity was similar to the influent.

ORP ranged from -15.6 to 425.0 mV in the $Mg(OH)_2$ barrel and from -30.2 to -171.3 mV in BCR4. ORP values in BCR4 remained negative throughout the study but were not as reducing as BCR3. The consistently negative values in the range of -140 to -170 mV could be an indicator that sulfate reduction was occurring to some degree.

The $Mg(OH)_2$ barrel DO ranged from 2.48 to 7.22 mg/L, while the BCR4 DO ranged from 0.02 mg/L initially to 4.35 mg/L at the end of the study. DO values for both barrels at the end of the study were greater than the influent MIW. The reason for the increased DO is unknown, but may be due to instrument error, sampler error, or some unknown chemical or biological reaction.

Metals

The following includes observations of dissolved metal trends (Table 4.2-1 and Figures 4.2-4 through 4.2-15), MRE ranges (Table 4.2-3), and comparison to water quality standards (Table 4.2-4). Dissolved metals are the focus of the discussion since the total metals data set is limited to only two sampling events. Total metals data are presented and discussed where relevant.

- Dissolved Al concentrations in the $Mg(OH)_2$ barrel ranged from 180 to 12,800 µg/L, while the MRE ranged from 98.1 to zero percent. For BCR4 dissolved Al concentrations ranged from non-detect (less than 30 µg/L) to 130 µg/L, while the overall MRE was consistently greater than 99 percent (comparison of BCR4 effluent to the $Mg(OH)_2$ barrel MIW influent). The chronic aquatic standard was exceeded in the first sampling event (130 µg/L) and on 9/4 (90 µg/L) for BCR4. Results indicate that BCR4 effectively polished additional Al not removed in the $Mg(OH)_2$ barrel. Total metals concentrations were greater than dissolved for both barrels.

- Dissolved As concentrations in the $Mg(OH)_2$ barrel ranged from non-detect (less than 1 µg/L) to 152 µg/L, while the MRE ranged from greater than 99.1 percent to only 27.6 percent. For BCR4 dissolved As concentrations ranged from 2 to 20 µg/L, while the overall MRE ranged from 93.6 to 99.3 percent. The human health standard was exceeded only in the incubation sample (20 µg/L) for BCR4. As was either completely removed by the $Mg(OH)_2$ barrel or slightly polished by BCR4.

- Dissolved Ba was elevated in the BCR4 incubation sample (550 µg/L) and then gradually declined similar to all other BCRs. Ba was not detected in the $Mg(OH)_2$ barrel as expected.

- Dissolved Be concentrations in the $Mg(OH)_2$ barrel ranged from non-detect (less than 1 µg/L) to 7 µg/L, while the MRE ranged from greater than 87.5 to -16.7 percent. For BCR4 dissolved Be was effectively polished to below the reporting limit (1 µg/L) for all samples.

- Dissolved Cd concentrations in the $Mg(OH)_2$ barrel ranged from 140 to 280 µg/L, while the MRE ranged from 21.2 to -13.5 percent. For BCR4, dissolved Cd concentrations were consistently non-detect (less than 1 µg/L), while the overall MRE was consistently greater than 99 percent. Dissolved Cd was effectively polished by BCR4 with very little Cd removal occurring in the $Mg(OH)_2$ barrel. A greater total Cd concentration was detected in the incubation sample for BCR4 (27 µg/L); however, the later total Cd sample result was non-detect (less than 1 µg/L).

- Dissolved Co MRE in the $Mg(OH)_2$ barrel ranged from 24.1 to zero percent. BCR4 MRE ranged from greater than 89.7 percent to -13.2 percent. The results for BCR4 are similar to BCRs 1 and 2 with a relatively fast adsorption breakthrough for Co.

- Dissolved Cu concentrations in the $Mg(OH)_2$ barrel ranged from 79 to 1,570 µg/L, while the MRE ranged from 92.9 to -12.1 percent. For BCR4, dissolved Cu concentrations were consistently non-detect (less than 5 µg/L), while the overall MRE was consistently greater than 99 percent. Dissolved Cu was effectively polished by BCR4. A greater total Cu concentration was detected in the incubation sample for BCR4 (172 µg/L); however, the later total Cu sample result was non-detect (less than 5 µg/L).

- Dissolved Fe concentrations in the $Mg(OH)_2$ barrel ranged from 470 to 140,000 µg/L, while the MRE ranged from 99.7 to 13.6 percent. For BCR4 dissolved Fe concentrations ranged from 1,500 to 65,400 µg/L, while the overall MRE ranged from 99.2 to 59.6 percent. The chronic aquatic standard was exceeded in all BCR4 samples. BCR4 did provide some additional removal after the $Mg(OH)_2$ barrel although effluent concentrations were still very high. The decline in Fe removal is likely due to the lack of sulfate reduction in the substrate, as discussed below.

- Dissolved Pb concentrations in the $Mg(OH)_2$ barrel ranged from non-detect (less than 1 µg/L) to 165 µg/L, while MRE ranged from greater than 99.6 percent to only 4.6 percent. For BCR4 dissolved Pb concentrations were all non-detect (less than 1 µg/L), while the overall MRE was consistently greater than 99 percent. Dissolved Pb was effectively polished by BCR4. A greater total Pb concentration was detected in the incubation sample for BCR4 (84 µg/L); however, the later total Pb sample result was non-detect (less than 1 µg/L).

- Dissolved Mn concentrations in the $Mg(OH)_2$ barrel ranged from 92,100 µg/L at the end of the study to a high of 122,000 µg/L, while the MRE ranged from 19.4 percent initially to -2.8 percent. For BCR4, dissolved Mn concentrations ranged from 11,000 µg/L in the incubation sample to a high of to 146,000 µg/L, while the overall MRE ranged from 91.1 percent initially to -25.9 percent. Overall Mn was removed only in the incubation sample, followed by either no removal or possibly a small amount of leaching from the substrate.

- Dissolved Ni concentrations in the $Mg(OH)_2$ barrel ranged from 26 to 36 µg/L, while the MRE ranged from 23.1 percent initially to a low of zero percent. For BCR4, dissolved Ni concentrations ranged from non-detect (less than 5 µg/L) to 29 µg/L, while the MRE ranged from greater than 86.5 percent to -3.6 percent. Neither the $Mg(OH)_2$ barrel or BCR significantly or consistently removed Ni from the influent MIW, although no standards were exceeded due to the low influent concentrations.

- Tl was not removed by the $Mg(OH)_2$ pre-treatment. However, dissolved Tl concentrations were all non-detect (less than 0.5 µg/L in BCR4 as observed for the other BCRs.

- Dissolved Zn concentrations in the $Mg(OH)_2$ barrel ranged from 36,200 to 53,100 µg/L, while the MRE ranged from 31.3 percent initially to 0.4 percent. For BCR4, dissolved Zn concentrations ranged from 20 µg/L to 10,400 µg/L, while the MRE ranged from greater than 99 percent to 68.1 percent. Overall, results were similar to BCR2 with slightly better Zn removal than BCR2. Initially, treatment of Zn was good; however, conditions in BCR4 were not reducing enough to sustain sulfate reduction to remove zinc as a sulfide precipitate. BCR4 effluent concentrations exceeded the chronic and acute aquatic standards during the last four sampling events. The human health standard was also exceeded in three of the last four sampling events.

Wet Chemistry Parameters

Figure 4.2-23 illustrates the acidity and alkalinity relationship for the $Mg(OH)_2$ barrel and BCR4. In the $Mg(OH)_2$ barrel acidity concentrations ranged from non-detect (less than 4 mg/L) to 700 mg/L. Alkalinity concentrations were non-detect (less than 1 mg/L) for the first four sampling events, followed by detections of 8 and 13 mg/L in the last two sampling events. Acidity concentrations in BCR4 ranged from non-detect for the first two sampling events (4 mg/L) to a high of 260 mg/L. Alkalinity concentrations in BCR4 ranged from 1,500 mg/L in the incubation sample to 93 mg/L at the end of the study. Alkalinity concentrations in BCR4 gradually decreased throughout the study. Overall, because of the operational issues with the $Mg(OH)_2$ barrel, alkalinity was not generated to buffer the influent MIW acidity. As a result, a net alkaline effluent was difficult to maintain.

The $Mg(OH)_2$ barrel generally did not reduce sulfate concentrations from the influent MIW with percent removal ranging from 60 to -4.5 percent. For BCR4 sulfate ranged from 280 mg/L in the incubation sample to 1,300 mg/L, while overall percent removal ranged from 82.5 percent in the incubation sample to 40.9 percent. Additional decrease in sulfate in BCR4 from the $Mg(OH)_2$ barrel effluent did occur based on the first four sampling events; however, no decrease in sulfate was observed in the last two sampling events.

For BCR4 sulfide concentrations ranged from 6.6 mg/L to non-detect (less than 0.02 mg/L) at the end of the study. The greatest sulfide concentrations (0.7 to 6.6 mg/L) were detected in the first three sampling events. Sulfide was also detected in the fourth and fifth sampling events at low concentrations. The greater sulfide concentrations detected during the first half of the study correlate with the greatest decrease in sulfate concentrations. These data together along with ORP around -150 mV indicates that some sulfate reduction was occurring.

Summary

Overall, the $Mg(OH)_2$/BCR4 treatment performed similarly to the SAPS/BCR2 treatment but not as good as the Chitorem/BCR3 treatment with respect to sulfate reducing conditions and Fe and Zn removal. The $Mg(OH)_2$/BCR4 treatment had slightly better overall removal efficiency for Fe and Zn compared to the SAPS/BCR2 treatment, but was still unable to reliably remove these metals to meet standards. Removal efficiency of Al, Be, Cd, Cu, Pb, and Tl in the $Mg(OH)_2$/BCR4 treatment was similar to both the SAPS/BCR2 and Chitorem/BCR3. Based on the sulfate, sulfide, and ORP data, some sulfate reduction appeared to have occurred in BCR4 in the first half of the study. Although there were numerous operational issues with the $Mg(OH)_2$ barrel, dosing of BCR4 with a soluble alkaline material appears to have resulted in the greatest pH increase. The greater pH may have helped promote the sulfate reduction process; however, the high mineral acidity from Fe and Mn could not be buffered by the treatment system to sustain the process.

After the average flow rate change on 9/4, the 9/16 sample showed some moderate improvement in Fe, Ni, and Zn MRE. This improvement was coupled with going from net acidic to net alkaline conditions in both the $Mg(OH)_2$ and BCR4 barrel. A non-routine site visit was conducted on 9/11 to complete the Chitorem substrate modification activity. The $Mg(OH)_2$ dosing system was observed to be plugged and a batch $Mg(OH)_2$ dose was added at this time. The moderate improvement in MRE and alkalinity balance could be due to the additional maintenance activity and/or the decrease in average flow rate. Insufficient time remained in the season to evaluate treatment effectiveness further after the flow modification.

4.2.6 Post-Treatment Oxidation Tests

Post-treatment oxidation tests were conducted on one of the BCR effluents during the last five sample events. Samples were aerated by a variety of methods. The post-treatment oxidation data are shown in Table 4.2-5 including the field parameters and BOD, ammonia, and sulfide. Interim DO measurements were taken to track the oxidation test progress for some of the sampling events. As discussed in Section 2.2.2.6, various methods were utilized to provide oxidation of the samples. Overall of the methods provided moderate increases in DO concentrations, with variable results. On 7/23 DO was increased by 3 mg/L, while on 8/19 DO was increased by 2.11 mg/L, and on 9/16 DO was increased by 1.92 mg/L. Each of these larger increases observed were for BCR2 samples. The remaining two tests were for BCR3 samples, which resulted in a decrease in DO or a small increase less than 1 mg/L.

With exception to the 9/16 test that had all non-detect BOD results, BOD slightly increased from the original split sample to the oxidized sample. The opposite result was anticipated since oxidation can result in a decrease in BOD; however, the small BOD increases could be within the relative accuracy/precision of the analytical method. Ammonia concentrations also increased for all samples with exception to the 9/16 test. In contrast, sulfide concentrations decreased in the 7/23, 8/7, and 9/4 tests while the 8/19 and 9/16 tests had non-detect concentrations. The oxidation of sulfide can occur by biotic and abiotic mechanisms with breakdown products to elemental sulfur or to sulfate or off-gassing of hydrogen sulfide if present.

These results show that aeration alone without establishing an aerobic biological consortium is not sufficient to reduce these secondary contaminants in the BCR effluents. After the initial oxidation, more time is necessary for settling and development of aerobic heterotopic communities to consume the BOD. Post-treatment using an aerobic wetland would improve removal of BOD and the other contaminants, and also reduce any higher pH values. Passive aeration by cascading, followed by an aerobic wetland can be implemented. The wetland would contain a variety of riparian native plant species and the associated aerobic microorganisms that can consume the ammonia through conversion to nitrate, degrade the BOD into cellular material and minerals, aid in the oxidation of sulfide, and increase oxygen concentrations through plant respiration. The plant communities would also help consume phosphorous present in the BCR effluent and may remove and/or filter trace dissolved and suspended metals.

4.2.7 Substrate Leach Tests

Modified SPLP data for the organic compost, wood chips, sawdust, and Chitorem materials are provided in Table 4.2-6. The SPLP test was modified to provide a greater amount of solid to synthetic precipitation water (3:1 ratio) versus the standard 20:1 ratio of solid to water. This approach provides a more realistic approach of what metals would leach immediately upon contact with a slightly acidic water. The SPLP method does not simulate the reaction mechanisms in a BCR, but it does provide a surrogate test to determine which metals are immediately soluble.

Review of the SPLP data illustrates a correlation with some of the effluent metal results observed from the pre-treatment and BCR barrels. In particular, the incubation samples showed that the all of the BCR barrels and the SAPS barrel had elevated Ba concentrations, presumably from the organic substrates. The Chitorem barrel also had elevated Ba initially. The SPLP data shows that Ba leached from all of the substrates tested with the most significant concentrations in the Chitorem (2,000 µg/L) and compost (500 µg/L). Based on these data, the greater incubation sample concentrations of Ba in the BCR and SAPS barrels can be linked to the compost used in the substrate mixture.

For the Chitorem barrel, leaching of As, Co, and Ni were also observed in the incubation samples followed by decreases in concentrations. For SPLP As was 1,600 µg/L, Co was 72 µg/L, and Ni was 680 µg/L. These were the highest concentrations detected compared to the other substrates and are likely the reason for the elevated concentrations detected in both the Chitorem and subsequent BCR3 barrel at the beginning of the study. Elevated Cd (190 µg/L), Cu (840 µg/L), and Zn (1,900 µg/L) SPLP concentrations were also detected in the Chitorem. In the Chitorem and BCR3 barrels, the greatest dissolved and total concentrations for these metals were detected in the incubation samples followed by decreases for the remainder of the study. The high concentrations in the incubation samples could be linked to the initial leaching from the Chitorem substrate.

Overall, although there appears to be a leaching issue associated with the Chitorem material initially, this leaching is limited to the initial incubation and concentrations are adequately removed to low concentrations for the remainder of the study. The only exception to this trend is for As. Compared to the other BCRs, BCR3 that followed the Chitorem barrel never successfully reduced As concentrations below the human health standard.

Section 5

Conclusions and Recommendations

This section summarizes the conclusions of the bench-scale and pilot-scale treatability studies and presents recommendations for modifications to the pilot-scale setup and operation for year 2 in summer 2014.

5.1 Bench-Scale Treatability Study Conclusions

The bench-scale treatability study consisted of five steps: 1) oxidation; 2) alkaline titrations; 3) hydraulic tests; 4) pre-treatment columns; and 5) BCR treatment. The DO in the MIW remained near saturation and there was no visual change in the sample (i.e. no Fe precipitation) during the oxidation test. The results of this step suggest that further oxidation of the raw water does not promote precipitation of solids under the laboratory conditions and for the water tested. However, these results do not eliminate the possibility that some Fe precipitation could be promoted by oxidation, particularly with a MIW that contains much higher and unstable Fe concentrations at the tested pH values.

Treatment of MIW was tested using three different alkaline materials at two different pH values (pre-treatment at 4.5 su and conventional treatment at 9.5 su). Of the three pre-treatment materials, Chitorem provided the best overall treatment performance for metal removal. Each pre-treatment material effectively removed Fe and Pb (greater than 90 percent for dissolved and between 50 and 90 percent for total), but total concentrations of these metals exceeded standards. Al and As also had moderate removal efficiencies. Most metals which previously exceeded standards in the raw MIW still exceeded some or all of the same standards. However, Fe and Pb concentrations decreased significantly and likely accounted for much of the sludge measured in the Imhoff cone tests. As a result, much of the Fe was removed prior to entering the SAPS columns which would reduce clogging of the substrate material.

Of the two conventional treatment materials, the NaOH solution removed metals slightly more effectively than the $Ca(OH)_2$ solution. Most dissolved concentrations of metals decreased to trace or non-detect levels. Most exceedances were for total metals. In a conventional alkaline addition process, neutralized water would be clarified or filtered prior to discharge which would remove the total metal load.

The next step of the column study involved passing water through pre-treatment columns. Many metals concentrations were reduced below water quality standards or at detection limits, some of which were above the water quality standards. Al, Fe, Pb, and Zn concentrations were removed at greater than 90 percent efficiency. However, some of the Fe and Pb was removed previously by the alkaline pre-treatment. Co and Cu were removed in the upper 70 to upper 80 percent range. Because sulfate reduction has not occurred, removal of metals occurred as a result of sorption and oxy-hydroxide and/or carbonate precipitation reactions within the substrate media. If allowed to run longer, removal of Al, Co, Cu, Zn, and other metals is not suspected to be maintained as the organic substrate sorption sites would eventually become saturated with metals, substrate-armoring would occur, and the available buffering capacity of the substrate would be diminished. As concentrations actually increased suggesting the element is naturally occurring in some of the various substrate materials. The column effluent pH increased to neutral, alkalinity increased, and the DO decreased to less than 1 mg/L. Overall, of the three SAPS pre-treatment columns there was no apparent difference in MRE or other parameter changes between the SAPS with alkaline addition pre-treatments (Columns #1 and #2) and the SAPS alone (Column #3). Column #4 had some improvement in metal removal such as Al and Zn compared to the SAPS columns, but less efficient at removal of Cd and Cu and also leached more As.

The final step of the study was to treat the column effluents in the BCR containers. As a result of the majority of metals being removed in the columns, most metals either saw 1) little to no change in dissolved concentrations suggesting that they sorbed to substrate media or reacted to form precipitates, or 2) showed increased concentrations suggesting the metals leached from the BCR substrates. Only Cu saw additional polishing of metal concentrations as a result of the BCRs. The parameters for sulfate reduction were either not maintained after six weeks of incubation at the time of sampling or not achieved at all. Reasons for why sulfate reduction could not be maintained in the BCRs may have been due to acidity overloading from the substrate, lack of sufficient metals (reactants) to sustain the reaction, or lack of other conditions amenable to SRB.

Overall, almost all metals were completely removed in the pre-treatment columns. The pre-treatments by alkaline addition, SAPS, and Chitorem columns were intended to primarily reduce concentrations of major metals such as Al and Fe, co-precipitate other metals in small amounts with the Al and Fe, raise pH, and reduce DO. The BCR would then remove the remainder of trace metals through the sulfate reduction process. The pre-treatment columns contained a large amount of very soluble alkalinity in the form of calcium carbonate, which quickly neutralized the MIW and removed most metals. In time, the quickly soluble fraction would reduce and the pre-treatment would only be able to remove a small fraction of metals rather than as the predominant treatment.

Lower detection limits of some metals, including Al, Cd, Fe, and Tl would be required to determine if exceedances actually occurred on some samples throughout the bench-scale treatability study as the detection limits were greater than the standards. This was mostly an issue for the pre-treatment column effluent samples. The pre-treatment columns removed a much greater amount of metals than expected or desired; therefore, not reporting data at low detection levels does not necessarily have a great effect on conclusions of the study as a whole.

The approximate porosity of the SAPS columns was measured in Step 3, hydraulic testing. This testing determined the overall porosity of the limestone, manure, and compost as one unit. Porosity of each substrate by itself was not tested and neither was the porosity of the Chitorem and sand mixture. These data are being collected by others in related experiments. The porosity of the limestone, manure, and compost ranged from 51.4 to 54.1 percent between the two tests. The retention time could not be estimated within the columns because they would not flow freely by gravity.

5.2 Pilot-Scale Treatability Study Conclusions

Although the Chitorem barrel had hydraulic flow issues, the Chitorem/BCR3 treatment provided the best overall treatment performance for both metal removal and sustaining sulfate reducing conditions. The Chitorem/BCR3 treatment had the lowest sustained negative ORP, some of highest pH values (second to BCR4), the highest sulfide and alkalinity concentrations, and the greatest sulfate concentration reduction. A net alkaline condition was maintained throughout the study which is one of the key elements to sustaining sulfate reducing conditions in a BCR.

Most important for water treatment concerns, the Chitorem/BCR3 treatment removed all of the major metals to below water quality standards or to non-detect concentrations after the initial incubation sample. The only exception is As. Arsenic was treated to lower concentrations than in the influent; however, treatment to concentrations below the human health standard was not attained. In comparison, BCRs 2 and 4 in combination with their pre-treatments both removed As to concentrations below the human health standard after the incubation sample. BCR1 treated As to concentrations below the human health standard for some of the sampling events. The difference in As treatment in BCR3 is due to the observed leaching from the Chitorem substrate, and may vary within tests due to the benthic environment of the original marine animals from which the Chitorem is produced.

BCRs 1, 2, and 4 successfully removed Be, Cd, Cu, Pb, and Tl to below water quality standards or to non-detect concentrations. BCR1 did not sustain sulfate reducing conditions, did not effectively remove Fe, Ni, and Zn, and had the lowest overall pH values compared to other BCRs. BCR1 removed a significant amount of Al although not to concentrations below the aquatic standards. In contrast, the Chitorem/BCR3 treatment was successful at removing all of these metals as described above.

The SAPS/BCR2 treatment performed slightly better than BCR1 in terms of sulfate reduction parameters and metal removal. BCR2 had occasional negative ORP values after the incubation sample, generated more sulfide and alkalinity, and had a greater pH than BCR1. The SAPS/BCR2 also had greater removal of Al, As, Co, Fe, Ni, and Zn than BCR1 alone. However, MRE for Co and Ni in BCR2 toward the latter half of the study was very low or negative and Fe and Zn removal was not sufficient enough to meet water quality standards. Overall, the SAPS/BCR2 treatment did not sustain sulfate reducing conditions and net alkaline conditions to drive the reaction were difficult to maintain.

The $Mg(OH)_2$ solution dosing system had repeated issues with peristaltic pump tubing collapse/clogging. This issue resulted in inconsistent dosing of the pre-treatment barrel throughout the study. Despite this limitation, the $Mg(OH)_2$/BCR4 treatment performed similarly to the SAPS/BCR2 treatment, with some differences. BCR 4 had the highest pH in the latter half of the study compared to all other barrels. This condition may have been a result of overloading of residual $Mg(OH)_2$ at times into BCR4, providing extra buffering capacity. The $Mg(OH)_2$ barrel/BCR4 treatment did result in some sulfide production and sulfate concentration reduction similar to BCR2, although BCR4 produced consistently negative ORP values unlike BCR2. However, a net alkaline condition was difficult to maintain in BCR4 and keep ORP values low enough to provide conditions that promoted sulfate reduction. Most of the major metals (i.e., Al, Be, Cd, Cu, Pb, and Tl) were removed to similar concentrations in BCR4 compared to BCR2. The $Mg(OH)_2$/BCR4 treatment had slightly better overall removal efficiency for Fe and Zn compared to the SAPS/BCR2 treatment, but was still unable to reliably remove these metals to meet standards.

Since sulfate reduction generally did not occur after the incubation period for BCRs 1, 2, and 4, the significant removal of metals such as Cd, Cu, and Pb and partial removal of Fe and Zn were likely dominated by sorption and oxy-hydroxide and/or carbonate precipitation reactions within the substrate media, rather than by sulfate reduction. Had the study been continued for a longer period and sulfate reducing conditions had still not rebounded, removal of these metals is not suspected to be maintained as the organic substrate sorption sites become saturated with metals and/or the available buffering capacity of the substrate is diminished. Reasons for why sulfate reduction could not be maintained in these BCRs may have been due to acidity overloading, low retention time, or lack of the correct substrate nutrients to sustain sulfate reduction. Although the average flow rate for these treatments was reduced to two-thirds of the original flow rate on 9/4/13 (25 ml/min), insufficient time remained in the season to evaluate treatment effectiveness after this modification.

Overall, hydraulic performance in the Chitorem/BCR3 performance was poor and the average treatment flow rate was probably much less than the timer valve settings indicated. Despite several attempted maintenance remedies as described in Sections 2.2.4.2 and 4.2.4, flow through the Chitorem barrel remained slower than other barrels and samples were difficult to collect. BCRs 1, 2, and 4 and the SAPS were flowing more freely than the Chitorem/BCR3 treatment even after reducing the average flow rate by two-thirds of the original flow rate on 8/7/13 for the Chitorem/BCR3 treatment (the original average flow rate was 37.5 ml/min). This reduction in flow rate for the Chitorem/BCR3 treatment was implemented approximately one month prior to the same change in all other treatment trains.

The challenges with hydraulic flow through the Chitorem barrel make direct comparison to other barrels difficult. Based on maintenance observations and chemistry data trends, the BCR1, SAPS/BCR2, and $Mg(OH)_2$/BCR4 treatments appear to have been overloaded and the hydraulic retention time too low, while the Chitorem/BCR3 treatment hydraulic retention time was too high. This slower flow in the Chitorem barrel presents some bias because it likely resulted in greater treatment performance for the Chitorem/BCR3 combination. The slower flow also limits the ability to understand what the ideal hydraulic retention should be to achieve this performance and to scale-up the design of the treatment system.

5.3 Recommendations for Year 2 Pilot-Study

Changes in the treatability design are needed and recommended for the year 2 pilot study. These modifications are intended to provide information with regard to some inconclusive results for the year 1 study, improve system performance of the BCRs and pre-treatments, and provide design parameters for a potential full-scale treatment system. The year 1 study resulted in some BCRs that had inadequate sulfate reduction, potentially due to overloading or other factors. The study also had hydraulic issues related to the Chitorem barrel and a number of operational issues with the $Mg(OH)_2$ dosing system. The following provides recommendations for changes to the pilot-study design.

5.3.1 Study Time Length

Overall, the ability to evaluate year 1 pilot-study performance was limited by the late startup and early shutdown. Modifications to the treatment are recommended to be implemented as early as possible in the spring when the site can be accessed safely. A shorter incubation period is recommended (approximately 1 week) and the system should be started with recycle followed by low flow through operation as soon as possible. It is recommended that the system operation be checked once per week (i.e., collecting field parameters along with checking valves, pumps, mixers, reagents, etc.) to ensure study period time is not lost due to equipment-related issues. Bi-weekly analytical sample collection is still recommended, although the operation and sampling activities should be conducted until weather conditions prevent access to the site or cause freezing conditions. Ideally, a minimum of 3 months of testing operation are recommended.

5.3.2 BCR Modifications

Revisions to the substrates and treatment trains are recommended for year 2. As summarized above, BCRs 1, 2, and 4 and the SAPS appear to have been overloaded with acidity and could not maintain sulfate reduction. In addition, less manure and limestone was utilized than originally designed in the BCRs, and the Chitorem barrel and the alkaline addition system had clogging or permeability issues. Because of these variables, all substrates should be replaced to correct these issues and to also collect a non-biased set of data. This approach will allow all treatments to start at an equal level with changes implemented designed to improve performance.

As detailed in the SAP Addendum Appendix D, calculations were performed for the BCR barrel substrate sizing, flow rate, and hydraulic retention time using Darcy's Law. Hydraulic retention time was assumed and porosity values were assumed based on bench-scale testing and data from others. For all BCRs, a retention time of 24 hours was assumed to be adequate and a porosity of 40 percent was utilized. The overall average flow rate initially was 37.5 ml/min, based on the batch volume and time intervals. The actual substrate volume utilized was 31.75 gallons based on the raw materials. However, a shrinkage factor should probably be applied to the actual volume once all of these materials are mixed. Assuming 10 percent shrinkage, the volume within each barrel is assumed to be only 28.6 gallons. Using the assumed 40 percent porosity, the reduced substrate volume, and average flow rate, the actual calculated retention time is approximately 19.2 hours. This retention time, on average, was probably somewhat achieved in BCRs 1, 2, and 4. Based on the data presented in this memorandum, this retention time was probably insufficient to maintain treatment. For BCR3, the average retention time was probably much greater than this number, although there is no way to estimate such a value since raw water frequently overflowed out of the vent in the lid of the Chitorem barrel.

Sizing of a BCR treatment system using this basic calculation approach can present risks because the sizing is solely based on an assumed retention time. An alternative sizing approach is recommended based on the approach originally presented in Wildeman et. al. (1993), the recently published Interstate Technology Regulatory Council (ITRC) guidance *Biochemical Reactors for Treating Mining-Influenced Water* (ITRC 2013), Gusek and Figueroa (2009), and several other references. Overall, approach suggests calculating the BCR substrate volume needed for treatment based on the acidity loading of the MIW influent. The stoichiometric metal acidity load (expressed in units of millimoles acidity/day) is balanced with the rate at which sulfate is reduced and alkalinity is generated by SRB, according to the equations presented in Section 1.2. Published literature sulfate reduction rates expressed in units of millimoles sulfate per cubic meter per day can be used for the calculation. The acidity load is divided by the sulfate reduction rate to obtain the necessary volume.

An important limitation to this sizing approach is that it assumes all alkalinity production needed to balance acidity is generated biotically from the sulfate reduction process. Since limestone is utilized in the substrate, it will contribute alkalinity through dissolution. Therefore, some correction factor could be applied to account for limestone dissolution. Since pre-treatments also neutralize some of the acidity, a correction factor could be applied to BCR sizing based on the assumed acidity reduction achieved by the pre-treatment.

Based on the above discussion and conclusions presented in Section 5.2, the following are recommended for year 2:

- A non-pretreated BCR is not recommended to be implemented for year 2.
- For all BCRs utilized in year 2 of this study, substrate composition should be modified to include the originally designed manure volume (20 percent) and to increase the limestone quantity to 30 percent compared to the originally designed quantity. The greater alkalinity content is recommended to provide more buffering of the highly acidic Danny T adit water. The wood chip percentage is recommended to be decreased by 10 percent.
- Acidity loading to the BCRs should be decreased. This can be achieved by decreasing the average influent MIW flow rate, which reduces the amount of substrate volume needed for treatment. The flow rate should be decreased so that the acidity load is balanced by the alkalinity generation from sulfate reduction and from limestone dissolution. The flow decrease should also account for acidity loading that is assumed to be removed by the pre-treatment utilized. Data will be generated such as sulfate reduction rate, flow rate, hydraulic retention time, and other parameters that are specific and applicable for each treatment. These data will be utilized for the feasibility study evaluations to scale-up treatment design and estimate treatment costs.

5.3.3 Pre-Treatment Modifications

The SAPS pre-treatment removed a moderate amount of acidity from the influent MIW. Not counting the incubation sample, a range of 30 to 46 percent of the acidity was removed from the SAPS, which would theoretically decrease the volume of BCR substrate needed by a similar amount. In the long-term, the degree of acidity reduction may vary and decrease once the substrate becomes depleted or armored with precipitates. Knowing that the overall SAPS/BCR2 treatment train was undersized with respect to the flow rate, the following are recommended for year 2:

- The smaller 30 gallon SAPS pre-treatment barrel should be replaced with a 55-gallon barrel to increase the SAPS substrate volume. The volume increase will provide more surface area for contact with the MIW, more organic matter to reduce oxidation state, and more limestone to provide alkalinity.
- As described above, the overall flow rate through the SAPS/BCR2 treatment train should be decreased so that the reactions in BCR2 decrease the acidity load from the influent, while accounting for an assumed reduction in acidity load by the SAPS pre-treatment.

The Chitorem pre-treatment removed almost all of the acidity and most metals while the BCR3 provided only a polishing treatment for some of the metals. Given hydraulic problems encountered, these data do not provide a realistic picture of treatment efficiency by this combined system. Had flow rate been higher on average, the Chitorem barrel may not have been nearly as efficient at decreasing acidity and treating metals. The following changes are recommended for year 2:

- The substrate mixture should be modified to reduce the percentage of Chitorem and sand and increase the percentage of inert gravel to increase permeability. The substrate replacement activities in September 2013 indicated that when the original substrate was mixed with 1 part new pea gravel to original substrate, the mixture was not free-draining through a cone. When 2 parts new pea gravel to 1 part original mixture was tested, the mixture was immediately free-draining. In-lieu of additional field testing, a mixture of 1.5 parts new pea gravel to 1 part original mixture was implemented assuming this mixture would be free draining enough for the study. A comparison of the original to revised material percentages is provided in Exhibit 5-1.

Exhibit 5-1. Original versus Revised Chitorem Barrel Substrate Percentages

Material	Original Percent	Revised Percent
Chitorem	40.0	16.0
Pea Gravel	30.0	72.0
Sand	30.0	12.0
sum	100.0	100.0

The inability for the original substrate mixture to be free draining is a result of the low permeability of the mixture, but also because of the apparent slimy biomass layer that formed during the study. While this material is most likely formed from the protein and leftover animal tissue in the shells, it also assists in microbial consortium development in the early stages of the testing. The main concern with using the revised mixture for the year 2 study is the smaller fraction of Chitorem used than originally recommended by the manufacturer. Since the year 1 study ended too early to verify the effectiveness of this mixture, some basic laboratory tests are recommended to determine if other mixtures with slightly higher Chitorem content will also be free draining. A range of mixtures can be created and tested in a similar cone apparatus to determine the optimum mixture for use in the year 2 study.

- Similar to the SAPS recommendation, the larger 55-gallon barrel should be utilized for the Chiotrem pre-treatment. This change will provide the same substrate volume as the SAPS/BCR2 to allow direct comparison of data and development of full-scale design parameters.

When functioning, the alkaline addition pre-treatment removed some of the influent acidity. Results were sporadic and not reliable to draw conclusions about the effectiveness. However, it is well known that alkaline addition using $Mg(OH)_2$ or other bases such as NaOH to pH values around 5.0 su will remove a significant quantity of the iron and aluminum acidity. The following are recommended for year 2:

- Consideration should be given to use of NaOH rather than $Mg(OH)_2$. NaOH has disadvantages because of its highly caustic nature and high freezing point; however, these disadvantages may be less severe than the issues encountered with $Mg(OH)_2$. Since $Mg(OH)_2$ is a suspension, more energy and infrastructure may be required to dose the system, and more maintenance/operator presence may be required compared to a NaOH system. Issues with the collapsed tubing should be researched, and possibly a different pump and larger tubing may correct the issue.

5.3.4 Post-Treatment Oxidation Testing

As discussed in Section 4.2.6, post-treatment is a necessary component of a complete passive treatment system. Testing a gravity fed aeration system at the low flow rates used in a pilot study can be difficult as flow can stagnate between batch flow intervals and result in more sulfate reduction rather than oxidation. Use of a wetland oxidation pond with live plants may improve this limitation by providing a plant filter and the microbial communities needed to oxidize the secondary contaminants.

Implementation of a combined cascade aeration system with a small wetland pond is recommended for year 2. Effluent water from each of the treatment trains can be combined into a single pipe and treated in the system. Since the goal is to remove nutrient and sulfide load, a single combined influent and effluent will test this hypothesis. This approach will also save costs by limiting the required infrastructure and laboratory analyses.

Effluent water can be combined into a 4-inch corrugated pipe, drained downslope by approximately 20 to 50 feet, and cascaded into an open pond. The oxidation pond(s) can be constructed out of small plastic wading pools. Local wetland plants and soil can be excavated from an area selected along Galena Creek (or other optimum location) and transplanted into the downgradient end of the tank. Influent can be sampled prior to the cascade and effluent can be sampled through a bulkhead installed in the side of the tank.

Section 6

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Tables

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Table 4.1-1
Bench-Scale Analytical Results
Danny T Adit Treatability Study Year 1

Sample Name		13BH-DT-BENCH-RAW				13BH-BENCH-OXD				13BH-DT-BENCH-PH45-NAOH				13BH-DT-BENCH-PH45-LIME				13BH-DT-BENCH-PH45-CHIT				13BH-DT-BENCH-PH95-NAOH				13BH-DT-BENCH-PH95-LIME			
Date		2/25/2013				2/25/2013				2/25/2013				2/25/2013				2/26/2013				2/26/2013				2/27/2013			
Description		Raw Water				Oxidized Water				Treated to pH 4.5 w/ NaOH				Treated to pH 4.5 w/ Lime				Treated to pH 4.5 w/ Chitorem				Treated to pH 9.5 w/ NaOH				Treated to pH 9.5 w/ Lime			
Fraction		Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q
Metals	**Units**																												
Aluminum	ug/L	6,370		6,490		6,250		6,440		5,190		5,240		5,520		5,740		3,810		5,070		121	J	321		100	U	123	J
Antimony	ug/L	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U
Arsenic	ug/L	5.19	J	14.3		4.81	J	8.1	J	2.96	J	3.1	J	2.5	U	3.04	J	5.06	J	10.1		2.5	U	2.5	U	2.5	U	2.5	U
Barium	ug/L	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U
Beryllium	ug/L	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U
Cadmium	ug/L	141		134		138		136		148		138		137		138		129		130		0.5	U	4.49		0.708	J	1.44	
Calcium	ug/L	95,600		94,600		95,900		94,100		95,400		93,200		189,000		185,000		186,000		188,000		90,200		89,700		303,000		296,000	
Chromium	ug/L	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Cobalt	ug/L	26.5		25.5		27.7		25.4		27.3		26.2		26.5		25.3		24.4		24.6		0.5	U	0.5	U	0.5	U	0.5	U
Copper	ug/L	426	J	426	J	421		399		406		402		397		400		307		331		10.0	U	21.2		10.0	U	10.2	
Iron	ug/L	78,000		82,400		79,200		77,900		500	U	11,900		500	U	20,900		500	U	40,800		500	U	2,180		500	U	500	U
Lead	ug/L	87.1		80.3		82.6		74.7		7.52		19.2		18.5		35.8		1.51		28.2		0.5	U	2.41		0.5	U	0.575	J
Magnesium	ug/L	20,700		20,500		20,900		20,400		20,900		20,300		21,900		21,100		27,900		27,200		17,400		17,100		20,600		19,700	
Manganese	ug/L	90,200		89,700		91,200		89,400		87,100		87,800		89,100		88,300		87,400		88,000		2,690		5,690		3,030		3,770	
Nickel	ug/L	21.8		19.7		26.4		25.9		26.2		23.8		25.2		27.1		21.9		21.9		2.5	U	2.5	U	3.56	J	2.5	U
Potassium	ug/L	1,250	U	1,250	U	2,110	J	1,630	J	1,440	J	1,250	U	1,320	J	1,250	U	5,190		4,270	J	1,500	J	1,250	U	1,600	J	1,250	U
Selenium	ug/L	4.18	J	8.16		5.14		7.59		8.73		7.23		4.83	J	10.5		4.85	J	7.46		2.5	U	3.22	J	3.56	J	2.5	U
Silver	ug/L	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U
Sodium	ug/L	7,930		5,780		8,310		5,980		121,000		123,000		8,260		5,860		22,500		19,000		269,000		266,000		8,260		5,710	
Thallium	ug/L	2.5	U	34.6		2.5	U	6.89		2.5	U	2.83	J	2.5	U	3.33	J	2.5	U	3.46	J	2.5	U	2.5	U	2.5	U	2.5	U
Vanadium	ug/L	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U
Zinc	ug/L	39,800		39,100		40,700		38,700		39,700		39,200		40,000		38,700		37,300		37,100		50.0	U	1,240		57.7	J	268	
General Chemistry	**Units**																												
Chloride	mg/L			10.0	U			10.0	U			10.0	U			10.0	U			19.4	J			10.0	U			10.0	U
Sulfate as SO4	mg/L			835				841				799				803				829				829				817	
Fluoride	mg/L			1.9	J			1.9	J			1.8	J			2.0				2.4				1.7	J			1.5	J
Acidity	mg/L			380				340				260				110				240				8.0				4.0	U
Total Alkalinity	mg CaCO3 / L			5.0	U			5.0	U			5.0	U			5.0	U			5.0	U			18.3				14.1	
Bicarbonate Alkalinity	mg HCO3 / L							325																297				842	
Carbonate Alkalinity	mg CO3 / L																												
Hydroxide Alkalinity	mg OH / L							601																418				382	
Hardness	mg/L			324				325				324				562				579				297				842	
TSS	mg/L							1,697				156				248								2.557				2.374	
Sulfide	mg/L							7.75																9.5				9.8	
BOD	mg/L							16.55																7.38				6.37	
CDM Smith Laboratory	**Units**																												
Sulfide	mg/L																												
Alkalinity	mg/L																												
ORP	mV			563				601				418				382													
pH	su			2.75				2.76				4.5				4.5				4.5				9.5				9.5	
Conductivity	mS/cm			1.722				1.697				2.557				2.374													
DO	mg/L			10.77				7.75				9.5				9.8													
Temperature	^{o}C			7.67				16.55				7.38				6.37													

Notes:

Blank cell indicates that sample was not measured for that parameter
Q = Laboratory qualifier
> = Above detection limit (reporting limit shown)

NM - not measured
J = Estimated value
mg/L = milligrams per liter
^{o}C = degrees Celcius
ORP = oxygen reduction potential
DO = dissolved oxygen

U = Below detection limit (detection limit shown)
R = Rejected value
ug/L = micrograms per liter
su = standard units
mV = millivolts
mS/cm = milliSiemens per centimeter

Table 4.1-1
Bench-Scale Analytical Results
Danny T Adit Treatability Study Year 1

Sample Name		13BH-DT-BENCH-SPS-C1				13BH-DT-BENCH-SPS-C2				13BH-DT-BENCH-SPS-C3				13BH-DT-BENCH-CHI-C4				13H-DT-Bench-BCR-C1				13H-DT-Bench-BCR-C2				13H-DT-Bench-BCR-C3				13H-DT-Bench-BCR-C4			
Date		2/27/2013				2/27/2013				2/27/2013				2/27/2013				4/15/2013				4/15/2013				4/15/2013				4/15/2013			
Description		Pretreated pH 4.5 (NaOH) after SAPS column				Pretreated pH 4.5 (lime) after SAPS column				Raw water (no pretreatment) after SAPS column				Raw water after Chitorem column				Post BCR Treatment				Post BCR Treatment				Post BCR Treatment				Post BCR Treatment			
Fraction		Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q
Metals	**Units**																																
Aluminum	ug/L	200	U	414	J	200	U	485	J	200	U	414	J	200	U	200	U	240		NM		220		NM		240		NM		200		NM	
Antimony	ug/L	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	NM		NM		NM		NM		NM		NM		NM		NM	
Arsenic	ug/L	29.3		35.0		27.5		26.7		23.8		27.5		127		104		10.0		NM		9.0		NM		9.0		NM		67.0		NM	
Barium	ug/L	60.4	J	63.3	J	59.3	J	65.7	J	61.0	J	63.4	J	50.0	U	50.0	U	1,690		NM		1,740		NM		1,600		NM		1,750		NM	
Beryllium	ug/L	20.0	U	20.0	U	20.0	U	20.0	U	20.0	U	20.0	U	20.0	U	20.0	U	1.0	U	NM		1.0	U	NM		1.0	U	NM		1.0	U	NM	
Cadmium	ug/L	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	2.41		2.38		1.0	U	NM		1.0	U	NM		1.0	U	NM		1.0	U	NM	
Calcium	ug/L	99,200		97,200		172,000		169,000		160,000		154,000		198,000		194,000		1,120,000		NM		1,020,000		NM		1,180,000		NM		1,100,000		NM	
Chromium	ug/L	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	24.8		20.4		5.0	U	NM		5.0	U	NM		5.0	U	NM		5.0		NM	
Cobalt	ug/L	5.4		5.72		4.35		4.63		3.52		3.65		1.0	U	1.0	U	16.0		NM		18.0		NM		19.0		NM		16.0		NM	
Copper	ug/L	34.9		50.6		26.6		47.7		35.8		64.8		79.8		49.8		22.0		NM		16.0		NM		15.0		NM		23.0		NM	
Iron	ug/L	1,000	U	1,000	U	1,000	U	1,000	U	1,000	U	1,000	U	1,000	U	1,000	U	13,700		NM		12,600		NM		14,400		NM		13,600		NM	
Lead	ug/L	1.9	J	3.13		1.13	J	2.35		1.0	U	3.79		1.0	U	1.0	U	3.0		NM		2.0		NM		3.0		NM		3.0		NM	
Magnesium	ug/L	65,600		63,200		73,000		71,900		81,800		77,400		103,000		100,000		157,000		NM		158,000		NM		169,000		NM		205,000		NM	
Manganese	ug/L	7,270		7,320		17,900		17,900		13,300		13,000		20.0	U	20.0	U	9,900		NM		19,200		NM		16,500		NM		4,940		NM	
Nickel	ug/L	16.7		15.0		13.4		15.8		11.7		12.2		26.5		22.8		71.0		NM		67.0		NM		74.0		NM		78.0		NM	
Potassium	ug/L	253,000		239,000		221,000		219,000		231,000		221,000		138,000		128,000		1,090,000		NM		981,000		NM		1,020,000		NM		977,000		NM	
Selenium	ug/L	5.0	U	10.9		11.4		5.0	U	5.0	U	10.7		49.6		34.9		NM		NM		NM		NM		NM		NM		NM		NM	
Silver	ug/L	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	1.0	U	NM		1.0	U	NM		1.0	U	NM		1.0	U	NM	
Sodium	ug/L	156,000		153,000		52,500		49,300		49,400		43,300		424,000		379,000		162,000		NM		65,000		NM		64,000		NM		271,000		NM	
Thallium	ug/L	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	0.5	U	NM		0.5	U	NM		0.5	U	NM		0.5	U	NM	
Vanadium	ug/L	48.4		44.4		39.0		29.8	J	37.8		20.5	J	28.3	J	20.0	U			NM		NM		NM		NM		NM		NM		NM	
Zinc	ug/L	189	J	192	J	301		376		214		242		100	U	100	U	470		NM		450		NM		450		NM		460		NM	
General Chemistry	**Units**																																
Chloride	mg/L			89.8				90.2				70.3				519				410				260				340				450	
Sulfate as SO4	mg/L			808				793				801				777				1,000				950				1,000				960	
Fluoride	mg/L			1.3	J			1.2	J			1.0	U			2.3				0.3				0.3				0.2				0.1	U
Acidity	mg/L			4.0	U			4.0	U			4.0	U			4.0	U			1,200				950				550				640	
Total Alkalinity	mg CaCO3 / L			214				196				235				574				3,100				2,700				3,100				3,500	
Bicarbonate Alkalinity	mg HCO3 / L																			3,800				3,300				3,700				4,300	
Carbonate Alkalinity	mg CO3 / L																			1.0	U			1.0	U			1.0	U			1.0	U
Hydroxide Alkalinity	mg OH / L																			1.0	U			1.0	U			1.0	U			1.0	U
Hardness	mg/L			518				730				737				918				3,444				3,198				3,643				3,591	
TSS	mg/L																			1,020				550				1,830				1,400	
Sulfide	mg/L																			13.0				3.0				11.0				8.0	
BOD	mg/L																			1,788	>			1,782	>			1,785	>			1,791	>
CDM Smith Laboratory	**Units**																																
Sulfide	mg/L																			0.264				0.318				0.255				0.284	
Alkalinity	mg/L																			4,250				4,250				4,080				5,610	
ORP	mV			198				198				163				141				-13.8				-35.9				-35.0				-55.1	
pH	su			7.32				7.41				7.55				8.89				4.954				4.934				4.999				5.129	
Conductivity	mS/cm			4.649				4.259				4.05				7.459				6.0				5.62				6.23				7.63	
DO	mg/L			0.71				0.65				0.52				1.2				1.0	U			1.0	U			1.0	U			1.0	U
Temperature	^{o}C			24.66				25.77				25.16				24.7				16.95				17.1				16.8				16.45	

Notes:

Blank cell indicates that sample was not measured for that parameter

NM - not measured

U = Below detection limit (detection limit shown)

Q = Laboratory qualifier

J = Estimated value

R = Rejected value

> = Above detection limit (reporting limit shown)

mg/L = milligrams per liter

ug/L = micrograms per liter

^{o}C = degrees Celcius

su = standard units

ORP = oxygen reduction potential

mV = millivolts

DO = dissolved oxygen

mS/cm = milliSiemens per centimeter

Table 4.1-2
Bench-Scale Removal Efficiency
Danny T Adit Treatability Study Year 1

Sample Name					13BH-BENCH-OXD				13BH-DT-BENCH-PH45-NAOH				13BH-DT-BENCH-PH45-LIME				13BH-DT-BENCH-PH45-CHIT				13BH-DT-BENCH-PH95-NAOH				13BH-DT-BENCH-PH95-LIME			
Date					2/25/2013				2/25/2013				2/25/2013				2/26/2013				2/26/2013				2/27/2013			
Description					Oxidized Water				Treated to pH 4.5 w/ NaOH				Treated to pH 4.5 w/ Lime				Treated to pH 4.5 w/ Chitorem				Treated to pH 9.5 w/ NaOH				Treated to pH 9.5 w/ Lime			
Method Reporting Limit:		RAW, OXD, PH45, PH95	SPS, CHI	BCR	% removal D		% removal T		% removal D		% removal T		% removal D		% removal T		% removal D		% removal T		% removal D		% removal T		% removal D		% removal T	
Metals	**Units**																											
Aluminum	ug/L	250	500	30		1.9%		0.8%		18.5%		19.3%		13.3%		11.6%		40.2%		21.9%		98.1%		95.1%	>	98.4%		98.1%
Antimony	ug/L	5	10		NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--
Arsenic	ug/L	10	20	1		7.3%		43.4%		43.0%		78.3%	>	51.8%		78.7%		2.5%		29.4%	>	51.8%	>	82.5%	>	51.8%	>	82.5%
Barium	ug/L	50	100	50	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--
Beryllium	ug/L	25	50	1	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--
Cadmium	ug/L	1	2	1		2.1%		-1.5%		-5.0%		-3.0%		2.8%		-3.0%		8.5%		3.0%	>	99.6%		96.6%		99.5%		98.9%
Calcium	ug/L	1250	2500	1000		-0.3%		0.5%		0.2%		1.5%		-97.7%		-95.6%		-94.6%		-98.7%		5.6%		5.2%		-216.9%		-212.9%
Chromium	ug/L	10	20	5	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--
Cobalt	ug/L	1	2	5		-4.5%		0.4%		-3.0%		-2.7%		0.0%		0.8%		7.9%		3.5%	>	98.1%	>	98.0%	>	98.1%	>	98.0%
Copper	ug/L	10	20	5		1.2%		6.3%		4.7%		5.6%		6.8%		6.1%		27.9%		22.3%	>	97.7%		95.0%	>	97.7%		97.6%
Iron	ug/L	1250	2500	30		-1.5%		5.5%	>	99.4%		85.6%	>	99.4%		74.6%	>	99.4%		50.5%	>	99.4%		97.4%	>	99.4%	>	99.4%
Lead	ug/L	1	2	1		5.2%		7.0%		91.4%		76.1%		78.8%		55.4%		98.3%		64.9%	>	99.4%		97.0%	>	99.4%		99.3%
Magnesium	ug/L	1250	2500	1000		-1.0%		0.5%		-1.0%		1.0%		-5.8%		-2.9%		-34.8%		-32.7%		15.9%		16.6%		0.5%		3.9%
Manganese	ug/L	25	50	1		-1.1%		0.3%		3.4%		2.1%		1.2%		1.6%		3.1%		1.9%		97.0%		93.7%		96.6%		95.8%
Nickel	ug/L	5	10	5		-21.1%		-31.5%		-20.2%		-20.8%		-15.6%		-37.6%		-0.5%		-11.2%	>	88.5%	>	87.3%		83.7%	>	87.3%
Potassium	ug/L	5000	10000	1000	<	-68.8%	<	-30.4%	<	-15.2%	NA	--	<	-5.6%	NA	--	<	-315.2%	<	-241.6%	<	-20.0%	NA	--	<	-28.0%	NA	--
Selenium	ug/L	5	10			-23.0%		7.0%		-108.9%		11.4%		-15.6%		-28.7%		-16.0%		8.6%	>	40.2%		60.5%		14.8%	>	69.4%
Silver	ug/L	5	10	1	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--
Sodium	ug/L	5000	10000	1000		-4.8%		-3.5%		-1425.9%		-2028.0%		-4.2%		-1.4%		-183.7%		-228.7%		-3292.2%		-4502.1%		-4.2%		1.2%
Thallium	ug/L	5	10	0.5	NA	--		80.1%	NA	--		91.8%	NA	--		90.4%	NA	--		90.0%	NA	--	>	92.8%	NA	--	>	92.8%
Vanadium	ug/L	15	30		NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--
Zinc	ug/L	100	200	10		-2.3%		1.0%		0.3%		-0.3%		-0.5%		1.0%		6.3%		5.1%	>	99.9%		96.8%		99.9%		99.3%
General Chemistry	**Units**																											
Acidity	mg/L	4	4	4		NM		10.5%		NM		31.6%		NM		71.1%		NM		36.8%		NM		97.9%		NM	>	98.9%
Total Alkalinity	mg CaCO3 / L	5	5	1		NM	NA	--		NM	NA	--		NM	NA	--		NM	NA	--		NM	<	-266.0%		NM	<	-182.0%
Sulfate as SO4	mg/L	50	50	5		NM		-0.7%		NM		4.3%		NM		3.8%		NM		0.7%		NM		0.7%		NM		2.2%

Notes:

NA =Removal efficiency calculation is not applicable due to the following logic cases:

1) Both the raw water and treated water effluent have results that are less than 5 times their respective reporting limits

2) The treated water effluent is non-detect and the raw water was detected at a concentration less than the treated water effluent reporting limit

3) The raw water is non-detect and the treated effluent water was detected at a concentration less than the raw water reporting limit

4) Both the raw water and the treated water effluent are non-detect

< = The true removal efficiency is less than the percent shown because the raw water is non-detect and the treated water effluent was detected at a concentration greater than the raw water reporting limit

> = The true removal efficiency is greater than the percent shown because the treated water effluent is non-detect and the raw water was detected at a concentration greater than the treated water effluent reporting limit

NM - not measured

mg/L = milligrams per liter

ug/L = micrograms per liter

Table 4.1-2
Bench-Scale Removal Efficiency
Danny T Adit Treatability Study Year 1

				Sample Name	13BH-DT-BENCH-SPS-C1		13BH-DT-BENCH-SPS-C2		13BH-DT-BENCH-SPS-C3		13BH-DT-BENCH-CHI-C4		13H-DT-Bench-BCR-C1		13H-DT-Bench-BCR-C2		13H-DT-Bench-BCR-C3		13H-DT-Bench-BCR-C4	
				Date	2/27/2013		2/27/2013		2/27/2013		2/27/2013		4/15/2013		4/15/2013		4/15/2013		4/15/2013	
				Description	Pretreated pH 4.5 (NaOH) after SAPS column		Pretreated pH 4.5 (lime) after SAPS column		Raw water (no pretreatment) after SAPS column		Raw water after Chitorem column		Post BCR Treatment		Post BCR Treatment		Post BCR Treatment		Post BCR Treatment	
Method Reporting Limit:		RAW, OXD, PH45, PH95	SPS, CHI	BCR	% removal D	% removal T	% removal D	% removal T	% removal D	% removal T	% removal D	% removal T	% removal D	% removal T	% removal D	% removal T	% removal D	% removal T	% removal D	% removal T
Metals	**Units**																			
Aluminum	ug/L	250	500	30	> 96.9%	93.6%	> 96.9%	92.5%	> 96.9%	93.6%	> 96.9%	> 96.9%	96.2%	NM	96.5%	NM	96.2%	NM	96.9%	NM
Antimony	ug/L	5	10		NA --	NA --	NA --	NA --	NA --	NA --	NA --	NA --	< NM	< NM	< NM	< NM	< NM	< NM	< NM	< NM
Arsenic	ug/L	10	20	1	NA --	NA --	NA --	NA --	NA --	NA --	-2347.0%	-627.3%	-92.7%	NM	-73.4%	NM	-73.4%	NM	-1190.9%	NM
Barium	ug/L	50	100	50	NA --	NA --	NA --	NA --	NA --	NA --	NA --	NA --	< -6660.0%	< NM	< -6860.0%	< NM	< -6300.0%	< NM	< -6900.0%	< NM
Beryllium	ug/L	25	50	1	NA --	NA --	NA --	NA --	NA --	NA --	NA --	NA --	NA --	< NM	NA --	< NM	NA --	< NM	NA --	< NM
Cadmium	ug/L	1	2	1	> 99.3%	> 99.3%	> 99.3%	> 99.3%	> 99.3%	> 99.3%	98.3%	98.2%	> 99.3%	NM	> 99.3%	NM	> 99.3%	NM	> 99.3%	NM
Calcium	ug/L	1250	2500	1000	-3.8%	-2.7%	-79.9%	-78.6%	-67.4%	-62.8%	-107.1%	-105.1%	-1071.5%	NM	-966.9%	NM	-1134.3%	NM	-1050.6%	NM
Chromium	ug/L	10	20	5	NA --	NA --	NA --	NA --	NA --	NA --	NA --	NA --	NA --	< NM	NA --	< NM	NA --	< NM	NA --	< NM
Cobalt	ug/L	1	2	5	79.6%	77.6%	83.6%	81.8%	86.7%	85.7%	> 96.2%	> 96.1%	39.6%	NM	32.1%	NM	28.3%	NM	39.6%	NM
Copper	ug/L	10	20	5	91.8%	88.1%	93.8%	88.8%	91.6%	84.8%	81.3%	88.3%	94.8%	NM	96.2%	NM	96.5%	NM	94.6%	NM
Iron	ug/L	1250	2500	30	> 98.7%	> 98.8%	> 98.7%	> 98.8%	> 98.7%	> 98.8%	> 98.7%	> 98.8%	82.4%	NM	83.8%	NM	81.5%	NM	82.6%	NM
Lead	ug/L	1	2	1	97.8%	96.1%	98.7%	97.1%	> 98.9%	95.3%	> 98.9%	> 98.8%	96.6%	NM	97.7%	NM	96.6%	NM	96.6%	NM
Magnesium	ug/L	1250	2500	1000	-216.9%	-208.3%	-252.7%	-250.7%	-295.2%	-277.6%	-397.6%	-387.8%	-658.5%	NM	-663.3%	NM	-716.4%	NM	-890.3%	NM
Manganese	ug/L	25	50	1	91.9%	91.8%	80.2%	80.0%	85.3%	85.5%	> 99.98%	> 99.98%	89.0%	NM	78.7%	NM	81.7%	NM	94.5%	NM
Nickel	ug/L	5	10	5	NA --	NA --	NA --	NA --	NA --	NA --	NA --	NA --	-225.7%	NM	-207.3%	NM	-239.4%	NM	-257.8%	NM
Potassium	ug/L	5000	10000	1000	< -20140.0%	< -19020.0%	< -17580.0%	< -17420.0%	< -18380.0%	< -17580.0%	< -10940.0%	< -10140.0%	< -87100.0%	< NM	< -78380.0%	< NM	< -81500.0%	< NM	< -78060.0%	< NM
Selenium	ug/L	5	10		NA --	NA --	NA --	NA --	NA --	NA --	NA --	NA --	NM	NM	NM	NM	NM	NM	NM	NM
Silver	ug/L	5	10	1	NA --	NA --	NA --	NA --	NA --	NA --	NA --	NA --	NA --	< NM	NA --	< NM	NA --	< NM	NA --	< NM
Sodium	ug/L	5000	10000	1000	-1867.2%	-2547.1%	-562.0%	NA --	NA --	NA --	-5246.8%	-6457.1%	-1942.9%	NM	-719.7%	NM	-707.1%	NM	-3317.4%	NM
Thallium	ug/L	5	10	0.5	NA --	> 85.5%	NA --	> 85.5%	NA --	> 85.5%	NA --	> 85.5%	NA --	NM	NA --	NM	NA --	NM	NA --	NM
Vanadium	ug/L	15	30		NA --	NA --	NA --	NA --	NA --	NA --	NA --	NA --	< NM	< NM	< NM	< NM	< NM	< NM	< NM	< NM
Zinc	ug/L	100	200	10	99.5%	99.5%	99.2%	99.0%	99.5%	99.4%	> 99.7%	> 99.7%	98.8%	NM	98.9%	NM	98.9%	NM	98.8%	NM
General Chemistry	**Units**																			
Acidity	mg/L	4	4	4	NM	> 98.9%	NM	> 98.9%	NM	> 98.9%	NM	> 98.9%	NM	-215.8%	NM	-150.0%	NM	-44.7%	NM	-68.4%
Total Alkalinity	mg CaCO3 / L	5	5	1	NM	< -4180.0%	NM	< -3820.0%	NM	< -4600.0%	NM	< -11380.0%	NM	< -61900.0%	NM	< -53900.0%	NM	< -61900.0%	NM	< -69900.0%
Sulfate as SO4	mg/L	50	50	5	NM	3.2%	NM	5.0%	NM	4.1%	NM	6.9%	NM	-19.8%	NM	-13.8%	NM	-19.8%	NM	-15.0%

Notes:

NA =Removal efficiency calculation is not applicable due to the following logic cases:

1) Both the raw water and treated water effluent have results that are less than 5 times their respective reporting limits

2) The treated water effluent is non-detect and the raw water was detected at a concentration less than the treated water effluent reporting limit

3) The raw water is non-detect and the treated effluent water was detected at a concentration less than the raw water reporting limit

4) Both the raw water and the treated water effluent are non-detect

< = The true removal efficiency is less than the percent shown because the raw water is non-detect and the treated water effluent was detected at a concentration greater than the raw water reporting limit

> = The true removal efficiency is greater than the percent shown because the treated water effluent is non-detect and the raw water was detected at a concentration greater than the treated water effluent reporting limit

NM - not measured

mg/L = milligrams per liter

ug/L = micrograms per liter

Table 4.1-3
Bench-Scale Comparison to Water Quality Standards
Danny T Adit Treatability Study Year 1

	Sample Name	13BH-DT-BENCH-RAW				13BH-BENCH-OXD				13BH-DT-BENCH-PH45-NAOH				13BH-DT-BENCH-PH45-LIME				13BH-DT-BENCH-PH45-CHIT				13BH-DT-BENCH-PH95-NAOH				13BH-DT-BENCH-PH95-LIME			
	Date	2/25/2013				2/25/2013				2/25/2013				2/25/2013				2/26/2013				2/26/2013				2/27/2013			
	Description	Raw Water				Oxidized Water				Treated to pH 4.5 w/ NaOH				Treated to pH 4.5 w/ Lime				Treated to pH 4.5 w/ Chitorem				Treated to pH 9.5 w/ NaOH				Treated to pH 9.5 w/ Lime			
	Fraction	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q
Metals	**Units**																												
Aluminum	ug/L	**6,370**		6,490		**6,250**		6,440		**5,190**		5,240		**5,520**		5,740		**3,810**		5,070		**121**	J	321		100	U	123	J
Antimony	ug/L	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U
Arsenic	ug/L	5.19	J	14.3		4.81	J	8.1	J	2.96	J	3.1	J	2.5	U	3.04	J	5.06	J	10.1		2.5	U	2.5	U	2.5	U	2.5	U
Barium	ug/L	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U	25.0	U
Beryllium	ug/L	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U
Cadmium	ug/L	**141**		**134**		**138**		**136**		**148**		**138**		**137**		**138**		**129**		**130**		0.5	U	**4.49**		0.708	J	**1.44**	
Chromium	ug/L	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Copper	ug/L	**426**	J	**426**	J	**421**		**399**		**406**		**402**		**397**		**400**		**307**		**331**		10.0	U	21.2		10.0	U	10.2	
Iron	ug/L	**78,000**		**82,400**		**79,200**		**77,900**		500	U	**11,900**		500	U	**20,900**		500	U	**40,800**		500	U	**2,180**		500	U	500	U
Lead	ug/L	**87.1**		**80.3**		**82.6**		**74.7**		7.52		**19.2**		18.5		**35.8**		1.51		**28.2**		0.5	U	2.41		0.5	U	0.575	J
Nickel	ug/L	21.8		19.7		26.4		25.9		26.2		23.8		25.2		27.1		21.9		21.9		2.5	U	2.5	U	3.56	J	2.5	U
Selenium	ug/L	4.18	J	**8.16**		**5.14**		**7.59**		**8.73**		**7.23**		4.83	J	**10.5**		4.85	J	**7.46**		2.5	U	3.22	J	3.56	J	2.5	U
Silver	ug/L	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U
Thallium	ug/L	2.5	U	34.6		2.5	U	6.89		2.5	U	2.83	J	2.5	U	3.33	J	2.5	U	3.46	J	2.5	U	2.5	U	2.5	U	2.5	U
Zinc	ug/L	**39,800**		**39,100**		**40,700**		**38,700**		**39,700**		**39,200**		**40,000**		**38,700**		**37,300**		**37,100**		50.0	U	**1,240**		57.7	J	268	

Notes:

Blank cell indicates that sample was not measured for that parameter

NM - not measured

U = Below detection limit (reporting limit shown)

> = Above detection limit (reporting limit shown)

Q = Laboratory qualifier

J = Estimated value

R = Rejected value

ug/L = micrograms per liter

Flags:

Text - Exceeds Human Health standard.

Text - Exceeds Chronic Aquatic Life standard.

Text - Exceeds Acute Aquatic Life standard.

Table 4.1-3
Bench-Scale Comparison to Water Quality Standards
Danny T Adit Treatability Study Year 1

Sample Name		13BH-DT-BENCH-SPS-C1				13BH-DT-BENCH-SPS-C2				13BH-DT-BENCH-SPS-C3				13BH-DT-BENCH-CHI-C4				13H-DT-Bench-BCR-C1				13H-DT-Bench-BCR-C2				13H-DT-Bench-BCR-C3				13H-DT-Bench-BCR-C4			
Date		2/27/2013				2/27/2013				2/27/2013				2/27/2013				4/15/2013				4/15/2013				4/15/2013				4/15/2013			
Description		Pretreated pH 4.5 (NaOH) after SAPS column				Pretreated pH 4.5 (lime) after SAPS column				Raw water (no pretreatment) after SAPS column				Raw water after Chitorem column				Post BCR Treatment				Post BCR Treatment				Post BCR Treatment				Post BCR Treatment			
Fraction		Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q	Dissolved	Q	Total	Q
Metals	**Units**																																
Aluminum	ug/L	200	U	414	J	200	U	485	J	200	U	414	J	200	U	200	U	**240**		NM		**220**		NM		**240**		NM		**200**		NM	
Antimony	ug/L	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	NM		NM		NM		NM		NM		NM		NM		NM	
Arsenic	ug/L	29.3		35.0		27.5		26.7		23.8		27.5		127		104		10.0		NM		9.0		NM		9.0		NM		67.0		NM	
Barium	ug/L	60.4	J	63.3	J	59.3	J	65.7	J	61.0	J	63.4	J	50.0	U	50.0	U	1,690		NM		1,740		NM		1,600		NM		1,750		NM	
Beryllium	ug/L	20.0	U	20.0	U	20.0	U	20.0	U	20.0	U	20.0	U	20.0	U	20.0	U	1.0	U	NM		1.0	U	NM		1.0	U	NM		1.0	U	NM	
Cadmium	ug/L	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	**2.41**		**2.38**		1.0	U	NM		1.0	U	NM		1.0	U	NM		1.0	U	NM	
Chromium	ug/L	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	10.0	U	24.8		20.4		5.0	U	NM		5.0	U	NM		5.0	U	NM		5.0		NM	
Copper	ug/L	**34.9**		**50.6**		26.6		**47.7**		**35.8**		**64.8**		**79.8**		**49.8**		22.0		NM		16.0		NM		15.0		NM		23.0		NM	
Iron	ug/L	1,000	U	1,000	U	1,000	U	1,000	U	1,000	U	1,000	U	1,000	U	1,000	U	**13,700**		NM		**12,600**		NM		**14,400**		NM		**13,600**		NM	
Lead	ug/L	1.9	J	3.13		1.13	J	2.35		1.0	U	3.79		1.0	U	1.0	U	3.0		NM		2.0		NM		3.0		NM		3.0		NM	
Nickel	ug/L	16.7		15.0		13.4		15.8		11.7		12.2		26.5		22.8		71.0		NM		67.0		NM		74.0		NM		78.0		NM	
Selenium	ug/L	5.0	U	**10.9**		**11.4**		5.0	U	5.0	U	**10.7**		**49.6**		**34.9**		NM		NM		NM		NM		NM		NM		NM		NM	
Silver	ug/L	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	1.0	U	NM		1.0	U	NM		1.0	U	NM		1.0	U	NM	
Thallium	ug/L	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	0.5	U	NM		0.5	U	NM		0.5	U	NM		0.5	U	NM	
Zinc	ug/L	189	J	192	J	301		376		214		242		100	U	100	U	**470**		NM		**450**		NM		**450**		NM		**460**		NM	

Notes:

Blank cell indicates that sample was not measured for that parameter

NM - not measured

U = Below detection limit (reporting limit shown)

> = Above detection limit (reporting limit shown)

Q = Laboratory qualifier

J = Estimated value

R = Rejected value

ug/L = micrograms per liter

Flags:

Text - Exceeds Human Health standard.

Text - Exceeds Chronic Aquatic Life standard.

Text - Exceeds Acute Aquatic Life standard.

Table 4.2-1
Pilot-Scale Laboratory Data
Danny T Adit Treatability Study Year 1

Sample Location	Sample ID	Sample Type	Analyte	ALUMINUM				ARSENIC				BARIUM				BERYLLIUM				CADMIUM				CALCIUM				CHROMIUM				COBALT				COPPER				IRON				LEAD				MAGNESIUM			
			Unit	µg/L				µg/L				µg/L				µg/L				µg/L				mg/L				µg/L				µg/L				µg/L				µg/L				µg/L				mg/L			
			Fraction	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q
INFL	13BH-DT-PILOT-INFL-071113	N	7/11/2013	15,600		18,900		311.0		324.0		50.0	U	50.0	U	8.0		8.0		316.0		293.0		108.0		107.0		6.0		6.0		58.0		56.0		2,160.0		2,040.0		180,000		179,000		252.0		255.0		24.0		24.0	
	13BH-DT-PILOT-INFD-071113	FD	7/11/2013	7,870		17,500		313.0		337.0		50.0	U	50.0	U	8.0		8.0		315.0		300.0		105.0		106.0		6.0		6.0		57.0		56.0		2,160.0		1,950.0		177,000		179,000		255.0		251.0		23.0		23.0	
	13BH-DT-PILOT-INFL-072313	N	7/23/2013	14,900		-		278.0		-		50.0	U	-		8.0		-		298.0		-		106.0		-		6.0		-		48.0		-		1,940.0		-		179,000		-		212.0		-		25.0		-	
	13BH-DT-PILOT-INFL-080713	N	8/7/2013	12,800		-		210.0		-		50.0	U	-		6.0		-		191.0		-		93.0		-		5.0	U	-		55.0		-		1,400.0		-		162,000		-		173.0		-		20.0		-	
	13BH-DT-PILOT-INFL-081913	N	8/19/2013	12,000		-		168.0		-		50.0	U	-		6.0		-		228.0		-		95.0		-		5.0	U	-		41.0		-		1,300.0		-		145,000		-		151.0		-		21.0		-	
	13BH-DT-PILOT-INFL-090413	N	9/4/2013	10,900		12,600		113.0		150.0		50.0	U	50.0	U	6.0		5.0		155.0		150.0		97.0		98.0		5.0	U	5.0	U	38.0		39.0		1,120.0		1,180.0		130,000		129,000		136.0		258.0		22.0		22.0	
	13BH-DT-PILOT-INFL-091613	N	9/16/2013	8,710		-		93.0		-		50.0	U	-		6.0		-		154.0		-		93.0		-		5.0	U	-		36.0		-		924.0		-		112,000		-		122.0		-		20.0		-	
SAPS	13BH-DT-PILOT-SAPS-071113	N	7/11/2013	40		220		6.0		56.0		300.0		320.0		1.0	U	1.0	U	1.0	U	19.0		371.0		375.0		5.0	U	5.0	U	5.0	U	8.0		5.0	U	88.0		2,630		4,860		1.0	U	14.0		81.0		81.0	
	13BH-DT-PILOT-SAPS-072313	N	7/23/2013	1,440		-		5.0		-		90.0		-		1.0		-		45.0		-		267.0		-		5.0	U	-		62.0		-		7.0		-		108,000		-		1.0	U	-		28.0		-	
	13BH-DT-PILOT-SAPS-080713	N	8/7/2013	2,550		-		4.0		-		50.0	U	-		3.0		-		71.0		-		235.0		-		5.0	U	-		59.0		-		20.0		-		111,000		-		2.0		-		21.0		-	
	13BH-DT-PILOT-SAPS-081913	N	8/19/2013	1,920		-		4.0		-		50.0	U	-		2.0		-		89.0		-		227.0		-		5.0	U	-		43.0		-		9.0		-		86,500		-		2.0		-		23.0		-	
	13BH-DT-PILOT-SAPS-090413	N	9/4/2013	680		154,000		3.0		746.0		50.0	U	50.0		1.0		63.0		67.0		584.0		238.0		210.0		5.0	U	82.0		40.0		38.0		5.0	U	10,100.0		79,100		669,000		1.0		1,950.0		23.0		20.0	
	13BH-DT-PILOT-SAPS-091613	N	9/16/2013	2,020		-		52.0		-		50.0	U	-		7.0		-		100.0		-		233.0		-		6.0		-		39.0		-		780.0		-		107,000		-		184.0		-		22.0		-	
CHIT	13BH-DT-PILOT-CHIT-071113	N	7/11/2013	300		710		4,180.0		4,280.0		280.0		300.0		1.0	U	1.0	U	44.0		51.0		3,010.0		2,880.0		23.0		25.0		183.0		190.0		430.0		550.0		26,500		26,200		7.0		11.0		1,270.0		1,210.0	
	13BH-DT-PILOT-CHIT-072313	N	7/23/2013	30	U	-		24.0		-		50.0		-		1.0	U	-		1.0	U	-		926.0		-		5.0	U	-		6.0		-		5.0	U	-		820		-		1.0	U	-		60.0		-	
	13BH-DT-PILOT-CHIT-080713	N	8/7/2013	30	U	-		58.0		-		70.0		-		1.0	U	-		1.0	U	-		1,060.0		-		5.0	U	-		9.0		-		5.0	U	-		1,370		-		1.0	U	-		65.0		-	
	13BH-DT-PILOT-CHIT-081913	N	8/19/2013	30	U	-		23.0		-		50.0		-		1.0	U	-		1.0	U	-		852.0		-		5.0	U	-		12.0		-		5.0	U	-		32,200		-		1.0	U	-		46.0		-	
	13BH-DT-PILOT-CHIT-090413	N	9/4/2013	30	U	110		33.0		42.0		50.0	U	50.0		1.0	U	1.0	U	1.0	U	2		575.0		546.0		5.0	U	5.0	U	5.0		8.0		5.0	U	21.0		39,400		45,300		1.0	U	2.0		46.0		43.0	
	13BH-DT-PILOT-CHIT-091613	N	9/16/2013	90		-		34.0		-		50.0	U	-		1.0	U	-		1.0	U	-		377.0		-		5.0	U	-		11.0		-		5.0	U	-		39,400		-		1.0	U	-		43.0		-	
MGOH	13BH-DT-PILOT-MGOH-071113	N	7/11/2013	870		1,560		7.0		34.0		50.0	U	50.0	U	1.0		2.0		249.0		248.0		102.0		103.0		5.0	U	5.0	U	44.0		44.0		361.0		463.0		41,000		54,800		1.0	U	20.0		146.0		148.0	
	13BH-DT-PILOT-MGOH-072313	N	7/23/2013	7,520		-		4.0		-		50.0	U	-		5.0		-		280.0		-		111.0		-		5.0	U	-		47.0		-		1,400.0		-		470		-		23.0		-		149.0		-	
	13BH-DT-PILOT-MGOH-080713	N	8/7/2013	12,800		-		152.0		-		50.0	U	-		7.0		-		186.0		-		107.0		-		5.0	U	-		51.0		-		1,570.0		-		140,000		-		165.0		-		29.0		-	
	13BH-DT-PILOT-MGOH-081913	N	8/19/2013	10,200		-		9.0		-		50.0	U	-		5.0		-		224.0		-		103.0		-		5.0	U	-		40.0		-		1,110.0		-		36,600		-		111.0		-		88.0		-	
	13BH-DT-PILOT-MGOH-090413	N	9/4/2013	210		3,410		1.0	U	34.0		50.0	U	50.0	U	1.0	U	2.0		176.0		161.0		102.0		98.0		5.0	U	5.0	U	38.0		38.0		79.0		362.0		4,680		36,300		1.0	U	58.0		123.0		120.0	
	13BH-DT-PILOT-MGOH-091613	N	9/16/2013	180		-		12.0		-		50.0	U	-		3.0		-		140.0		-		95.0		-		5.0	U	-		35.0		-		480.0		-		37,600		-		52.0		-		89.0		-	
BCR1	13BH-DT-PILOT-BCR1-071113	N	7/11/2013	130		1,070		15.0		94.0		550.0		640.0		1.0	U	1.0	U	1.0	U	21.0		428.0		437.0		5.0	U	5.0	U	5.0	U	14.0		6.0		191.0		5,100		8,490		1.0	U	60.0		162.0		163.0	
	13BH-DT-PILOT-BCR1-072313	N	7/23/2013	90		-		7.0		-		360.0		-		1.0	U	-		1.0	U	-		301.0		-		5.0	U	-		28.0		-		5.0	U	-		104,000		-		1.0	U	-		40.0		-	
	13BH-DT-PILOT-BDR1-072313	FD	7/23/2013	90		-		8.0		-		360.0		-		1.0	U	-		1.0	U	-		300.0		-		5.0	U	-		40.0		-		5.0	U	-		106,000		-		1.0	U	-		40.0		-	
	13BH-DT-PILOT-BCR1-080713	N	8/7/2013	290		-		15.0		-		100.0		-		1.0	U	-		1.0	U	-		233.0		-		5.0	U	-		55.0		-		5.0	U	-		138,000		-		1.0	U	-		22.0		-	
	13BH-DT-PILOT-BCR1-081913	N	8/19/2013	430		-		13.0		-		70.0		-		1.0	U	-		1.0	U	-		242.0		-		5.0	U	-		44.0		-		5.0	U	-		111,000		-		1.0	U	-		23.0		-	
	13BH-DT-PILOT-BCR1-090413	N	9/4/2013	840		870		8.0		10.0		50.0		50.0		1.0		1.0		1.0		1.0		235.0		228.0		5.0	U	5.0	U	40.0		39.0		5.0	U	5.0	U	86,200		83,400		1.0	U	9.0		23.0		21.0	
	13BH-DT-PILOT-BDR1-090413	FD	9/4/2013	1,220		1,010		8.0		10.0		50.0		50.0		1.0		1.0		1.0		1.0		235.0		233.0		5.0	U	5.0	U	40.0		39.0		5.0	U	5.0	U	86,100		84,400		1.0	U	6.0		23.0		22.0	
	13BH-DT-PILOT-BCR1-091613	N	9/16/2013	290		-		6.0		-		50.0	U	-		1.0		-		1.0	U	-		223.0		-		5.0	U	-		42.0		-		5.0	U	-		74,700		-		1.0	U	-		22.0		-	
BCR2	13BH-DT-PILOT-BCR2-071113	N	7/11/2013	140		1,050		20.0		64.0		570.0		710.0		1.0	U	1.0	U	1.0	U	9.0		453.0		461.0		5.0	U	5.0		11.0		16.0		5.0		186.0		5,080		6,540		1.0	U	72.0		246.0		243.0	
	13BH-DT-PILOT-BCR2-072313	N	7/23/2013	30	U	-		2.0		-		420.0		-		1.0	U	-		1.0	U	-		349.0		-		5.0	U	-		7.0		-		5.0	U	-		33,300		-		1.0	U	-		48.0		-	
	13BH-DT-PILOT-BCR2-POST-072313	POST	7/23/2013	-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-	
	13BH-DT-PILOT-BCR2-080713	N	8/7/2013	40		-		3.0		-		230.0		-		1.0	U	-		1.0	U	-		275.0		-		5.0	U	-		29.0		-		5.0	U	-		77,000		-		1.0	U	-		22.0		-	
	13BH-DT-PILOT-BCR2-081913	N	8/19/2013	50		-		2.0		-		150.0		-		1.0	U	-		1.0	U	-		290.0		-		5.0	U	-		30.0		-		5.0	U	-		69,300		-		1.0	U	-		23.0		-	
	13BH-DT-PILOT-BCR2-POST-081913	POST	8/19/2013	-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-	
	13BH-DT-PILOT-BCR2-090413	N	9/4/2013	80		120		2.0		3.0		100.0		80.0		1.0	U	1.0	U	1.0	U	1.0	U	276.0		271.0		5.0	U	5.0	U	35.0		37.0		5.0	U	5.0	U	46,400		45,000		1.0	U	1.0		22.0		22.0	
	13BH-DT-PILOT-BCR2-091613	N	9/16/2013	60		-		2.0		-		70.0		-		1.0	U	-		1.0	U	-		280.0		-		5.0	U	-		35.0		-		5.0	U	-		33,700		-		1.0	U	-		22.0		-	
	13BH-DT-PILOT-BCR2-POST-091613	POST	9/16/2013	-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-	
BCR3	13BH-DT-PILOT-BCR3-071113	N	7/11/2013	170		790		75.0		107.0		790.0		850.0		1.0	U	1.0	U	1.0	U	7.0		593.0		605.0		5.0	U	5.0	U	24.0		23.0		8.0		169.0		8,710		9,660		1.0		74.0		288.0		288.0	
	13BH-DT-PILOT-BCR3-072313	N	7/23/2013	30	U	-		41.0		-		530.0		-		1.0	U	-		1.0	U	-		824.0		-		5.0	U	-		5.0	U	-		5.0	U	-		140		-		1.0	U	-		113.0		-	
	13BH-DT-PILOT-BCR3-080713	N	8/7/2013	30	U	-		29.0		-		260.0		-		1.0	U	-		1.0	U	-		815.0		-		5.0	U	-		5.0		-		5.0	U	-		30	U	-		1.0	U	-		60.0		-	
	13BH-DT-PILOT-BCR3-POST-080713	POST	8/7/2013	-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-	
	13BH-DT-PILOT-BCR3-081913	N	8/19/2013	30	U	-		30.0		-		280.0		-		1.0	U	-		1.0	U	-		1,040.0		-		5.0	U	-		5.0	U	-		5.0	U	-		160		-		1.0	U	-		64.0		-	
	13BH-DT-PILOT-BDR3-081913	FD	8/19/2013	30	U	-		32.0		-		290.0		-		1.0	U	-		1.0	U	-		1050.0		-		5.0	U	-		5.0	U	-		5.0	U	-		120		-		1.0	U	-		64.0		-	
	13BH-DT-PILOT-BCR3-090413	N	9/4/2013	30	U	160		23.0		29.0		120.0		130.0		1.0	U	1.0	U	1.0	U	1.0	U	583.0		586.0		5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	90		550		1.0	U	3.0		43.0		44.0	
	13BH-DT-PILOT-BCR3-POST-090413	POST	9/4/2013	-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-	
	13BH-DT-PILOT-BCR3-091613	N	9/16/2013	30	U	-		15.0		-		90.0		-		1.0	U	-		1.0	U	-		435.0		-		5.0	U	-		5.0	U	-		5.0	U	-		520		-		1.0	U	-		36.0		-	
	13BH-DT-PILOT-BDR3-091613	FD	9/16/2013	30	U	-		16.0		-		90.0		-		1.0	U	-		1.0	U	-		427.0		-		5.0	U	-		5.0	U	-		5.0	U	-		100		-		1.0	U	-		36.0		-	
BCR4	13BH-DT-PILOT-BCR4-071113	N	7/11/2013	130		1,070		20.0		118.0		550.0		650.0		1.0	U	1.0	U	1.0	U	27.0		409.0		425.0		5.0	U	5.0	U	6.0		13.0		5.0	U	172.0		3,420		6,090		1.0	U	84.0		241.0		243.0	
	13BH-DT-PILOT-BCR4-072313	N	7/23/2013	30	U	-		2.0		-		340.0		-		1.0	U	-		1.0	U	-		219.0		-		5.0	U	-		5.0	U	-		5.0	U	-		1,500		-		1.0	U	-		150.0		-	
	13BH-DT-PILOT-BCR4-080713	N	8/7/2013	50		-		5.0		-		230.0		-		1.0	U	-		1.0	U	-		252.0		-		5.0	U	-		42.0		-		5.0	U	-		65,400		-		1.0	U	-		40.0		-	
	13BH-DT-PILOT-BDR4-080713	FD	8/7/2013	50		-		5.0		-		240.0		-		1.0	U	-		1.0	U	-		253.0		-		5.0	U	-		37.0		-		5.0	U	-		65,400		-		1.0	U	-		41.0		-	
	13BH-DT-PILOT-BCR4-081913	N	8/19/2013	30	U	-		3.0		-		120.0		-		1.0	U	-		1.0	U	-		167.0		-		5.0	U	-		10.0		-		5.0	U	-		14,000		-		1.0	U	-		121.0		-	
	13BH-DT-PILOT-BCR4-090413	N	9/4/2013	90		130		6.0		6.0		110.0		100.0		1.0	U	1.0	U	1.0	U	1.0	U	239.0		233.0		5.0	U	5.0	U	43.0		44.0		5.0	U	5.0	U	52,200		51,900		1.0	U	1.0	U	41.0		36.0	
	13BH-DT-PILOT-BCR4-091613	N	9/16/2013	60		-		2.0		-		70.0		-		1.0	U	-		1.0	U	-		191.0		-		5.0	U	-		19.0		-		5.0	U	-		29,800		-		1.0	U	-		94.0		-	

Notes:

T = Total fraction ; D = Dissolved fraction

Q = Qualifier; BOD = Biochemical oxygen demand; TDS = Total dissolved solids

N = Normal sample; FD = Field duplicate; POST = Post-treatment oxidation sample

µg/L= micrograms per liter; mg/L = milligrams per liter

U = Result is less than the reporting limit shown

J = Estimated result

\- = Analyte not measured

Table 4.2-1

Pilot-Scale Laboratory Data

Danny T Adit Treatability Study Year 1

Sample Location	Sample ID	Sample Type	Analyte	MANGANESE				NICKEL				POTASSIUM				SILVER				SODIUM				THALLIUM				ZINC				ACIDITY		ALKALINITY		BICARBONATE		CARBONATE		HYDROXIDE		CHLORIDE		FLUORIDE	
			Unit	µg/L				µg/L				mg/L				µg/L				mg/L				µg/L				µg/L				mg/L as CaCO3		mg/L as CaCO3		mg/L as HCO3		mg/L as CO3		mg/L as OH		mg/L		mg/L	
			Fraction	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	T	Q	T	Q	T	Q	T	Q	T	Q	T	Q	T	Q
INFL	13BH-DT-PILOT-INFL-071113	N	7/11/2013	124,000		129,000		39.0		39.0		1.0		1.0	U	1.0	U	1.0	U	6.0		5.0		2.3		2.5		69,100.0		71,000.0		660		1	U	1	U	1	U	1	U	2		0.5	
	13BH-DT-PILOT-INFD-071113	FD	7/11/2013	63,700		131,000		37.0		39.0		1.0	U	1.0	U	1.0	U	1.0	U	4.0		4.0		3.2		2.6		34,800.0		71,300.0		-		-		-		-		-		-		-	
	13BH-DT-PILOT-INFL-072313	N	7/23/2013	128,000		-		37.0		-		1.0		-		1.0	U	-		7.0		-		2.2		-		57,400.0		-		820		1	U	1	U	1	U	1	U	1		0.2	
	13BH-DT-PILOT-INFL-080713	N	8/7/2013	116,000		-		34.0		-		1.0		-		1.0	U	-		7.0		-		2.1		-		53,300.0		-		700		1	U	1	U	1	U	1	U	1	U	0.7	J
	13BH-DT-PILOT-INFL-081913	N	8/19/2013	106,000		-		29.0		-		1.0		-		1.0	U	-		7.0		-		1.8		-		51,300.0		-		670		1	U	1	U	1	U	1	U	1	U	0.7	
	13BH-DT-PILOT-INFL-090413	N	9/4/2013	103,000		101,000		28.0		29.0		1.0	U	1.0		1.0	U	1.0	U	7.0		5.0		2.2		2.5		47,800.0		45,700.0		510		1	U	1	U	1	U	1	U	2		0.8	
	13BH-DT-PILOT-INFL-091613	N	9/16/2013	98,400		-		30.0		-		1.0	U	-		1.0	U	-		5.0		-		1.8		-		44,500.0		-		460		1	U	1	U	1	U	1	U	1	U	0.8	
SAPS	13BH-DT-PILOT-SAPS-071113	N	7/11/2013	42,400		42,600		5.0		10.0		38.0		38.0		1.0	U	1.0	U	13.0		11.0		0.5	U	0.5	U	70.0		6,050.0		4	U	750		910		1	U	1	U	27		0.8	
	13BH-DT-PILOT-SAPS-072313	N	7/23/2013	135,000		-		37.0		-		2.0		-		1.0	U	-		7.0		-		0.5	U	-		42,900.0		-		440		10		12		1	U	1	U	1	U	1.4	
	13BH-DT-PILOT-SAPS-080713	N	8/7/2013	120,000		-		42.0		-		1.0		-		1.0	U	-		7.0		-		0.8		-		63,200.0		-		450		1	U	1		1	U	1	U	1	U	1.9	J
	13BH-DT-PILOT-SAPS-081913	N	8/19/2013	113,000		-		31.0		-		1.0		-		1.0	U	-		7.0		-		1.1		-		50,800.0		-		420		42		51		1	U	1	U	1	U	1.6	
	13BH-DT-PILOT-SAPS-090413	N	9/4/2013	105,000		96,300		29.0		30		1.0	U	1.0	U	1.0	U	1.0		7.0		5.0		2.3		6.7		50,100.0		69,800.0		320		51		62		1	U	1	U	2		1.5	
	13BH-DT-PILOT-SAPS-091613	N	9/16/2013	99,000		-		26.0		-		1.0	U	-		1.0	U	-		5.0		-		2.4		-		53,200.0		-		320		40		49		1	U	1	U	1	U	1.8	
CHIT	13BH-DT-PILOT-CHIT-071113	N	7/11/2013	3,110		3,290		1,060.0		1,110.0		1,490.0		1,430.0		1.0	U	1.0	U	6,850.0		6,520.0		0.5	U	0.5	U	1,040.0		1,460.0		4	U	23000		28000		1	U	1	U	12000		0.1	U
	13BH-DT-PILOT-CHIT-072313	N	7/23/2013	8,880		-		9.0		-		10.0		-		1.0	U	-		42.0		-		0.5	U	-		20.0		-		4	U	1800		2200		1	U	1	U	37		0.1	
	13BH-DT-PILOT-CHIT-080713	N	8/7/2013	64,300		-		19.0		-		16.0		-		1.0	U	-		82.0		-		0.5	U	-		50.0		-		4	U	3200		3900		1	U	1	U	190		0.2	J
	13BH-DT-PILOT-CHIT-081913	N	8/19/2013	75,000		-		8.0		-		6.0		-		1.0	U	-		30.0		-		0.5	U	-		20.0		-		4	U	1700		2100		1	U	1	U	31		0.6	
	13BH-DT-PILOT-CHIT-090413	N	9/4/2013	113,000		109,000		5.0		8		6.0		6.0		1.0	U	1.0	U	34.0		31.0		0.5	U	0.5	U	60.0		660.0		4	U	1500		1800		1	U	1	U	14		0.6	
	13BH-DT-PILOT-CHIT-091613	N	9/16/2013	94,100		-		15.0		-		5.0		-		1.0	U	-		30.0		-		0.5	U	-		20.0		-		4	U	620		750		1	U	1	U	16		0.6	
MGOH	13BH-DT-PILOT-MGOH-071113	N	7/11/2013	100,000		101,000		30.0		31.0		1.0		1.0	U	1.0	U	1.0	U	9.0		8.0		2.1		2.2		47,500.0		47,600.0		330		1	U	1	U	1	U	1	U	4		0.5	U
	13BH-DT-PILOT-MGOH-072313	N	7/23/2013	122,000		-		36.0		-		1.0		-		1.0	U	-		9.0		-		2.2		-		52,800.0		-		390		1	U	1	U	1	U	1	U	4		1.5	
	13BH-DT-PILOT-MGOH-080713	N	8/7/2013	117,000		-		34.0		-		1.0		-		1.0	U	-		7.0		-		2.0		-		53,100.0		-		700		1	U	1	U	1	U	1	U	1	U	0.8	J
	13BH-DT-PILOT-MGOH-081913	N	8/19/2013	109,000		-		28.0		-		1.0	U	-		1.0	U	-		8.0		-		1.8		-		51,000.0		-		410		1	U	1	U	1	U	1	U	2		1.3	
	13BH-DT-PILOT-MGOH-090413	N	9/4/2013	102,000		98,800		28.0		27.0		1.0	U	1.0	U	1.0	U	1.0	U	8.0		6.0		2.1		2.2		42,000.0		44,400.0		220		8		9		1	U	1	U	2		1	
	13BH-DT-PILOT-MGOH-091613	N	9/16/2013	92,100		-		26.0		-		1.0	U	-		1.0	U	-		6.0		-		1.7		-		36,200.0		-		4	U	13		16		1	U	1	U	2	U	1.9	
BCR1	13BH-DT-PILOT-BCR1-071113	N	7/11/2013	21,700		21,900		22.0		24.0		166.0		169.0		1.0	U	1.0	U	23.0		22.0		0.5	U	0.5	U	50.0		3,690.0		4	U	1400		1700		1	U	1	U	100		0.3	
	13BH-DT-PILOT-BCR1-072313	N	7/23/2013	122,000		-		8.0		-		7.0		-		1.0	U	-		5.0		-		0.5	U	-		60.0		-		270		93		110		1	U	1	U	2		1.3	
	13BH-DT-PILOT-BDR1-072313	FD	7/23/2013	122,000		-		7.0		-		8.0		-		1.0	U	-		7.0		-		0.5	U	-		90.0		-		-		-		-		-		-		-		-	
	13BH-DT-PILOT-BCR1-080713	N	8/7/2013	122,000		-		36.0		-		2.0		-		1.0	U	-		6.0		-		0.5	U	-		20,700.0		-		450		76		92		1	U	1	U	1	U	2	J
	13BH-DT-PILOT-BCR1-081913	N	8/19/2013	111,000		-		33.0		-		1.0		-		1.0	U	-		7.0		-		0.5	U	-		36,800.0		-		350		74		91		1	U	1	U	1	U	1.5	
	13BH-DT-PILOT-BCR1-090413	N	9/4/2013	105,000		102,000		29.0		29.0		1.0		1.0	U	1.0	U	1.0	U	7.0		5.0		0.5	U	0.5	U	35,500.0		34,300.0		230		76		93		1	U	1	U	1		1.3	
	13BH-DT-PILOT-BDR1-090413	FD	9/4/2013	105,000		103,000		30.0		29.0		1.0	U	1.0	U	1.0	U	1.0	U	5.0		5.0		0.5	U	0.5	U	35,900.0		35,200.0		-		-		-		-		-		-		-	
	13BH-DT-PILOT-BCR1-091613	N	9/16/2013	98,600		-		30.0		-		1.0	U	-		1.0	U	-		5.0		-		0.5	U	-		39,400.0		-		130		70		85		1	U	1	U	2	U	1.4	
BCR2	13BH-DT-PILOT-BCR2-071113	N	7/11/2013	7,260		7,590		35.0		39.0		421.0		424.0		1.0	U	1.0	U	37.0		35.0		0.5	U	0.5	U	40.0		1,580.0		4	U	1700		2000		1	U	1	U	210		0.2	
	13BH-DT-PILOT-BCR2-072313	N	7/23/2013	102,000		-		5.0	U	-		13.0		-		1.0	U	-		7.0		-		0.5	U	-		20.0		-		16		200		250		1	U	1	U	3		0.8	
	13BH-DT-PILOT-BCR2-POST-072313	POST	7/23/2013	-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-	
	13BH-DT-PILOT-BCR2-080713	N	8/7/2013	127,000		-		14.0		-		2.0		-		1.0	U	-		7.0		-		0.5	U	-		1,580.0		-		270		110		130		1	U	1	U	1	U	1.9	J
	13BH-DT-PILOT-BCR2-081913	N	8/19/2013	113,000		-		16.0		-		1.0		-		1.0	U	-		7.0		-		0.5	U	-		5,850.0		-		200		110		140		1	U	1	U	1	U	1.6	
	13BH-DT-PILOT-BCR2-POST-081913	POST	8/19/2013	-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-	
	13BH-DT-PILOT-BCR2-090413	N	9/4/2013	104,000		102,000		24.0		27.0		1.0		1.0	U	1.0	U	1.0	U	7.0		5.0		0.5	U	0.5	U	12,200.0		15,500.0		120		100		120		1	U	1	U	1		1.4	
	13BH-DT-PILOT-BCR2-091613	N	9/16/2013	99,900		-		24.0		-		1.0	U	-		1.0	U	-		5.0		-		0.5	U	-		13,700.0		-		80		110		140		1	U	1	U	2	U	1.5	
	13BH-DT-PILOT-BCR2-POST-091613	POST	9/16/2013	-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-	
BCR3	13BH-DT-PILOT-BCR3-071113	N	7/11/2013	6,360		6,510		66.0		68.0		379.0		379.0		1.0	U	1.0	U	350.0		346.0		0.5	U	0.5	U	40.0		620.0		4	U	2600		3100		1	U	1	U	450		0.1	
	13BH-DT-PILOT-BCR3-072313	N	7/23/2013	1,720		-		11.0		-		39.0		-		1.0	U	-		60.0		-		0.5	U	-		20.0		-		4	U	2600		3200		1	U	1	U	96		0.1	
	13BH-DT-PILOT-BCR3-080713	N	8/7/2013	13,100		-		8.0		-		17.0		-		1.0	U	-		39.0		-		0.5	U	-		20.0		-		4	U	2200		2700		1	U	1	U	61		0.1	J
	13BH-DT-PILOT-BCR3-POST-080713	POST	8/7/2013	-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-	
	13BH-DT-PILOT-BCR3-081913	N	8/19/2013	48,600		-		5.0	U	-		14.0		-		1.0	U	-		49.0		-		0.5	U	-		20.0		-		4	U	2600		3200		1	U	1	U	63		0.2	
	13BH-DT-PILOT-BDR3-081913	FD	8/19/2013	48,300		-		5.0	U	-		14.0		-		1.0	U	-		48.0		-		0.5	U	-		10.0	U	-		-		-		-		-		-		-		-	
	13BH-DT-PILOT-BCR3-090413	N	9/4/2013	60,000		61,200		5.0	U	5.0	U	8.0		8.0		1.0	U	1.0	U	26.0		25.0		0.5	U	0.5		10.0	U	30.0		4	U	1700		2100		1	U	1	U	31		0.4	
	13BH-DT-PILOT-BCR3-POST-090413	POST	9/4/2013	-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-		-	
	13BH-DT-PILOT-BCR3-091613	N	9/16/2013	61,300		-		5.0	U	-		6.0		-		1.0	U	-		24.0		-		0.5	U	-		40.0		-		4	U	1300		1600		1	U	1	U	8		0.5	
	13BH-DT-PILOT-BDR3-091613	FD	9/16/2013	61,900		-		5.0	U	-		4.0		-		1.0	U	-		23.0		-		0.5	U	-		10.0	U	-		-		-		-		-		-		-		-	
BCR4	13BH-DT-PILOT-BCR4-071113	N	7/11/2013	11,000		11,600		29.0		32.0		227.0		231.0		1.0	U	1.0	U	31.0		29.0		0.5	U	0.5	U	40.0		3,270.0		4	U	1500		1900		1	U	1	U	140		0.2	
	13BH-DT-PILOT-BCR4-072313	N	7/23/2013	61,100		-		5.0	U	-		9.0		-		1.0	U	-		9.0		-		0.5	U	-		20.0		-		4	U	200		240		1	U	1	U	4		1.2	
	13BH-DT-PILOT-BCR4-080713	N	8/7/2013	146,000		-		18.0		-		1.0		-		1.0	U	-		5.0		-		0.5	U	-		7,360.0		-		260		100		120		1	U	1	U	1	U	1.9	J
	13BH-DT-PILOT-BDR4-080713	FD	8/7/2013	147,000		-		18.0		-		2.0		-		1.0	U	-		7.0		-		0.5	U	-		7,080.0		-		-		-		-		-		-		-		-	
	13BH-DT-PILOT-BCR4-081913	N	8/19/2013	98,100		-		5.0	U	-		2.0		-		1.0	U	-		8.0		-		0.5	U	-		900.0		-		120		96		120		1	U	1	U	1	U	1.4	
	13BH-DT-PILOT-BCR4-090413	N	9/4/2013	116,000		113,000		29.0		31.0		1.0		1.0	U	1.0	U	1.0	U	7.0		5.0		0.5	U	0.5	U	10,400.0		14,600.0		170		100		120		1	U	1	U	2		1.8	
	13BH-DT-PILOT-BCR4-091613	N	9/16/2013	86,400		-		13.0		-		1.0	U	-		1.0	U	-		6.0		-		0.5	U	-		3,290.0		-		68		93		110		1	U	1	U	2	U	1.4	

Notes:
T = Total fraction ; D = Dissolved fraction
Q = Qualifier; BOD = Biochemical oxygen demand; TDS = Total dissolved solids
N = Normal sample; FD = Field duplicate; POST = Post-treatment oxidation sample
µg/L= micrograms per liter; mg/L = milligrams per liter
U = Result is less than the reporting limit shown
J = Estimated result
- = Analyte not measured

Table 4.2-1
Pilot-Scale Laboratory Data
Danny T Adit Treatability Study Year 1

Sample Location	Sample ID	Sample Type	Analyte	BOD		NITROGEN		PHOSPHORUS		SULFATE		SULFIDE		TDS	
			Unit	mg/L		mg/L, Ammonia as N		mg/L, Orthophosphate as P		mg/L		mg/L		mg/L	
			Fraction	T	Q	T	Q	T	Q	T	Q	T	Q	T	Q
INFL	13BH-DT-PILOT-INFL-071113	N	7/11/2013	-		-		0.1	U	1600		-		1840	
	13BH-DT-PILOT-INFD-071113	FD	7/11/2013	-		-		-		-		-		-	
	13BH-DT-PILOT-INFL-072313	N	7/23/2013	-		-		0.28		2000		-		1860	
	13BH-DT-PILOT-INFL-080713	N	8/7/2013	-		-		0.478		2200		-		1750	
	13BH-DT-PILOT-INFL-081913	N	8/19/2013	-		-		0.218	J	1900		-		1600	
	13BH-DT-PILOT-INFL-090413	N	9/4/2013	-		-		0.225		2500		-		1420	
	13BH-DT-PILOT-INFL-091613	N	9/16/2013	-		-		0.13		1700		-		1300	
SAPS	13BH-DT-PILOT-SAPS-071113	N	7/11/2013	-		-		10.4		600		-		2140	
	13BH-DT-PILOT-SAPS-072313	N	7/23/2013	-		-		0.07		1500		-		1950	
	13BH-DT-PILOT-SAPS-080713	N	8/7/2013	-		-		0.11		1700		-		1870	
	13BH-DT-PILOT-SAPS-081913	N	8/19/2013	-		-		0.125	J	1300		-		1750	
	13BH-DT-PILOT-SAPS-090413	N	9/4/2013	-		-		0.151		1300		-		1580	
	13BH-DT-PILOT-SAPS-091613	N	9/16/2013	-		-		0.05		1200		-		1490	
CHIT	13BH-DT-PILOT-CHIT-071113	N	7/11/2013	-		-		47.7		2300		29		51300	
	13BH-DT-PILOT-CHIT-072313	N	7/23/2013	-		-		12.5		1100		-		3980	
	13BH-DT-PILOT-CHIT-080713	N	8/7/2013	-		-		40.2		780		-		6320	
	13BH-DT-PILOT-CHIT-081913	N	8/19/2013	-		-		45.2	J	1100		-		3830	
	13BH-DT-PILOT-CHIT-090413	N	9/4/2013	-		-		65.8		520		-		2770	
	13BH-DT-PILOT-CHIT-091613	N	9/16/2013	-		-		14		730		-		1660	
MGOH	13BH-DT-PILOT-MGOH-071113	N	7/11/2013	-		-		0.1	U	1200		-		1800	
	13BH-DT-PILOT-MGOH-072313	N	7/23/2013	-		-		0.1		1600		-		1810	
	13BH-DT-PILOT-MGOH-080713	N	8/7/2013	-		-		0.343		2300		-		1800	
	13BH-DT-PILOT-MGOH-081913	N	8/19/2013	-		-		0.182	J	1400		-		1440	
	13BH-DT-PILOT-MGOH-090413	N	9/4/2013	-		-		0.185		1000		-		1460	
	13BH-DT-PILOT-MGOH-091613	N	9/16/2013	-		-		0.02		990		-		1320	
BCR1	13BH-DT-PILOT-BCR1-071113	N	7/11/2013	-		-		43.8		240		4		3730	
	13BH-DT-PILOT-BCR1-072313	N	7/23/2013	-		-		0.81		1200		0.94		1870	
	13BH-DT-PILOT-BDR1-072313	FD	7/23/2013	-		-		-		-		-		-	
	13BH-DT-PILOT-BCR1-080713	N	8/7/2013	-		-		0.083		1400		0.12		1890	
	13BH-DT-PILOT-BCR1-081913	N	8/19/2013	-		-		0.027	J	1200		0.04	U	1730	
	13BH-DT-PILOT-BCR1-090413	N	9/4/2013	-		-		0.029		1100		0.04	U	1580	
	13BH-DT-PILOT-BDR1-090413	FD	9/4/2013	-		-		-		-		-		-	
	13BH-DT-PILOT-BCR1-091613	N	9/16/2013	-		-		0.04		1000		0.2	U	1500	
BCR2	13BH-DT-PILOT-BCR2-071113	N	7/11/2013	-		-		57.8		480		11		5180	
	13BH-DT-PILOT-BCR2-072313	N	7/23/2013	75		3.2		4.77		1200		2.4		1890	
	13BH-DT-PILOT-BCR2-POST-072313	POST	7/23/2013	94		5		-				0.47		-	
	13BH-DT-PILOT-BCR2-080713	N	8/7/2013	-		-		0.355		1300		0.7		1800	
	13BH-DT-PILOT-BCR2-081913	N	8/19/2013	39	U	0.05		0.196	J	1100		0.04	U	1630	
	13BH-DT-PILOT-BCR2-POST-081913	POST	8/19/2013	56		0.08		-		-		0.04	U	-	
	13BH-DT-PILOT-BCR2-090413	N	9/4/2013	-		-		0.05		1000		0.15		1510	
	13BH-DT-PILOT-BCR2-091613	N	9/16/2013	35	U	0.05	U	0.02		980		0.2	U	1460	
	13BH-DT-PILOT-BCR2-POST-091613	POST	9/16/2013	35	U	0.05	U	-		-		0.2	U	-	
BCR3	13BH-DT-PILOT-BCR3-071113	N	7/11/2013	-		-		72.3		750		11		7300	
	13BH-DT-PILOT-BCR3-072313	N	7/23/2013	-		-		15.3		970		23		4490	
	13BH-DT-PILOT-BCR3-080713	N	8/7/2013	1400		166		22		640		112		3970	
	13BH-DT-PILOT-BCR3-POST-080713	POST	8/7/2013	1700		237		-		-		1.7		-	
	13BH-DT-PILOT-BCR3-081913	N	8/19/2013	-		-		30.2	J	670		62		4310	
	13BH-DT-PILOT-BDR3-081913	FD	8/19/2013	-		-		-		-		-		-	
	13BH-DT-PILOT-BCR3-090413	N	9/4/2013	1500		179		62.1		350		78		2630	
	13BH-DT-PILOT-BCR3-POST-090413	POST	9/4/2013	1600		229		-		-		1.3		-	
	13BH-DT-PILOT-BCR3-091613	N	9/16/2013	-		-		26		600		56		2050	
	13BH-DT-PILOT-BDR3-091613	FD	9/16/2013	-		-		-		-		-		-	
BCR4	13BH-DT-PILOT-BCR4-071113	N	7/11/2013	-		-		46.8		280		4		4590	
	13BH-DT-PILOT-BCR4-072313	N	7/23/2013	-		-		5.66		1100		6.6		1860	
	13BH-DT-PILOT-BCR4-080713	N	8/7/2013	-		-		0.085		1300		0.7		1840	
	13BH-DT-PILOT-BDR4-080713	FD	8/7/2013	-		-		-		-		-		-	
	13BH-DT-PILOT-BCR4-081913	N	8/19/2013	0.04	U	-		0.211	J	1000		0.11		1490	
	13BH-DT-PILOT-BCR4-090413	N	9/4/2013	-		-		0.048		1000		0.34		1510	
	13BH-DT-PILOT-BCR4-091613	N	9/16/2013	-		-		0.04		990		0.2	U	1460	

Notes:

T = Total fraction ; D = Dissolved fraction

Q = Qualifier; BOD = Biochemical oxygen demand; TDS = Total dissolved solids

N = Normal sample; FD = Field duplicate; POST = Post-treatment oxidation sample

µg/L= micrograms per liter; mg/L = milligrams per liter

U = Result is less than the reporting limit shown

J = Estimated result

- = Analyte not measured

Table 4.2-2
Pilot-Scale Field Data
Danny T Adit Treatability Study Year 1

Location	Date	Time	Temp (°C)	DO (mg/L)	DO (%)	pH (su)	ORP (mV)	Conductivity (uS/cm)
Raw Influent (INFL)	7/11/2013	16:20	25.00	6.48		2.81	490.9	2,267
Raw Influent (INFL)	7/23/2013	10:30	15.19	3.87	NM	2.93	476.4	1,332
Raw Influent (INFL)	8/7/2013	10:25	16.34	NM	42.40	2.94	477.4	2,610
Raw Influent (INFL)	8/19/2013	11:30	19.47	3.92	43.7	2.72	482.2	2,218
Raw Influent (INFL)	9/4/2013	11:20	21.72	2.41	27.1	2.85	382.6	2,404
Raw Influent (INFL)	9/16/2013	12:40	25.14	2.19	26	2.80	492.7	3,394
SAPS Pre-treatment (SAPS)	7/11/2013	17:55	21.97	0.09		6.38	-157.6	2,434
SAPS Pre-treatment (SAPS)	7/23/2013	11:15	16.76	1.20	NM	5.51	114.3	2,232
SAPS Pre-treatment (SAPS)	8/7/2013	10:45	13.38	2.36	22.90	5.11	178.3	2,347
SAPS Pre-treatment (SAPS)	8/19/2013	12:25	18.68	2.73	30	5.22	125.7	1,996
SAPS Pre-treatment (SAPS)	9/4/2013	11:35	17.74	1.58	15.8	5.22	132.8	2,091
SAPS Pre-treatment (SAPS)	9/16/2013	12:50	17.27	4.14	42.6	5.54	135.2	3,011
Chitorem Pre-treatment (CHIT)	7/11/2013	18:10	21.52	0.05		6.65	-206.8	60,571
Chitorem Pre-treatment (CHIT)	7/23/2013	11:30	19.10	0.25	NM	6.83	-142.0	5,133
Chitorem Pre-treatment (CHIT)	8/7/2013	11:00	13.52	3.31	32.9	6.52	-249.8	8,956
Chitorem Pre-treatment (CHIT)	8/19/2013	12:45	21.12	3.94	46.4	6.14	-125.1	6,475
Chitorem Pre-treatment (CHIT)	9/4/2013	9:53	16.95	3.08	31.9	6.07	-184.7	2,941
Chitorem Pre-treatment (CHIT)	9/16/2013	13:00	17.53	1.57	17.1	6.13	-57.3	5,450
MGOH Pre-treatment (MGOH)	7/11/2013	18:30	19.28	3.95	NM	5.94	-15.6	1,995
MGOH Pre-treatment (MGOH)	7/23/2013	10:00	14.54	2.48	NM	4.63	306.5	2,186
MGOH Pre-treatment (MGOH)	8/7/2013	11:15	13.16	2.85	28	3.05	425.0	2,404
MGOH Pre-treatment (MGOH)	8/19/2013	13:05	20.33	3.08	34.9	3.68	243.8	1,930
MGOH Pre-treatment (MGOH)	9/4/2013	11:45	17.66	3.17	33.9	5.54	114.1	2,058
MGOH Pre-treatment (MGOH)	9/16/2013	13:30	16.50	7.22	74	3.69	103.5	3,022
BCR1	7/11/2013	16:50	20.60	0.02	NM	6.07	-163.0	3,505
BCR1	7/23/2013	12:00	20.07	0.57	NM	6.14	-76.8	2,388
BCR1	8/7/2013	11:40	14.95	1.33	13.6	5.70	77.2	2,424
BCR1	8/19/2013	13:20	20.25	1.09	12	5.60	35.3	1,992
BCR1	9/4/2013	10:25	17.95	1.50	15.9	5.91	-46.6	2,190
BCR1	9/16/2013	13:40	19.52	2.31	23	5.67	57.6	3,034
BCR2	7/11/2013	17:05	20.20	0.05	NM	6.29	-153.8	4,954
BCR2	7/23/2013	12:50	21.15	0.56	NM	6.32	-67.7	2,552
BCR2	8/7/2013	11:55	14.75	1.62	16.4	6.02	18.7	2,397
BCR2	8/19/2013	13:35	20.45	1.00	1.14	5.91	0.6	2,019
BCR2	9/4/2013	10:55	17.67	1.67	17.8	6.16	-28.0	2,187
BCR2	9/16/2013	12:15	18.40	8.52	92.1	6.26	19.4	3,224
BCR3	7/11/2013	17:20	19.65	0.04	NM	6.17	-152.5	8,162
BCR3	7/23/2013	13:45	20.21	0.10	NM	6.81	-267.5	6,424
BCR3	8/7/2013	12:15	14.50	2.38	23.5	6.75	-325.7	5,866
BCR3	8/19/2013	13:55	21.09	1.95	22.5	6.40	-303.4	7,172
BCR3	9/4/2013	9:40	17.84	4.34	46.4	6.17	-274.4	5,154
BCR3	9/16/2013	13:50	16.81	2.79	28.3	6.55	-247.5	6,207
BCR4	7/11/2013	17:35	20.16	0.02	NM	6.25	-144.8	4,001
BCR4	7/23/2013	14:15	19.96	0.21	NM	6.41	-169.1	2,437
BCR4	8/7/2013	12:45	16.20	1.64	17.2	6.87	-154.2	2,473
BCR4	8/19/2013	14:30	20.33	1.65	18.5	7.02	-171.3	2,018
BCR4	9/4/2013	11:10	17.95	2.47	26.3	6.36	-30.2	1,101
BCR4	9/16/2013	14:05	16.88	4.35	45.8	6.97	-117.7	3,247

Table 4.2-3
Pilot-Scale Removal Efficiency
Danny T Adit Treatability Study Year 1

Location	BCR1		BCR1		BCR1		BCR1		BCR1		BCR1		BCR1		BCR1	
Sample Date	7/11/2013		7/11/2013		7/23/2013		8/7/2013		8/19/2013		9/4/2013		9/4/2013		9/16/2013	
Fraction	Dissolved		Total		Dissolved		Dissolved		Dissolved		Dissolved		Total		Dissolved	
Analyte	% Removal		% removal		% Removal		% Removal		% Removal		% Removal		% removal		% Removal	
Metals																
Aluminum		99.2%		94.3%		99.4%		97.7%		96.4%		92.3%		93.1%		96.7%
Arsenic		95.2%		71.0%		97.5%		92.9%		92.3%		92.9%		93.3%		93.5%
Barium	<	-1000.0%	<	-1180.0%	<	-620.0%	<	-100.0%	<	-40.0%		0.0%		0.0%	NA	--
Beryllium	>	87.5%	>	87.5%	>	87.5%	>	83.3%	>	83.3%		83.3%		80.0%		83.3%
Cadmium	>	99.7%		92.8%	>	99.7%	>	99.5%	>	99.6%		99.4%		99.3%	>	99.4%
Calcium		-296.3%		-308.4%		-184.0%		-150.5%		-154.7%		-142.3%		-132.7%		-139.8%
Chromium	>	16.7%	>	16.7%	>	16.7%	NA	--	NA	--	NA	--	NA	--	NA	--
Cobalt	>	91.4%		75.0%		41.7%		0.0%		-7.3%		-5.3%		0.0%		-16.7%
Copper		99.7%		90.6%	>	99.7%	>	99.6%	>	99.6%	>	99.6%	>	99.6%	>	99.5%
Iron		97.2%		95.3%		41.9%		14.8%		23.4%		33.7%		35.3%		33.3%
Lead	>	99.6%		76.5%	>	99.5%	>	99.4%	>	99.3%	>	99.3%		96.5%	>	99.2%
Magnesium		-575.0%		-579.2%		-60.0%		-10.0%		-9.5%		-4.5%		4.5%		-10.0%
Manganese		82.5%		83.0%		4.7%		-5.2%		-4.7%		-1.9%		-1.0%		-0.2%
Nickel		43.6%		38.5%		78.4%		-5.9%		-13.8%		-3.6%		0.0%		0.0%
Potassium		-16500%	<	-16800%		-600.0%		-100.0%		0.0%		0.0%		0.0%	NA	--
Silver	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--
Sodium		-283.3%		-340.0%		28.6%		14.3%		0.0%		0.0%		0.0%		0.0%
Thallium	>	78.3%	>	80.0%	>	77.3%	>	76.2%	>	72.2%	>	77.3%	>	80.0%	>	72.2%
Zinc		99.9%		94.8%		99.9%		61.2%		28.3%		25.7%		24.9%		11.5%
Wet Chemistry																
Acidity	>	99.4%				67.1%		35.7%		47.8%		54.9%				71.7%
Alkalinity, Total	<	-139900%			<	-9200%	<	-7500%	<	-7300%	<	-7500%			<	-6900%
Sulfate		85.0%				40.0%		36.4%		36.8%		56.0%				41.2%

Notes:
*Wet chemistry data are the total fraction
Q = Laboratory qualifier
U = Below detection limit (reporting limit shown)
J = Estimated value
-- = Parameter not analyzed
NA = MRE Calculation is not applicable because both the raw water and the treated water effluent are non-detect.
< = The true MRE is less than the percent shown because the raw water is non-detect and the treated water effluent is greater than the reporting limit
> = The true MRE is greater than the percent shown because the treated water effluent is non-detect and the raw water is greater than the reporting limit

Table 4.2-3
Pilot-Scale Removal Efficiency
Danny T Adit Treatability Study Year 1

Location	SAPS		SAPS		SAPS		SAPS		SAPS		SAPS		SAPS		SAPS		BCR2		BCR2		BCR2		BCR2		BCR2		BCR2		BCR2		BCR2	
Sample Date	7/11/2013		7/11/2013		7/23/2013		8/7/2013		8/19/2013		9/4/2013		9/4/2013		9/16/2013		7/11/2013		7/11/2013		7/23/2013		8/7/2013		8/19/2013		9/4/2013		9/4/2013		9/16/2013	
Fraction	Dissolved		Total		Dissolved		Dissolved		Dissolved		Dissolved		Total		Dissolved		Dissolved		Total		Dissolved		Dissolved		Dissolved		Dissolved		Total		Dissolved	
Analyte	% Removal		% removal		% Removal		% Removal		% Removal		% Removal		% removal		% Removal		% Removal		% removal		% Removal		% Removal		% Removal		% Removal		% removal		% Removal	
Metals																																
Aluminum		99.7%		98.8%		90.3%		80.1%		84.0%		93.8%		-1122.2%		76.8%		99.1%		94.4%	>	99.8%		99.7%		99.6%		99.3%		99.0%		99.3%
Arsenic		98.1%		82.7%		98.2%		98.1%		97.6%		97.3%		-397.3%		44.1%		93.6%		80.2%		99.3%		98.6%		98.8%		98.2%		98.0%		97.8%
Barium	<	-500.0%	<	-540.0%	<	-80.0%	NA	--	NA	--	NA	--		0.0%	NA	--	<	-1040.0%	<	-1320.0%	<	-740.0%	<	-360.0%	<	-200.0%	<	-100.0%	<	-60.0%	<	-40.0%
Beryllium	>	87.5%	>	87.5%		87.5%		50.0%		66.7%		83.3%		-1160.0%		-16.7%	>	87.5%	>	87.5%	>	87.5%	>	83.3%	>	83.3%	>	83.3%	>	80.0%	>	83.3%
Cadmium	>	99.7%		93.5%		84.9%		62.8%		61.0%		56.8%		-289.3%		35.1%	>	99.7%		96.9%	>	99.7%	>	99.5%	>	99.6%	>	99.4%	>	99.3%	>	99.4%
Calcium		-243.5%		-250.5%		-151.9%		-152.7%		-138.9%		-145.4%		-114.3%		-150.5%		-319.4%		-330.8%		-229.2%		-195.7%		-205.3%		-184.5%		-176.5%		-201.1%
Chromium	>	16.7%	>	16.7%	>	16.7%	NA	--	NA	--	NA	--	<	-1540.0%	<	-20.0%	>	16.7%		16.7%	>	16.7%	NA	--	NA	--	NA	--	NA	--	NA	--
Cobalt	>	91.4%		85.7%		-29.2%		-7.3%		-4.9%		-5.3%		2.6%		-8.3%		81.0%		71.4%		85.4%		47.3%		26.8%		7.9%		5.1%		2.8%
Copper	>	99.8%		95.7%		99.6%		98.6%		99.3%	>	99.6%		-755.9%		15.6%		99.8%		90.9%	>	99.7%	>	99.6%	>	99.6%	>	99.6%	>	99.6%	>	99.5%
Iron		98.5%		97.3%		39.7%		31.5%		40.3%		39.2%		-418.6%		4.5%		97.2%		96.3%		81.4%		52.5%		52.2%		64.3%		65.1%		69.9%
Lead	>	99.6%		94.5%	>	99.5%		98.8%		98.7%		99.3%		-655.8%		-50.8%	>	99.6%		71.8%	>	99.5%	>	99.4%	>	99.3%	>	99.3%		99.6%	>	99.2%
Magnesium		-237.5%		-237.5%		-12.0%		-5.0%		-9.5%		-4.5%		9.1%		-10.0%		-925.0%		-912.5%		-92.0%		-10.0%		-9.5%		0.0%		0.0%		-10.0%
Manganese		65.8%		67.0%		-5.5%		-3.4%		-6.6%		-1.9%		4.7%		-0.6%		94.1%		94.1%		20.3%		-9.5%		-6.6%		-1.0%		-1.0%		-1.5%
Nickel		87.2%		74.4%		0.0%		-23.5%		-6.9%		-3.6%		-3.4%		13.3%		10.3%		0.0%	>	86.5%		58.8%		44.8%		14.3%		6.9%		20.0%
Potassium		-3700%	<	-3700%		-100.0%		0.0%		0.0%	NA	--		0.0%	NA	--		-42000%	<	-42300%		-1200.0%		-100.0%		0.0%		0.0%		0.0%	NA	--
Silver	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--		0.0%	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--
Sodium		-116.7%		-120.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		-516.7%		-600.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
Thallium	>	78.3%	>	80.0%	>	77.3%		61.9%		38.9%		-4.5%		-168.0%		-33.3%	>	78.3%	>	80.0%	>	77.3%	>	76.2%	>	72.2%	>	77.3%	>	80.0%	>	72.2%
Zinc		99.9%		91.5%		25.3%		-18.6%		1.0%		-4.8%		-52.7%		-19.6%		99.9%		97.8%		100.0%		97.0%		88.6%		74.5%		66.1%		69.2%
Wet Chemistry																																
Acidity	>	99.4%				46.3%		35.7%		37.3%		37.3%				30.4%	>	99.4%				98.0%		61.4%		70.1%		76.5%				82.6%
Alkalinity, Total	<	-74900%			<	-900%	NA	--	<	-4100%	<	-50			<	-3900%	<	-169900%			<	-19900%	<	-10900%	<	-10900%	<	-9900%			<	-10900%
Sulfate		62.5%				25.0%		22.7%		31.6%		48.0%				29.4%		70.0%				40.0%		40.9%		42.1%		60.0%				42.4%

Notes:
*Wet chemistry data are the total fraction
Q = Laboratory qualifier
U = Below detection limit (reporting limit shown)
J = Estimated value
-- = Parameter not analyzed
NA = MRE Calculation is not applicable because both the raw water and the treated water effluent are non-detect.
< = The true MRE is less than the percent shown because the raw water is non-detect and the treated water effluent is greater than the reporting limit
> = The true MRE is greater than the percent shown because the treated water effluent is non-detect and the raw water is greater than the reporting limit

Table 4.2-3
Pilot-Scale Removal Efficiency
Danny T Adit Treatability Study Year 1

Location	CHIT	CHIT	CHIT	CHIT	CHIT	CHIT	CHIT	CHIT	BCR3	BCR3	BCR3	BCR3	BCR3	BCR3	BCR3	BCR3
Sample Date	7/11/2013	7/11/2013	7/23/2013	8/7/2013	8/19/2013	9/4/2013	9/4/2013	9/16/2013	7/11/2013	7/11/2013	7/23/2013	8/7/2013	8/19/2013	9/4/2013	9/4/2013	9/16/2013
Fraction	Dissolved	Total	Dissolved	Dissolved	Dissolved	Dissolved	Total	Dissolved	Dissolved	Total	Dissolved	Dissolved	Dissolved	Dissolved	Total	Dissolved
Analyte	% Removal	% removal	% Removal	% Removal	% Removal	% Removal	% removal	% Removal	% Removal	% removal	% Removal	% Removal	% Removal	% Removal	% removal	% Removal
Metals																
Aluminum	98.1%	96.2%	> 99.8%	> 99.8%	> 99.8%	> 99.7%	99.1%	99.0%	98.9%	95.8%	> 99.8%	> 99.8%	> 99.8%	> 99.7%	98.7%	> 99.7%
Arsenic	-1244.1%	-1221.0%	91.4%	72.4%	86.3%	70.8%	72.0%	63.4%	75.9%	67.0%	85.3%	86.2%	82.1%	79.6%	80.7%	83.9%
Barium	< -460.0%	< -500.0%	0.0%	< -40.0%	0.0%	NA --	0.0%	NA --	< -1480.0%	< -1600.0%	< -960.0%	< -420.0%	< -460.0%	< -140.0%	< -160.0%	< -80.0%
Beryllium	> 87.5%	87.5%	> 87.5%	> 83.3%	> 83.3%	> 83.3%	> 80.0%	> 83.3%	> 87.5%	> 87.5%	> 87.5%	> 83.3%	> 83.3%	> 83.3%	> 80.0%	> 83.3%
Cadmium	86.1%	82.6%	> 99.7%	> 99.5%	> 99.6%	> 99.4%	98.7%	> 99.4%	> 99.7%	97.6%	> 99.7%	> 99.5%	> 99.6%	> 99.4%	> 99.3%	> 99.4%
Calcium	-2687.0%	-2591.6%	-773.6%	-1039.8%	-796.8%	-492.8%	-457.1%	-305.4%	-449.1%	-465.4%	-677.4%	-776.3%	-994.7%	-501.0%	-498.0%	-367.7%
Chromium	-283.3%	-316.7%	> 16.7%	NA --	NA --	NA --	NA --	NA --	> 16.7%	> 16.7%	> 16.7%	NA --	NA --	NA --	NA --	NA --
Cobalt	-215.5%	-239.3%	87.5%	83.6%	70.7%	86.8%	79.5%	69.4%	58.6%	58.9%	> 89.6%	90.9%	> 87.8%	> 86.8%	> 87.2%	> 86.1%
Copper	80.1%	73.0%	> 99.7%	> 99.6%	> 99.6%	> 99.6%	98.2%	> 99.5%	99.6%	91.7%	> 99.7%	> 99.6%	> 99.6%	> 99.6%	> 99.6%	> 99.5%
Iron	85.3%	85.4%	99.5%	99.2%	77.8%	69.7%	64.9%	64.8%	95.2%	94.6%	99.9%	> 100.0%	99.9%	99.9%	99.6%	99.5%
Lead	97.2%	95.7%	> 99.5%	> 99.4%	> 99.3%	> 99.3%	99.2%	> 99.2%	99.6%	71.0%	> 99.5%	> 99.4%	> 99.3%	> 99.3%	98.8%	> 99.2%
Magnesium	-5191.7%	-4941.7%	-140.0%	-225.0%	-119.0%	-109.1%	-95.5%	-115.0%	-1100.0%	-1100.0%	-352.0%	-200.0%	-204.8%	-95.5%	-100.0%	-80.0%
Manganese	97.5%	97.4%	93.1%	44.6%	29.2%	-9.7%	-7.9%	4.4%	94.9%	95.0%	98.7%	88.7%	54.2%	41.7%	39.4%	37.7%
Nickel	-2617.9%	-2746.2%	75.7%	44.1%	72.4%	82.1%	72.4%	50.0%	-69.2%	-74.4%	70.3%	76.5%	> 82.8%	> 82.1%	> 82.8%	> 83.3%
Potassium	-148900%	< -142900%	-900.0%	-1500.0%	-500.0%	< -500.0%	-500.0%	< -400.0%	-37800%	< -37800%	-3800.0%	-1600.0%	-1300.0%	< -700.0%	-700.0%	< -500.0%
Silver	NA --	NA --	NA --	NA --	NA --	NA --	NA --	NA --	NA --	NA --	NA --	NA --	NA --	NA --	NA --	NA --
Sodium	-114067%	-130300%	-500.0%	-1071.4%	-328.6%	-385.7%	-520.0%	-500.0%	-5733.3%	-6820.0%	-757.1%	-457.1%	-600.0%	-271.4%	-400.0%	-380.0%
Thallium	> 78.3%	> 80.0%	> 77.3%	> 76.2%	> 72.2%	> 77.3%	> 80.0%	> 72.2%	> 78.3%	> 80.0%	> 77.3%	> 76.2%	> 72.2%	> 77.3%	80.0%	> 72.2%
Zinc	98.5%	97.9%	100.0%	99.9%	100.0%	99.9%	98.6%	100.0%	99.9%	99.1%	100.0%	100.0%	100.0%	> 100.0%	99.9%	99.9%
Wet Chemistry*																
Acidity	> 99.4%		> 99.5%	> 99.4%	> 99.4%	> 99.2%		> 99.1%	> 99.4%		> 99.5%	> 99.4%	> 99.4%	> 99.2%		> 99.1%
Alkalinity, Total	< -2299900%		< -179900%	< -319900%	< -169900%	< -149900%		< -61900%	< -259900%		< -259900%	< -219900%	< -259900%	< -169900%		< -129900%
Sulfate	-43.8%		45.0%	64.5%	42.1%	79.2%		57.1%	53.1%		51.5%	70.9%	64.7%	86.0%		64.7%

Notes:
*Wet chemistry data are the total fraction
Q = Laboratory qualifier
U = Below detection limit (reporting limit shown)
J = Estimated value
-- = Parameter not analyzed
NA = MRE Calculation is not applicable because both the raw water and the treated water effluent are non-detect.
< = The true MRE is less than the percent shown because the raw water is non-detect and the treated water effluent is greater than the reporting limit
> = The true MRE is greater than the percent shown because the treated water effluent is non-detect and the raw water is greater than the reporting limit

Table 4.2-3
Pilot-Scale Removal Efficiency
Danny T Adit Treatability Study Year 1

Location	MGOH		MGOH		MGOH		MGOH		MGOH		MGOH		MGOH		MGOH		BCR4		BCR4		BCR4		BCR4		BCR4		BCR4		BCR4		BCR4	
Sample Date	7/11/2013		7/11/2013		7/23/2013		8/7/2013		8/19/2013		9/4/2013		9/4/2013		9/16/2013		7/11/2013		7/11/2013		7/23/2013		8/7/2013		8/19/2013		9/4/2013		9/4/2013		9/16/2013	
Fraction	Dissolved		Total		Dissolved		Dissolved		Dissolved		Dissolved		Total		Dissolved		Dissolved		Total		Dissolved		Dissolved		Dissolved		Dissolved		Total		Dissolved	
Analyte	% Removal		% removal		% Removal		% Removal		% Removal		% Removal		% removal		% Removal		% Removal		% removal		% Removal		% Removal		% Removal		% Removal		% removal		% Removal	
Metals																																
Aluminum		94.4%		91.7%		49.5%		0.0%		15.0%		98.1%		72.9%		97.9%		99.2%		94.3%	>	99.8%		99.6%	>	99.8%		99.2%		99.0%		99.3%
Arsenic		97.7%		89.5%		98.6%		27.6%		94.6%	>	99.1%		77.3%		87.1%		93.6%		63.6%		99.3%		97.6%		98.2%		94.7%		96.0%		97.8%
Barium	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	<	-1000.0%	<	-1200.0%	<	-580.0%	<	-360.0%	<	-140.0%	<	-120.0%	<	-100.0%	<	-40.0%
Beryllium		87.5%		75.0%		37.5%		-16.7%		16.7%	>	83.3%		60.0%		50.0%	>	87.5%	>	87.5%	>	87.5%	>	83.3%	>	83.3%	>	83.3%	>	80.0%	>	83.3%
Cadmium		21.2%		15.4%		6.0%		2.6%		1.8%		-13.5%		-7.3%		9.1%	>	99.7%		90.8%	>	99.7%	>	99.5%	>	99.6%	>	99.4%	>	99.3%	>	99.4%
Calcium		5.6%		3.7%		-4.7%		-15.1%		-8.4%		-5.2%		0.0%		-2.2%		-278.7%		-297.2%		-106.6%		-171.0%		-75.8%		-146.4%		-137.8%		-105.4%
Chromium	>	16.7%	>	16.7%	>	16.7%	NA	--	NA	--	NA	--	NA	--	NA	--	>	16.7%	>	16.7%	>	16.7%	NA	--	NA	--	NA	--	NA	--	NA	--
Cobalt		24.1%		21.4%		2.1%		7.3%		2.4%		0.0%		2.6%		2.8%		89.7%		76.8%	>	89.6%		23.6%		75.6%		-13.2%		-12.8%		47.2%
Copper		83.3%		77.3%		27.8%		-12.1%		14.6%		92.9%		69.3%		48.1%	>	99.8%		91.6%	>	99.7%	>	99.6%	>	99.6%	>	99.6%	>	99.6%	>	99.5%
Iron		77.2%		69.4%		99.7%		13.6%		74.8%		96.4%		71.9%		66.4%		98.1%		96.6%		99.2%		59.6%		90.3%		59.8%		59.8%		73.4%
Lead	>	99.6%		92.2%		89.2%		4.6%		26.5%	>	99.3%		77.5%		57.4%	>	99.6%		67.1%	>	99.5%	>	99.4%	>	99.3%	>	99.3%	>	99.6%	>	99.2%
Magnesium		-508.3%		-516.7%		-496.0%		-45.0%		-319.0%		-459.1%		-445.5%		-345.0%		-904.2%		-912.5%		-500.0%		-100.0%		-476.2%		-86.4%		-63.6%		-370.0%
Manganese		19.4%		21.7%		4.7%		-0.9%		-2.8%		1.0%		2.2%		6.4%		91.1%		91.0%		52.3%		-25.9%		7.5%		-12.6%		-11.9%		12.2%
Nickel		23.1%		20.5%		2.7%		0.0%		3.4%		0.0%		6.9%		13.3%		25.6%		17.9%	>	86.5%		47.1%	>	82.8%		-3.6%		-6.9%		56.7%
Potassium		0.0%	NA	--		0.0%		0.0%		0.0%	NA	--		0.0%	NA	--		-22600.0%	<	-23000.0%		-800.0%		0.0%		-100.0%		0.0%		0.0%	NA	--
Silver	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--
Sodium		-50.0%		-60.0%		-28.6%		0.0%		-14.3%		-14.3%		-20.0%		-20.0%		-416.7%		-480.0%		-28.6%		28.6%		-14.3%		0.0%		0.0%		-20.0%
Thallium		8.7%		12.0%		0.0%		4.8%		0.0%		4.5%		12.0%		5.6%	>	78.3%	>	80.0%	>	77.3%	>	76.2%	>	72.2%	>	77.3%	>	80.0%	>	72.2%
Zinc		31.3%		33.0%		8.0%		0.4%		0.6%		12.1%		2.8%		18.7%		99.9%		95.4%		100.0%		86.2%		98.2%		78.2%		68.1%		92.6%
Wet Chemistry*																																
Acidity		50.0%				52.4%		0.0%		38.8%		56.9%			>	99.1%	>	99.4%			>	99.5%		62.9%		82.1%		66.7%				85.2%
Alkalinity, Total	NA	--			NA	--	NA	--	NA	--	<	-700%			<	-1200%	<	-149900%			<	-19900%	<	-9900%	<	-9500%	<	-9900%			<	-9200%
Sulfate		25.0%				20.0%		-4.5%		26.3%		60.0%				41.8%		82.5%				45.0%		40.9%		47.4%		60.0%				41.8%

Notes:
*Wet chemistry data are the total fraction
Q = Laboratory qualifier
U = Below detection limit (reporting limit shown)
J = Estimated value
-- = Parameter not analyzed
NA = MRE Calculation is not applicable because both the raw water and the treated water effluent are non-detect.
< = The true MRE is less than the percent shown because the raw water is non-detect and the treated water effluent is greater than the reporting limit
> = The true MRE is greater than the percent shown because the treated water effluent is non-detect and the raw water is greater than the reporting limit

Table 4.2-4
Pilot-Scale Comparison to Water Quality Standards
Danny T Adit Treatability Study Year 1

Sample Location	Sample ID	Analyte	ALUMINUM				ARSENIC				BARIUM				BERYLLIUM				CADMIUM				CHROMIUM				COBALT				COPPER			
		Unit	µg/L				µg/L				µg/L				µg/L				µg/L				µg/L				µg/L				µg/L			
		Fraction	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q
INFL	13BH-DT-PILOT-INFL-071113	7/11/2013	**15,600.0**		18,900.0		**311.0**		**324.0**		50.0	U	50.0	U	8.0		8.0		**316.0**		**293.0**		6		6		58		56		**2,160.0**		**2,040.0**	
	13BH-DT-PILOT-INFL-072313	7/23/2013	**14,900.0**		-		**278.0**		-		50.0	U	-		8.0		-		**298.0**		-		6		-		48		-		**1,940.0**		-	
	13BH-DT-PILOT-INFL-080713	8/7/2013	**12,800.0**		-		**210.0**		-		50.0	U	-		6.0		-		**191.0**		-		5	U	-		55		-		**1,400.0**		-	
	13BH-DT-PILOT-INFL-081913	8/19/2013	**12,000.0**		-		**168.0**		-		50.0	U	-		6.0		-		**228.0**		-		5	U	-		41		-		**1,300.0**		-	
	13BH-DT-PILOT-INFL-090413	9/4/2013	**10,900.0**		12,600.0		113.0		150.0		50.0	U	50.0	U	6.0		5.0		**155.0**		**150.0**		5	U	5	U	38		39		**1,120.0**		**1,180.0**	
	13BH-DT-PILOT-INFL-091613	9/16/2013	**8,710.0**		-		93.0		-		50.0	U	-		6.0		-		**154.0**		-		5	U	-		36		-		**924.0**		-	
SAPS	13BH-DT-PILOT-SAPS-071113	7/11/2013	40.0		220.0		6.0		56.0		300.0		320.0		1.0	U	1.0	U	1.0	U	**19.0**		5	U	5	U	5	U	8		5.0	U	**88.0**	
	13BH-DT-PILOT-SAPS-072313	7/23/2013	**1,440.0**		-		5.0		-		90.0		-		1.0		-		**45.0**		-		5	U	-		62		-		7.0		-	
	13BH-DT-PILOT-SAPS-080713	8/7/2013	**2,550.0**		-		4.0		-		50.0	U	-		3.0		-		**71.0**		-		5	U	-		59		-		20.0		-	
	13BH-DT-PILOT-SAPS-081913	8/19/2013	**1,920.0**		-		4.0		-		50.0	U	-		2.0		-		**89.0**		-		5	U	-		43		-		9.0		-	
	13BH-DT-PILOT-SAPS-090413	9/4/2013	**680.0**		154,000.0		3.0		**746.0**		50.0	U	50.0		1.0		63.0		**67.0**		**584.0**		5	U	82		40		38		5.0	U	**10,100.0**	
	13BH-DT-PILOT-SAPS-091613	9/16/2013	**2,020.0**		-		52.0		-		50.0	U	-		7.0		-		**100.0**		-		6		-		39		-		**780.0**		-	
CHIT	13BH-DT-PILOT-CHIT-071113	7/11/2013	**300.0**		710.0		**4,180.0**		**4,280.0**		280.0		300.0		1.0	U	1.0	U	**44.0**		**51.0**		23		25		183		190		**430.0**		**550.0**	
	13BH-DT-PILOT-CHIT-072313	7/23/2013	30.0	U	-		24.0		-		50.0		-		1.0	U	-		1.0	U	-		5	U	-		6		-		5.0	U	-	
	13BH-DT-PILOT-CHIT-080713	8/7/2013	30.0	U	-		58.0		-		70.0		-		1.0	U	-		1.0	U	-		5	U	-		9		-		5.0	U	-	
	13BH-DT-PILOT-CHIT-081913	8/19/2013	30.0	U	-		23.0		-		50.0		-		1.0	U	-		1.0	U	-		5	U	-		12		-		5.0	U	-	
	13BH-DT-PILOT-CHIT-090413	9/4/2013	30.0	U	110.0		33.0		42.0		50.0	U	50.0		1.0	U	1.0	U	1.0	U	2		5	U	5	U	5		8		5.0	U	21.0	
	13BH-DT-PILOT-CHIT-091613	9/16/2013	**90.0**		-		34.0		-		50.0	U	-		1.0	U	-		1.0	U	-		5	U	-		11		-		5.0	U	-	
MGOH	13BH-DT-PILOT-MGOH-071113	7/11/2013	**870.0**		1,560.0		7.0		34.0		50.0	U	50.0	U	1.0		2.0		**249.0**		**248.0**		5	U	5	U	44		44		**361.0**		**463.0**	
	13BH-DT-PILOT-MGOH-072313	7/23/2013	**7,520.0**		-		4.0		-		50.0	U	-		5.0		-		**280.0**		-		5	U	-		47		-		**1,400.0**		-	
	13BH-DT-PILOT-MGOH-080713	8/7/2013	**12,800.0**		-		**152.0**		-		50.0	U	-		7.0		-		**186.0**		-		5	U	-		51		-		**1,570.0**		-	
	13BH-DT-PILOT-MGOH-081913	8/19/2013	**10,200.0**		-		9.0		-		50.0	U	-		5.0		-		**224.0**		-		5	U	-		40		-		**1,110.0**		-	
	13BH-DT-PILOT-MGOH-090413	9/4/2013	**210.0**		3,410.0		1.0	U	34.0		50.0	U	50.0	U	1.0	U	2.0		**176.0**		**161.0**		5	U	5	U	38		38		**79.0**		**362.0**	
	13BH-DT-PILOT-MGOH-091613	9/16/2013	**180.0**		-		12.0		-		50.0	U	-		3.0		-		**140.0**		-		5	U	-		35		-		**480.0**		-	
BCR1	13BH-DT-PILOT-BCR1-071113	7/11/2013	**130.0**		1,070.0		15.0		94.0		550.0		640.0		1.0	U	1.0	U	1.0	U	**21.0**		5	U	5	U	5	U	14		6.0		**191.0**	
	13BH-DT-PILOT-BCR1-072313	7/23/2013	**90.0**		-		7.0		-		360.0		-		1.0	U	-		1.0	U	-		5	U	-		28		-		5.0	U	-	
	13BH-DT-PILOT-BCR1-080713	8/7/2013	**290.0**		-		15.0		-		100.0		-		1.0	U	-		1.0	U	-		5	U	-		55		-		5.0	U	-	
	13BH-DT-PILOT-BCR1-081913	8/19/2013	**430.0**		-		13.0		-		70.0		-		1.0	U	-		1.0	U	-		5	U	-		44		-		5.0	U	-	
	13BH-DT-PILOT-BCR1-090413	9/4/2013	**840.0**		870.0		8.0		10.0		50.0		50.0		1.0		1.0		**1.0**		**1.0**		5	U	5	U	40		39		5.0	U	5.0	U
	13BH-DT-PILOT-BCR1-091613	9/16/2013	**290.0**		-		6.0		-		50.0	U	-		1.0		-		1.0	U	-		5	U	-		42		-		5.0	U	-	
BCR2	13BH-DT-PILOT-BCR2-071113	7/11/2013	**140.0**		1,050.0		20.0		64.0		570.0		710.0		1.0	U	1.0	U	1.0	U	**9.0**		5	U	5		11		16		5.0		**186.0**	
	13BH-DT-PILOT-BCR2-072313	7/23/2013	30.0	U	-		2.0		-		420.0		-		1.0	U	-		1.0	U	-		5	U	-		7		-		5.0	U	-	
	13BH-DT-PILOT-BCR2-080713	8/7/2013	40.0		-		3.0		-		230.0		-		1.0	U	-		1.0	U	-		5	U	-		29		-		5.0	U	-	
	13BH-DT-PILOT-BCR2-081913	8/19/2013	50.0		-		2.0		-		150.0		-		1.0	U	-		1.0	U	-		5	U	-		30		-		5.0	U	-	
	13BH-DT-PILOT-BCR2-090413	9/4/2013	80.0		120.0		2.0		3.0		100.0		80.0		1.0	U	1.0	U	1.0	U	1.0	U	5	U	5	U	35		37		5.0	U	5.0	U
	13BH-DT-PILOT-BCR2-091613	9/16/2013	60.0		-		2.0		-		70.0		-		1.0	U	-		1.0	U	-		5	U	-		35		-		5.0	U	-	
BCR3	13BH-DT-PILOT-BCR3-071113	7/11/2013	**170.0**		790.0		75.0		107.0		790.0		850.0		1.0	U	1.0	U	1.0	U	**7.0**		5	U	5	U	24		23		8.0		**169.0**	
	13BH-DT-PILOT-BCR3-072313	7/23/2013	30.0	U	-		41.0		-		530.0		-		1.0	U	-		1.0	U	-		5	U	-		5	U	-		5.0	U	-	
	13BH-DT-PILOT-BCR3-080713	8/7/2013	30.0	U	-		29.0		-		260.0		-		1.0	U	-		1.0	U	-		5	U	-		5		-		5.0	U	-	
	13BH-DT-PILOT-BCR3-081913	8/19/2013	30.0	U	-		30.0		-		280.0		-		1.0	U	-		1.0	U	-		5	U	-		5	U	-		5.0	U	-	
	13BH-DT-PILOT-BCR3-090413	9/4/2013	30.0	U	160.0		23.0		29.0		120.0		130.0		1.0	U	1.0	U	1.0	U	1.0	U	5	U	5	U	5	U	5	U	5.0	U	5.0	U
	13BH-DT-PILOT-BCR3-091613	9/16/2013	30.0	U	-		15.0		-		90.0		-		1.0	U	-		1.0	U	-		5	U	-		5	U	-		5.0	U	-	
BCR4	13BH-DT-PILOT-BCR4-071113	7/11/2013	**130.0**		1,070.0		20.0		118.0		550.0		650.0		1.0	U	1.0	U	1.0	U	**27.0**		5	U	5	U	6		13		5.0	U	**172.0**	
	13BH-DT-PILOT-BCR4-072313	7/23/2013	30.0	U	-		2.0		-		340.0		-		1.0	U	-		1.0	U	-		5	U	-		5	U	-		5.0	U	-	
	13BH-DT-PILOT-BCR4-080713	8/7/2013	50.0		-		5.0		-		230.0		-		1.0	U	-		1.0	U	-		5	U	-		42		-		5.0	U	-	
	13BH-DT-PILOT-BCR4-081913	8/19/2013	30.0	U	-		3.0		-		120.0		-		1.0	U	-		1.0	U	-		5	U	-		10		-		5.0	U	-	
	13BH-DT-PILOT-BCR4-090413	9/4/2013	**90.0**		130.0		6.0		6.0		110.0		100.0		1.0	U	1.0	U	1.0	U	1.0	U	5	U	5	U	43		44		5.0	U	5.0	U
	13BH-DT-PILOT-BCR4-091613	9/16/2013	60.0		-		2.0		-		70.0		-		1.0	U	-		1.0	U	-		5	U	-		19		-		5.0	U	-

Notes:

T = total fraction ; D = dissolved fraction

Q = Qualifier

U = Result is less than the reporting limit shown

- = Analyte not measured

Flags:

Text -	Exceeds Human Health standard.
Text -	Exceeds Chronic Aquatic Life standard.
▨ Text -	Exceeds Acute Aquatic Life standard.

Pilot-Scale Comparison to Water Quality Standards
Danny T Adit Treatability Study Year 1

Sample Location	Sample ID	Analyte	IRON				LEAD				MANGANESE				NICKEL				SILVER				THALLIUM				ZINC			
		Unit	µg/L				µg/L				µg/L				µg/L				µg/L				µg/L				µg/L			
		Fraction	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q	D	Q	T	Q
INFL	13BH-DT-PILOT-INFL-071113	7/11/2013	**180,000**		**179,000**		**252.0**		**255.0**		124000		129000		39.0		39.0		1.0	U	1.0	U	2.3		2.5		**69,100.0**		**71,000.0**	
	13BH-DT-PILOT-INFL-072313	7/23/2013	**179,000**		-		**212.0**		-		128000		-		37.0		-		1.0	U	-		2.2		-		**57,400.0**		-	
	13BH-DT-PILOT-INFL-080713	8/7/2013	**162,000**		-		**173.0**		-		116000		-		34.0		-		1.0	U	-		2.1		-		**53,300.0**		-	
	13BH-DT-PILOT-INFL-081913	8/19/2013	**145,000**		-		**151.0**		-		106000		-		29.0		-		1.0	U	-		1.8		-		**51,300.0**		-	
	13BH-DT-PILOT-INFL-090413	9/4/2013	**130,000**		**129,000**		**136.0**		**258.0**		103000		101000		28.0		29.0		1.0	U	1.0	U	2.2		2.5		**47,800.0**		**45,700.0**	
	13BH-DT-PILOT-INFL-091613	9/16/2013	**112,000**		-		**122.0**		-		98400		-		30.0		-		1.0	U	-		1.8		-		**44,500.0**		-	
SAPS	13BH-DT-PILOT-SAPS-071113	7/11/2013	**2,630**		**4,860**		1.0	U	14.0		42400		42600		5.0		10.0		1.0	U	1.0	U	0.5	U	0.5	U	70.0		**6,050.0**	
	13BH-DT-PILOT-SAPS-072313	7/23/2013	**108,000**		-		1.0	U	-		135000		-		37.0		-		1.0	U	-		0.5	U	-		**42,900.0**		-	
	13BH-DT-PILOT-SAPS-080713	8/7/2013	**111,000**		-		2.0		-		120000		-		42.0		-		1.0	U	-		0.8		-		**63,200.0**		-	
	13BH-DT-PILOT-SAPS-081913	8/19/2013	**86,500**		-		2.0		-		113000		-		31.0		-		1.0	U	-		1.1		-		**50,800.0**		-	
	13BH-DT-PILOT-SAPS-090413	9/4/2013	**79,100**		**669,000**		1.0		**1,950.0**		105000		96300		29.0		30		1.0	U	1.0		2.3		6.7		**50,100.0**		**69,800.0**	
	13BH-DT-PILOT-SAPS-091613	9/16/2013	**107,000**		-		**184.0**		-		99000		-		26.0		-		1.0	U	-		2.4		-		**53,200.0**		-	
CHIT	13BH-DT-PILOT-CHIT-071113	7/11/2013	**26,500**		**26,200**		7.0		11.0		3110		3290		**1,060.0**		**1,110.0**		1.0	U	1.0	U	0.5	U	0.5	U	**1,040.0**		**1,460.0**	
	13BH-DT-PILOT-CHIT-072313	7/23/2013	820		-		1.0	U	-		8880		-		9.0		-		1.0	U	-		0.5	U	-		20.0		-	
	13BH-DT-PILOT-CHIT-080713	8/7/2013	**1,370**		-		1.0	U	-		64300		-		19.0		-		1.0	U	-		0.5	U	-		50.0		-	
	13BH-DT-PILOT-CHIT-081913	8/19/2013	**32,200**		-		1.0	U	-		75000		-		8.0		-		1.0	U	-		0.5	U	-		20.0		-	
	13BH-DT-PILOT-CHIT-090413	9/4/2013	**39,400**		**45,300**		1.0	U	2.0		113000		109000		5.0		8		1.0	U	1.0	U	0.5	U	0.5	U	60.0		**660.0**	
	13BH-DT-PILOT-CHIT-091613	9/16/2013	**39,400**		-		1.0	U	-		94100		-		15.0		-		1.0	U	-		0.5	U	-		20.0		-	
MGOH	13BH-DT-PILOT-MGOH-071113	7/11/2013	**41,000**		**54,800**		1.0	U	**20.0**		100000		101000		30.0		31.0		1.0	U	1.0	U	2.1		2.2		**47,500.0**		**47,600.0**	
	13BH-DT-PILOT-MGOH-072313	7/23/2013	470		-		**23.0**		-		122000		-		36.0		-		1.0	U	-		2.2		-		**52,800.0**		-	
	13BH-DT-PILOT-MGOH-080713	8/7/2013	**140,000**		-		**165.0**		-		117000		-		34.0		-		1.0	U	-		2.0		-		**53,100.0**		-	
	13BH-DT-PILOT-MGOH-081913	8/19/2013	**36,600**		-		**111.0**		-		109000		-		28.0		-		1.0	U	-		1.8		-		**51,000.0**		-	
	13BH-DT-PILOT-MGOH-090413	9/4/2013	**4,680**		**36,300**		1.0	U	**58.0**		102000		98800		28.0		27.0		1.0	U	1.0	U	2.1		2.2		**42,000.0**		**44,400.0**	
	13BH-DT-PILOT-MGOH-091613	9/16/2013	**37,600**		-		**52.0**		-		92100		-		26.0		-		1.0	U	-		1.7		-		**36,200.0**		-	
BCR1	13BH-DT-PILOT-BCR1-071113	7/11/2013	**5,100**		**8,490**		1.0	U	**60.0**		21700		21900		22.0		24.0		1.0	U	1.0	U	0.5	U	0.5	U	50.0		**3,690.0**	
	13BH-DT-PILOT-BCR1-072313	7/23/2013	**104,000**		-		1.0	U	-		122000		-		8.0		-		1.0	U	-		0.5	U	-		60.0		-	
	13BH-DT-PILOT-BCR1-080713	8/7/2013	**138,000**		-		1.0	U	-		122000		-		36.0		-		1.0	U	-		0.5	U	-		**20,700.0**		-	
	13BH-DT-PILOT-BCR1-081913	8/19/2013	**111,000**		-		1.0	U	-		111000		-		33.0		-		1.0	U	-		0.5	U	-		**36,800.0**		-	
	13BH-DT-PILOT-BCR1-090413	9/4/2013	**86,200**		**83,400**		1.0	U	9.0		105000		102000		29.0		29.0		1.0	U	1.0	U	0.5	U	0.5	U	**35,500.0**		**34,300.0**	
	13BH-DT-PILOT-BCR1-091613	9/16/2013	**74,700**		-		1.0	U	-		98600		-		30.0		-		1.0	U	-		0.5	U	-		**39,400.0**		-	
BCR2	13BH-DT-PILOT-BCR2-071113	7/11/2013	**5,080**		**6,540**		1.0	U	**72.0**		7260		7590		35.0		39.0		1.0	U	1.0	U	0.5	U	0.5	U	40.0		**1,580.0**	
	13BH-DT-PILOT-BCR2-072313	7/23/2013	**33,300**		-		1.0	U	-		102000		-		5.0	U	-		1.0	U	-		0.5	U	-		20.0		-	
	13BH-DT-PILOT-BCR2-080713	8/7/2013	**77,000**		-		1.0	U	-		127000		-		14.0		-		1.0	U	-		0.5	U	-		**1,580.0**		-	
	13BH-DT-PILOT-BCR2-081913	8/19/2013	**69,300**		-		1.0	U	-		113000		-		16.0		-		1.0	U	-		0.5	U	-		**5,850.0**		-	
	13BH-DT-PILOT-BCR2-090413	9/4/2013	**46,400**		**45,000**		1.0	U	1.0		104000		102000		24.0		27.0		1.0	U	1.0	U	0.5	U	0.5	U	**12,200.0**		**15,500.0**	
	13BH-DT-PILOT-BCR2-091613	9/16/2013	**33,700**		-		1.0	U	-		99900		-		24.0		-		1.0	U	-		0.5	U	-		**13,700.0**		-	
BCR3	13BH-DT-PILOT-BCR3-071113	7/11/2013	**8,710**		**9,660**		1.0		**74.0**		6360		6510		66.0		68.0		1.0	U	1.0	U	0.5	U	0.5	U	40.0		**620.0**	
	13BH-DT-PILOT-BCR3-072313	7/23/2013	140		-		1.0	U	-		1720		-		11.0		-		1.0	U	-		0.5	U	-		20.0		-	
	13BH-DT-PILOT-BCR3-080713	8/7/2013	30	U	-		1.0	U	-		13100		-		8.0		-		1.0	U	-		0.5	U	-		20.0		-	
	13BH-DT-PILOT-BCR3-081913	8/19/2013	160		-		1.0	U	-		48600		-		5.0	U	-		1.0	U	-		0.5	U	-		20.0		-	
	13BH-DT-PILOT-BCR3-090413	9/4/2013	90		550		1.0	U	3.0		60000		61200		5.0	U	5.0	U	1.0	U	1.0	U	0.5	U	0.5		10.0	U	30.0	
	13BH-DT-PILOT-BCR3-091613	9/16/2013	520		-		1.0	U	-		61300		-		5.0	U	-		1.0	U	-		0.5	U	-		40.0		-	
BCR4	13BH-DT-PILOT-BCR4-071113	7/11/2013	**3,420**		**6,090**		1.0	U	**84.0**		11000		11600		29.0		32.0		1.0	U	1.0	U	0.5	U	0.5	U	40.0		**3,270.0**	
	13BH-DT-PILOT-BCR4-072313	7/23/2013	**1,500**		-		1.0	U	-		61100		-		5.0	U	-		1.0	U	-		0.5	U	-		20.0		-	
	13BH-DT-PILOT-BCR4-080713	8/7/2013	**65,400**		-		1.0	U	-		146000		-		18.0		-		1.0	U	-		0.5	U	-		**7,360.0**		-	
	13BH-DT-PILOT-BCR4-081913	8/19/2013	**14,000**		-		1.0	U	-		98100		-		5.0	U	-		1.0	U	-		0.5	U	-		**900.0**		-	
	13BH-DT-PILOT-BCR4-090413	9/4/2013	**52,200**		**51,900**		1.0	U	1.0	U	116000		113000		29.0		31.0		1.0	U	1.0	U	0.5	U	0.5	U	**10,400.0**		**14,600.0**	
	13BH-DT-PILOT-BCR4-091613	9/16/2013	**29,800**		-		1.0	U	-		86400		-		13.0		-		1.0	U	-		0.5	U	-		**3,290.0**		-	

Notes:
T = total fraction ; D = dissolved fraction
Q = Qualifier
U = Result is less than the reporting limit shown
- = Analyte not measured

Flags:

Text -	Exceeds Human Health standard.
Text -	Exceeds Chronic Aquatic Life standard.
▨ Text -	Exceeds Acute Aquatic Life standard.

Table 4.2-5
Post-Oxidation Test Data
Danny T Adit Treatability Study Year 1

Sample ID/Name	Date	Time	Temp (^{o}C)	DO (mg/L)	DO (%)	pH (su)	ORP (mV)	Conductivity (uS/cm)	Biochemical Oxygen Demand (mg/L)	Ammonia (mg/L as N)	Sulfide (mg/L)
13BH-DT-PILOT-BCR2-072313	7/23/2013	12:50	21.15	0.56	NM	6.32	-67.70	2552.00	75	3.2	2.4
BCR2 - Post Oxidation Interim Sample	7/23/2013	13:15	NM	0.58	NM	NM	NM	NM			
BCR2 - Post Oxidation Interim Sample	7/23/2013	13:20	NM	1.20	NM	NM	NM	NM			
BCR2 - Post Oxidation Interim Sample	7/23/2013	14:15	25.00	3.06	NM	NM	NM	NM			
13BH-DT-PILOT-BCR2-POST-072313	7/23/2013	14:45	28.70	3.56	NM	NM	NM	NM	94	5	0.47
13BH-DT-PILOT-BCR3-080713	8/7/2013	12:15	14.5	2.38	23.5	6.75	-325.7	5866	1400	166	112
BCR3 - Post Oxidation Interim Sample	8/7/2013	13:23	NM	1.74	18.2	NM	NM	NM			
BCR3 - Post Oxidation Interim Sample	8/7/2013	13:54	NM	1.9	21.7	NM	NM	NM			
BCR3 - Post Oxidation Interim Sample	8/7/2013	14:26	NM	2.96	34.8	NM	NM	NM			
13BH-DT-PILOT-BCR3-POST-080713	8/7/2013	14:35	25.07	2.92	34.7	7.92	176.1	6663	1700	237	1.7
13BH-DT-PILOT-BCR2-081913	8/19/2013	13:35	20.45	1	1.14	5.91	0.6	2019	<39	0.05	<0.04
13BH-DT-PILOT-BCR2-POST-081913	8/19/2013	14:10	NM	3.11	37.7	NM	NM	NM	56	0.08	<0.04
13BH-DT-PILOT-BCR3-090413	9/4/2013	9:40	17.84	4.34	46.4	6.17	-274.4	5154	1500	179	78
BCR3 - Post Oxidation Interim Sample	9/4/2013	10:12	NM	3.72	39	NM	NM	NM			
BCR3 - Post Oxidation Interim Sample	9/4/2013	10:30	NM	3.8	NM	NM	NM	NM			
BCR3 - Post Oxidation Interim Sample	9/4/2013	10:56	NM	4.09	42.2	NM	NM	NM			
BCR3 - Post Oxidation Interim Sample	9/4/2013	11:22	NM	3.89	40	NM	NM	NM			
BCR3 - Post Oxidation Interim Sample	9/4/2013	11:55	NM	3.55	38.8	NM	NM	NM			
13BH-DT-PILOT-BCR3-POST-090413	9/4/2013	12:02	NM	3.21	36.9	NM	NM	NM	1600	229	1.3
13BH-DT-PILOT-BCR2-091613	9/16/2013	12:15	18.4	8.52	92.1	6.26	19.4	3224	<35	<0.05	<0.2
13BH-DT-PILOT-BCR2-POST-091613	9/16/2013	14:15	NM	10.44	123.7	NM	NM	NM	<35	<0.05	<0.2

Table 4.2-6

SPLP Data for Substrate Materials

Danny T Adit Treatability Study Year 1

Material	Sample ID	Analyte Unit	ALUMINUM µg/L	ARSENIC µg/L	BARIUM µg/L	BERYLLIUM µg/L	CADMIUM µg/L	CALCIUM µg/L	CHROMIUM µg/L	COBALT µg/L	COPPER µg/L	IRON µg/L
Compost	13BH-DT-PILOT-COMP-SPLP	9/24/2013	4500	27	500	<1	<1	16000	10	<5	18	3700
Wood Chips	13BH-DT-PILOT-WOOD-SPLP	9/24/2013	230	6	170	<1	1	17000	8	<5	12	250
Sawdust	13BH-DT-PILOT-SDST-SPLP	9/24/2013	980	3	180	<1	<1	6000	8	<5	9	930
Chitorem	13BH-DT-PILOT-CHIT-SPLP	9/24/2013	290	1600	2000	<1	190	890000	54	72	840	2000

Material	Sample ID	Analyte Unit	LEAD µg/L	MAGNESIUM µg/L	MANGANESE µg/L	NICKEL µg/L	POTASSIUM µg/L	SILVER µg/L	SODIUM µg/L	THALLIUM µg/L	ZINC µg/L
Compost	13BH-DT-PILOT-COMP-SPLP	9/24/2013	11	5000	300	7	25000	<1	59000	<0.5	100
Wood Chips	13BH-DT-PILOT-WOOD-SPLP	9/24/2013	8	5000	540	<5	32000	<1	53000	<0.5	80
Sawdust	13BH-DT-PILOT-SDST-SPLP	9/24/2013	2	1000	21	<5	2000	<1	63000	<0.5	60
Chitorem	13BH-DT-PILOT-CHIT-SPLP	9/24/2013	3	470000	92	680	870000	2	3700000	<0.5	1900

Figures

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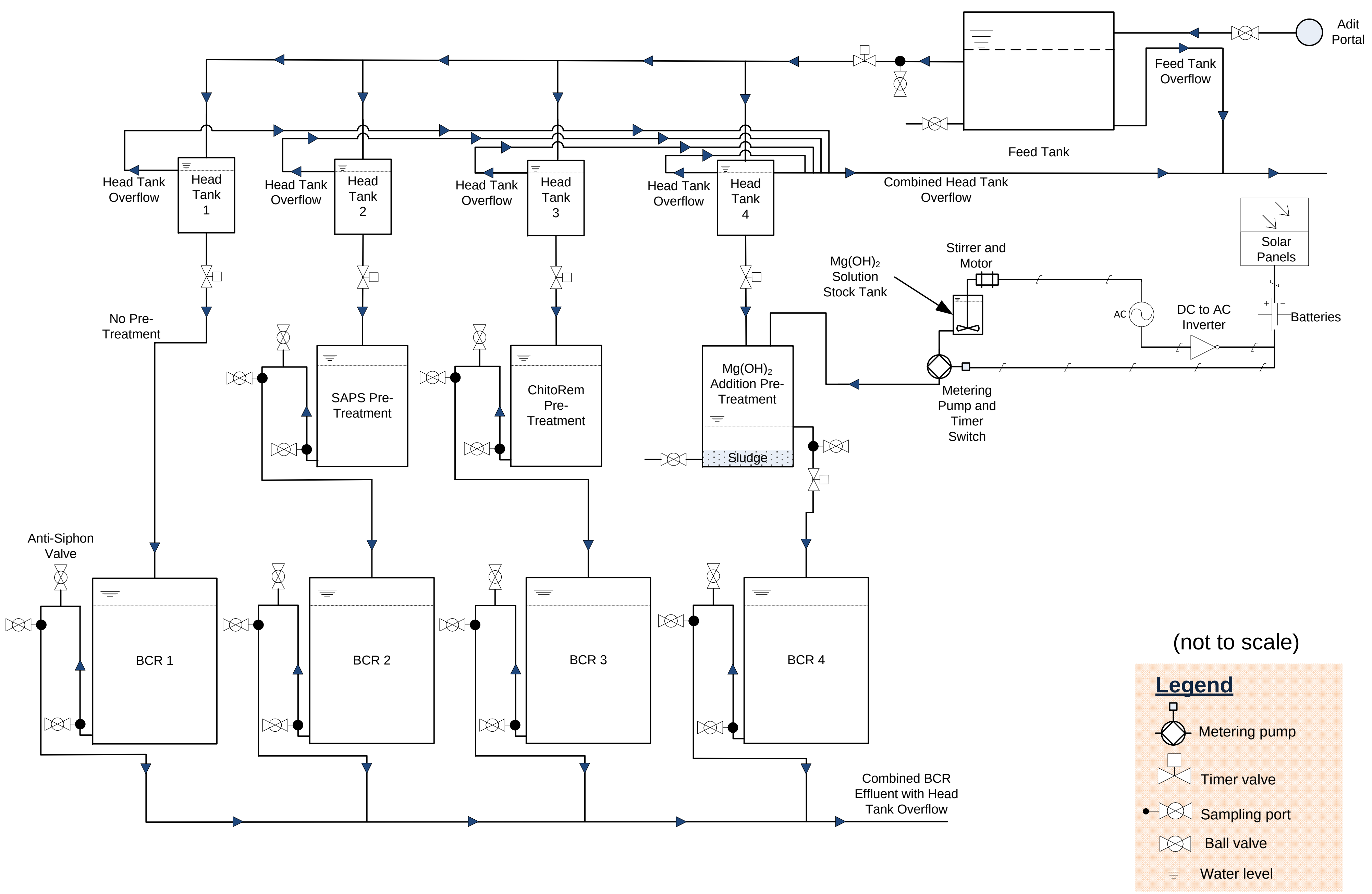


CDM Smith Inc.
50 West 14th Street
Suite 200
Helena, MT 59601

Barker-Hughesville Mining District Superfund Site

Figure 2.2-1
Pilot-Scale Treatability Study
Year 1
As-Built Process Flow Diagram

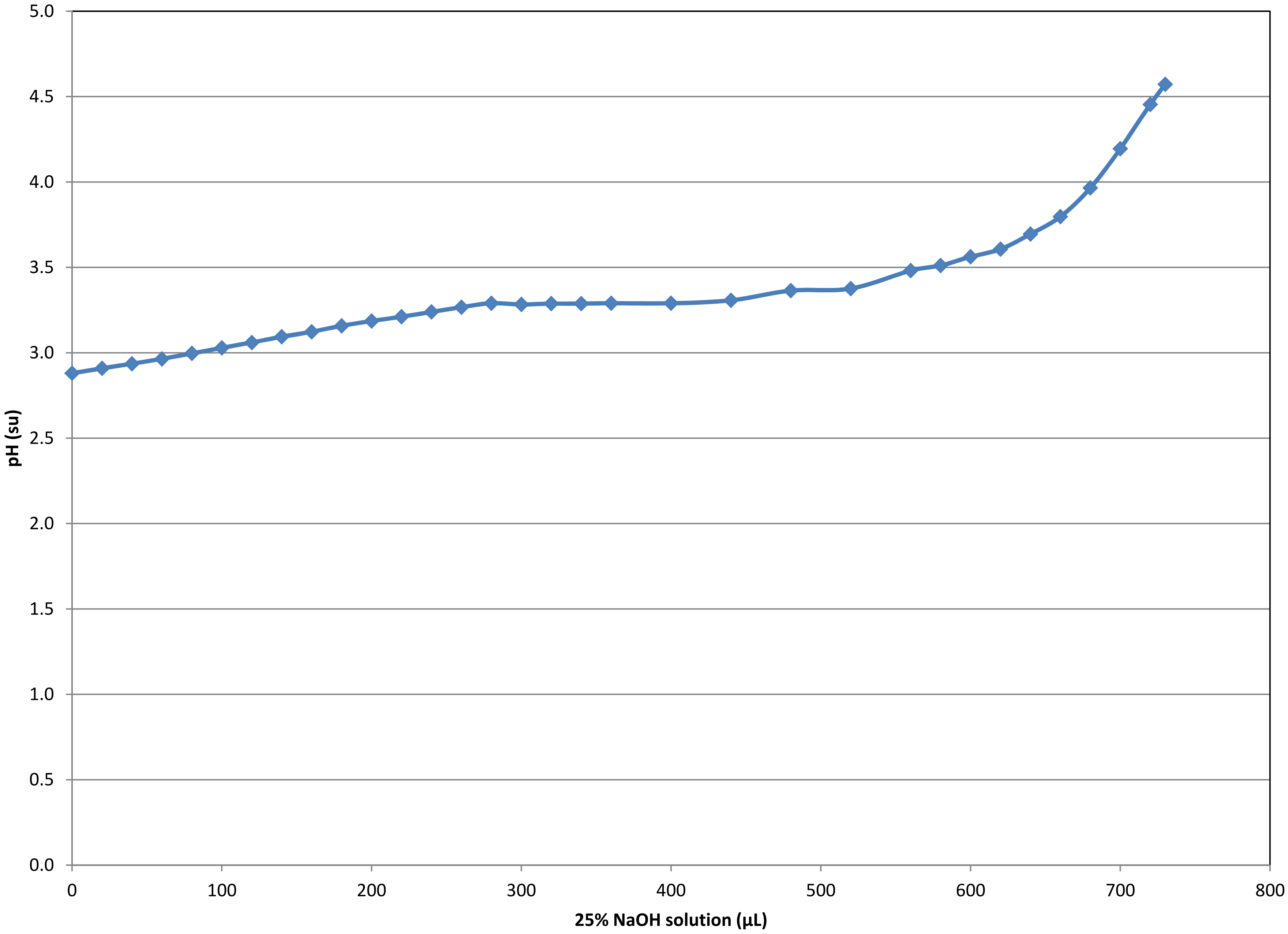


Figure 4.1-1
Titration Curve of Sodium Hydroxide to pH 4.5

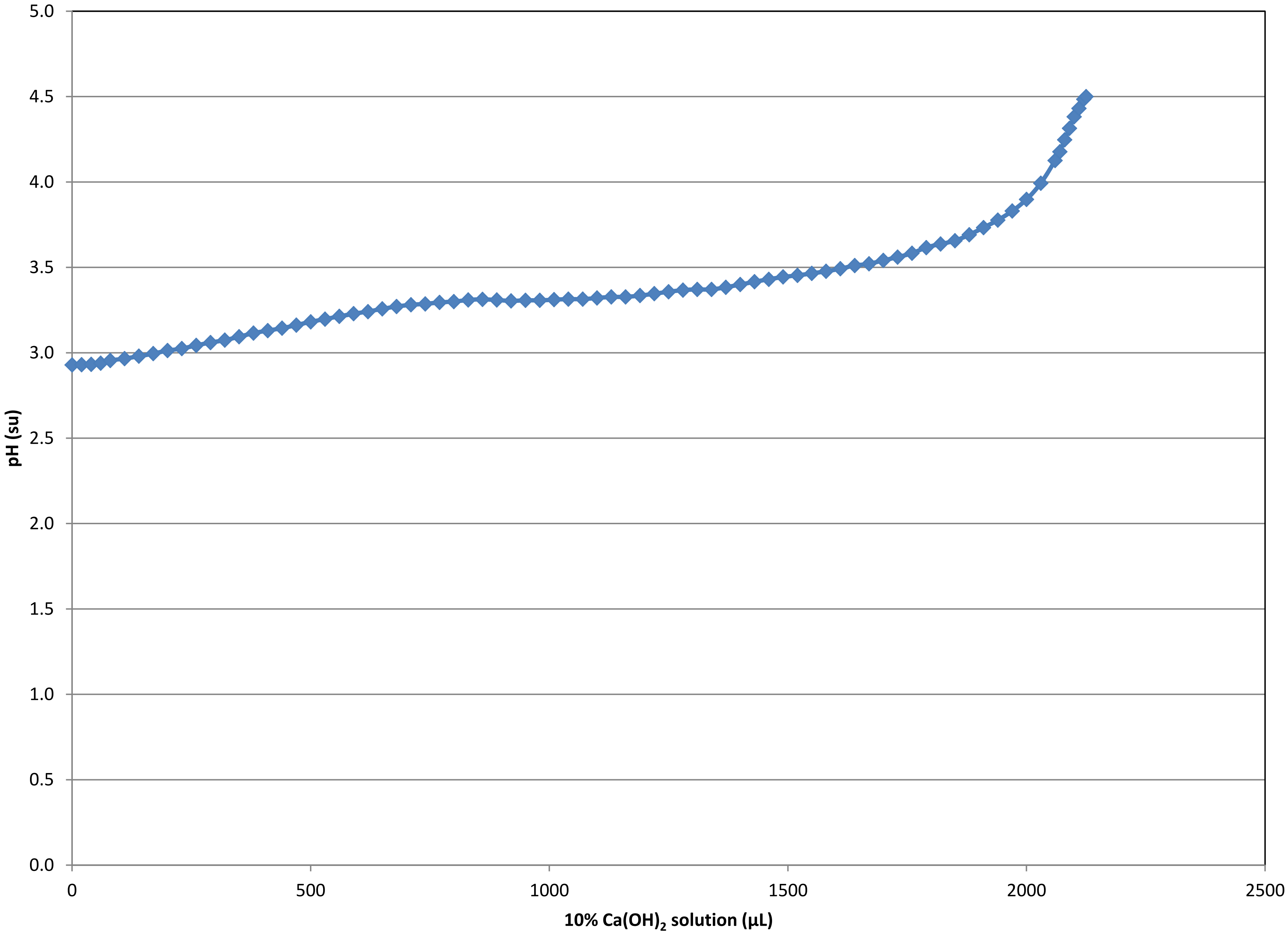


Figure 4.1-2

Titration Curve of Calcium Hydroxide to pH 4.5

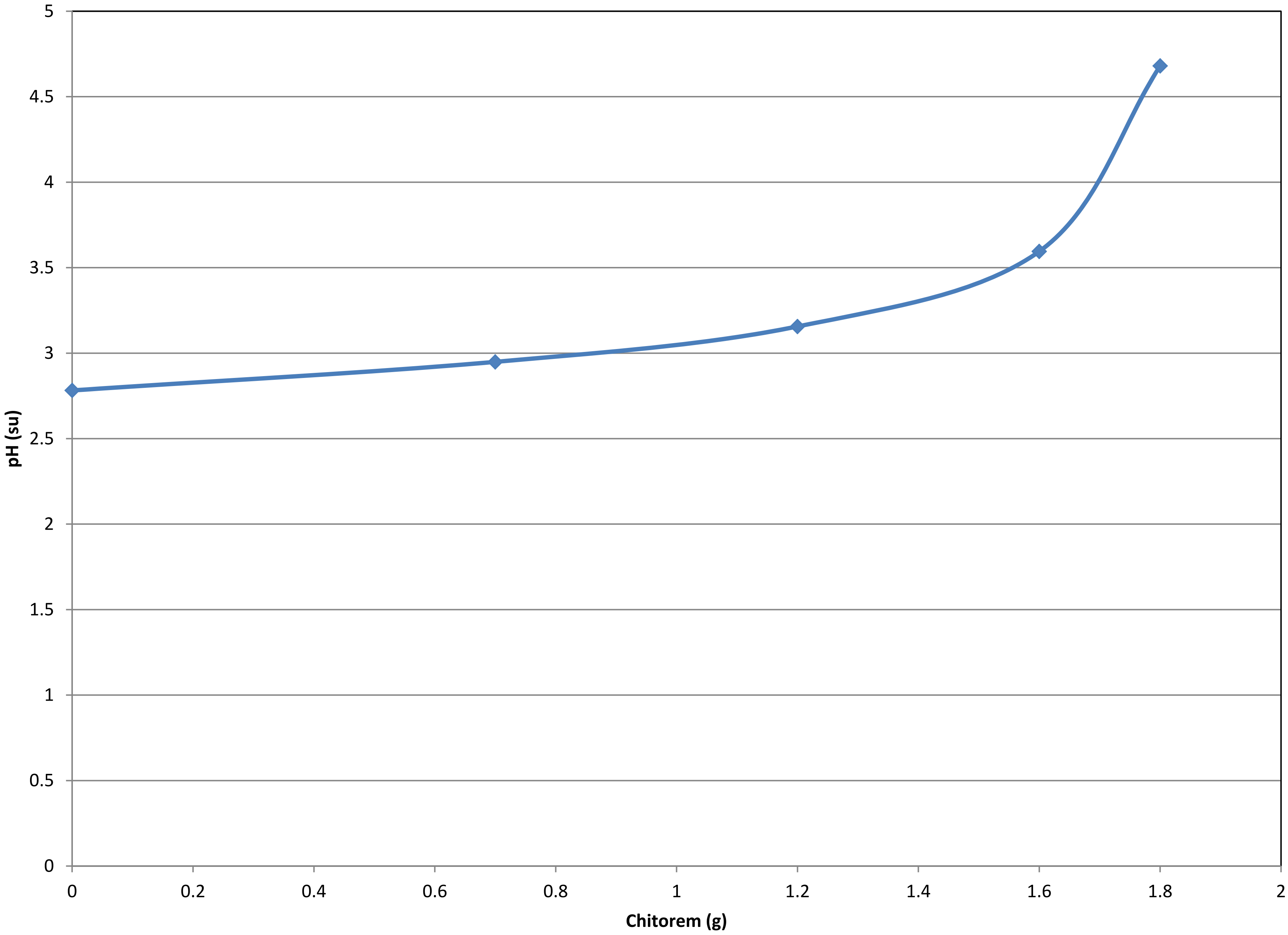


Figure 4.1-3
Titration Curve of Chitorem to pH 4.5

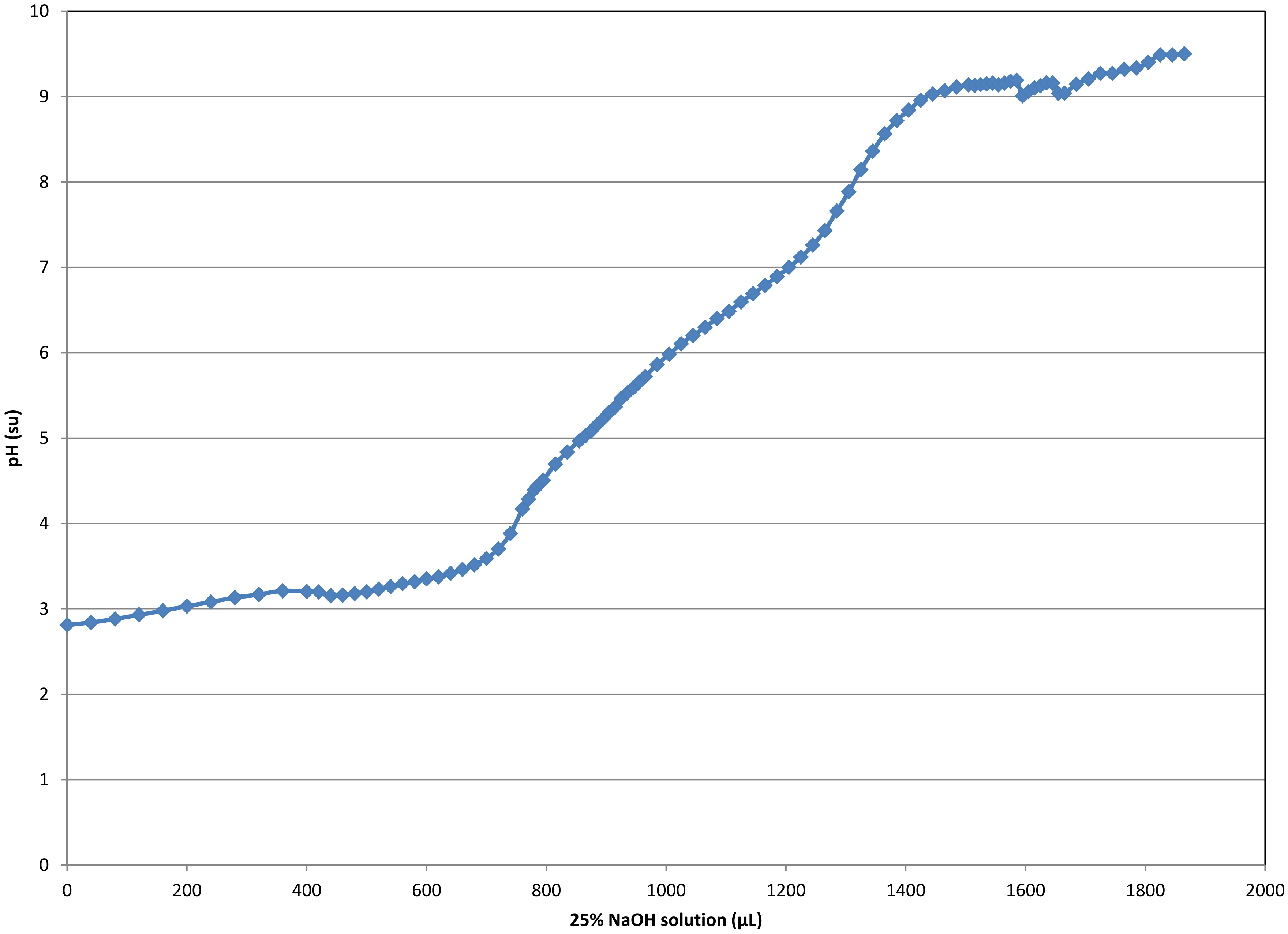


Figure 4.1-4

Titration Curve of Sodium Hydroxide to pH 9.5

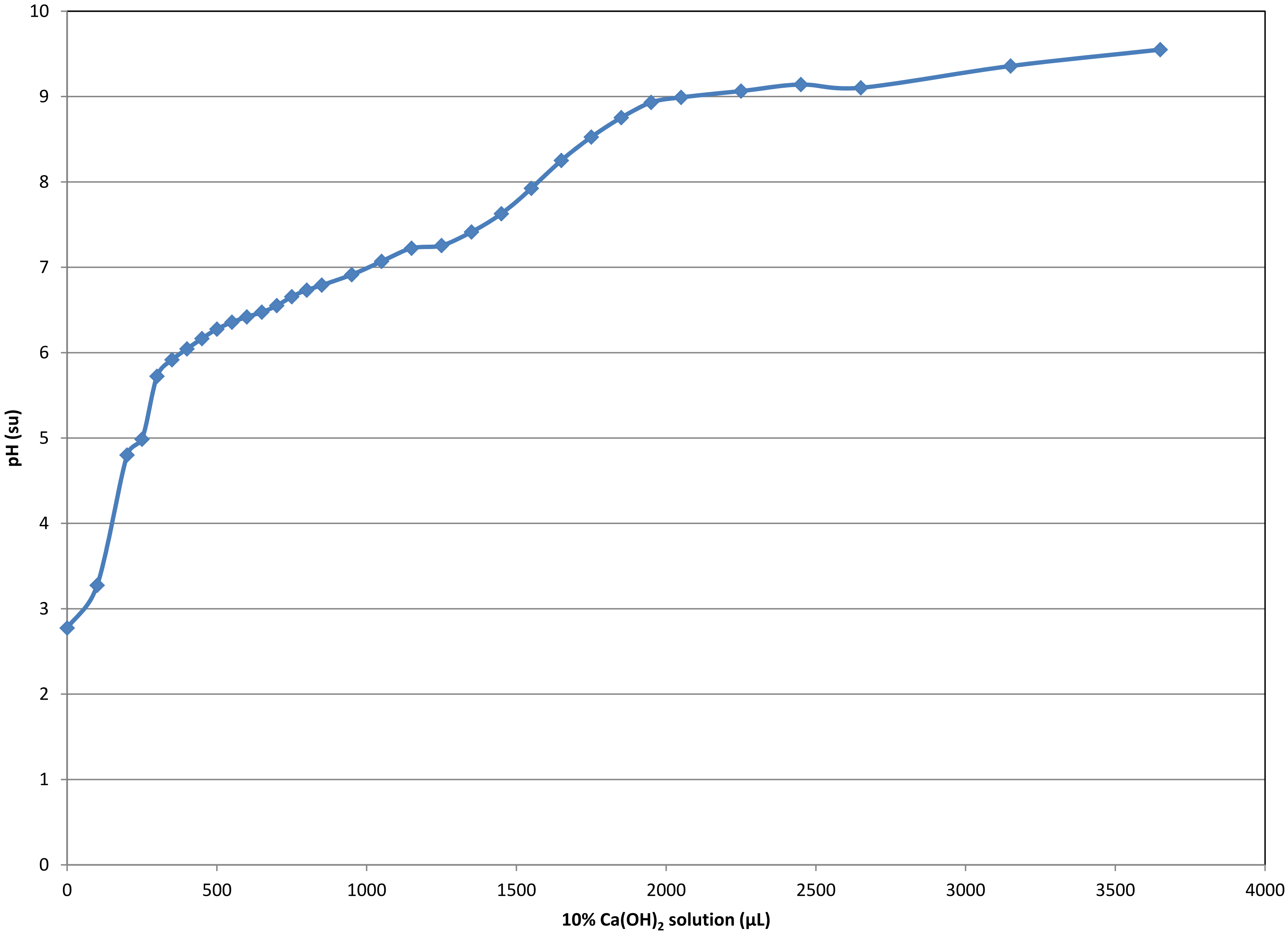


Figure 4.1-5

Titration Curve of Calcium Hydroxide to pH 9.5

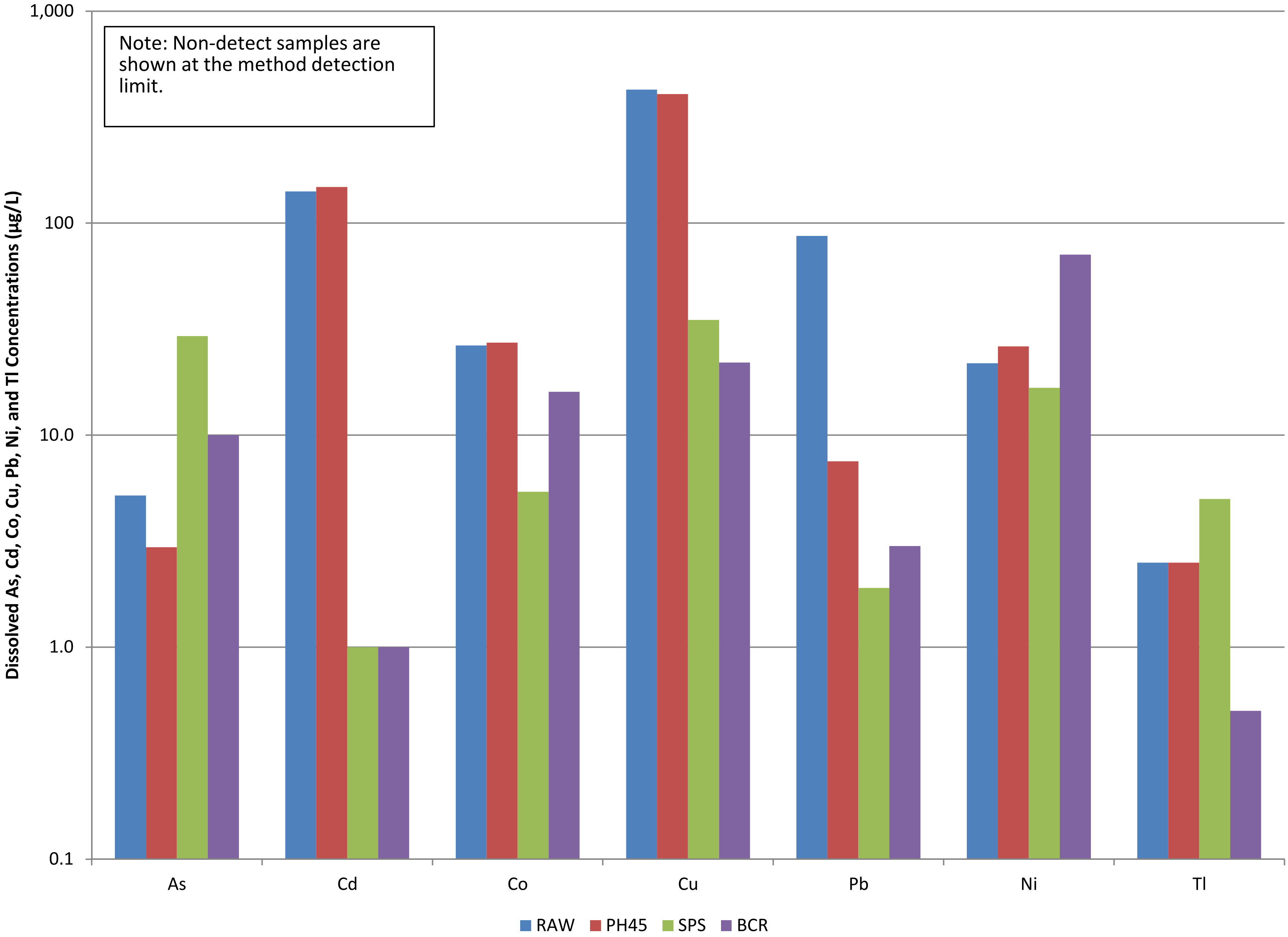


Figure 4.1-6a
Column 1 - NaOH Pre-Treatment and SAPS, Page 1

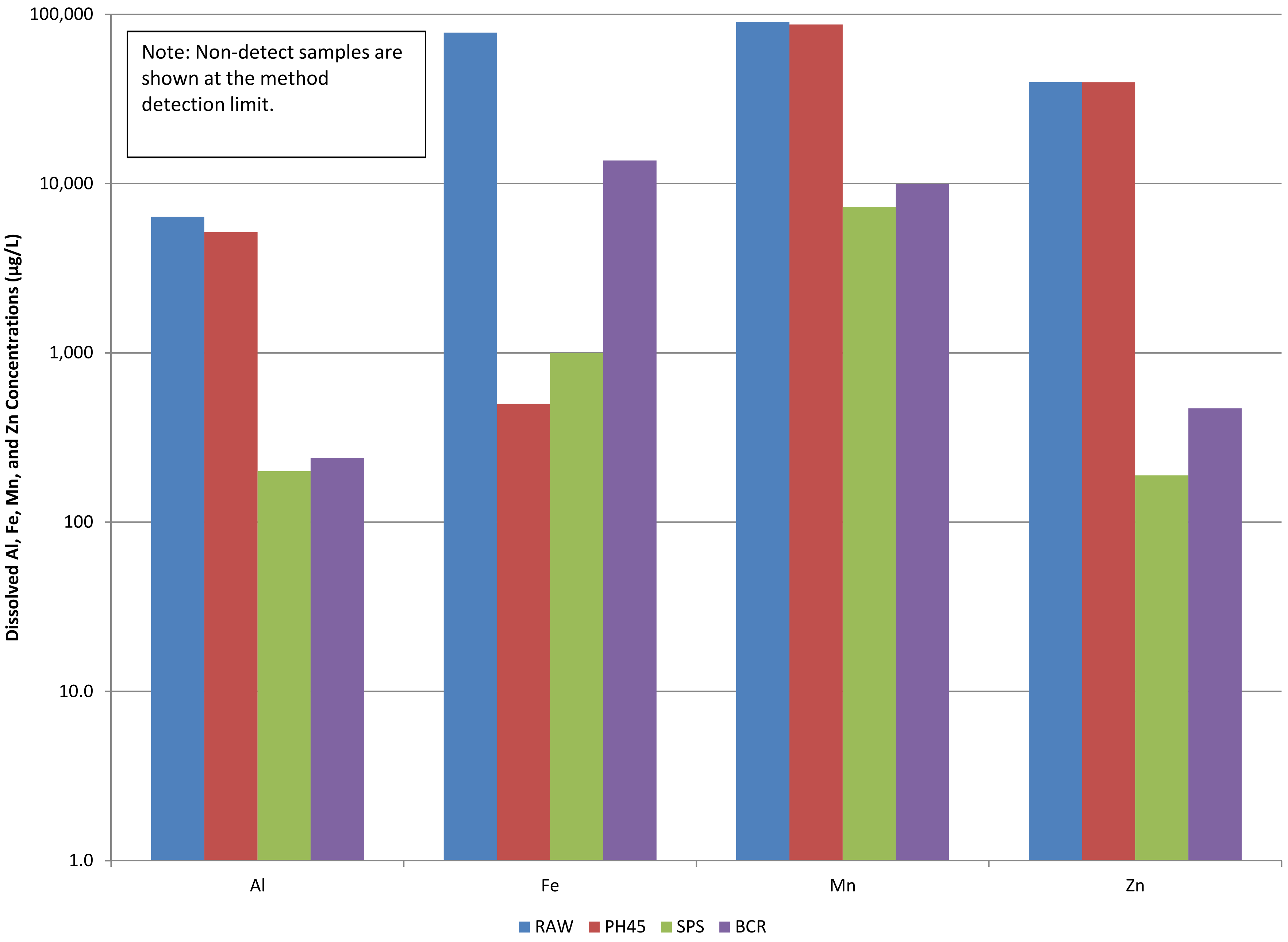


Figure 4.1-6b
Column 1 - NaOH Pre-Treatment and SAPS, Page 2

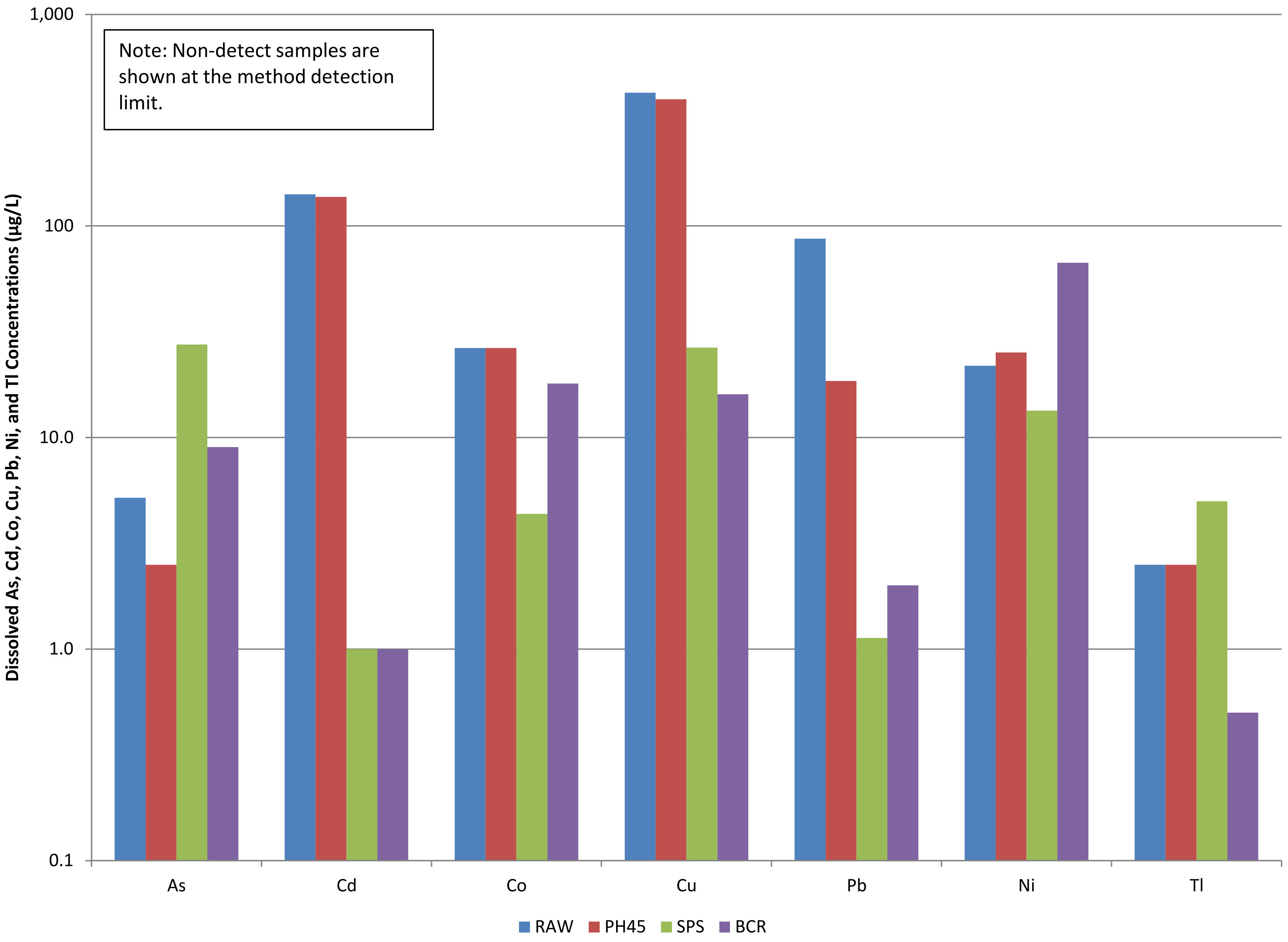


Figure 4.1-7a
Column 2 - $Ca(OH)_2$ Pre-Treatment and SAPS, Page 1

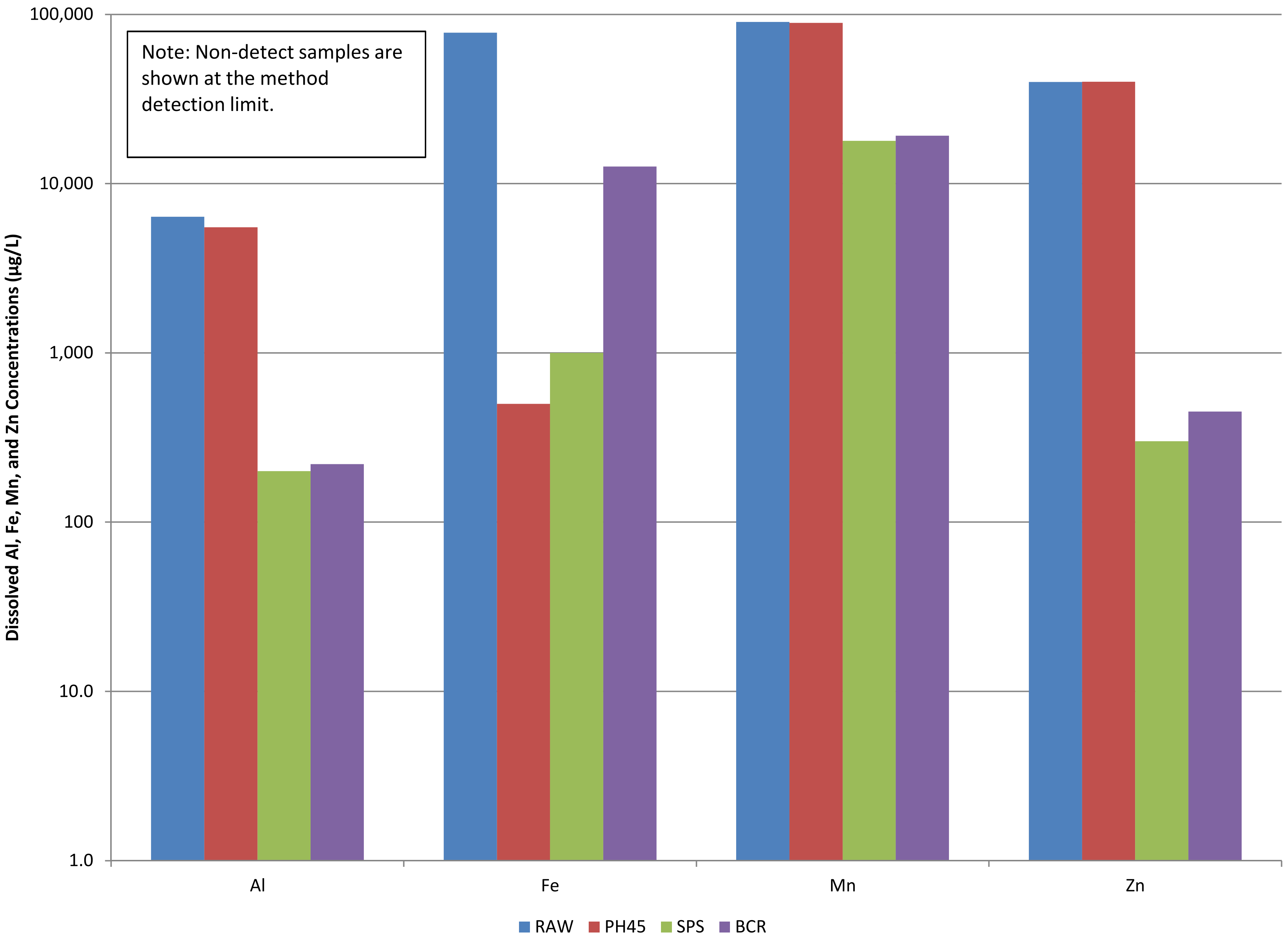


Figure 4.1-7b
Column 2 - $Ca(OH)_2$ Pre-Treatment and SAPS, Page 2

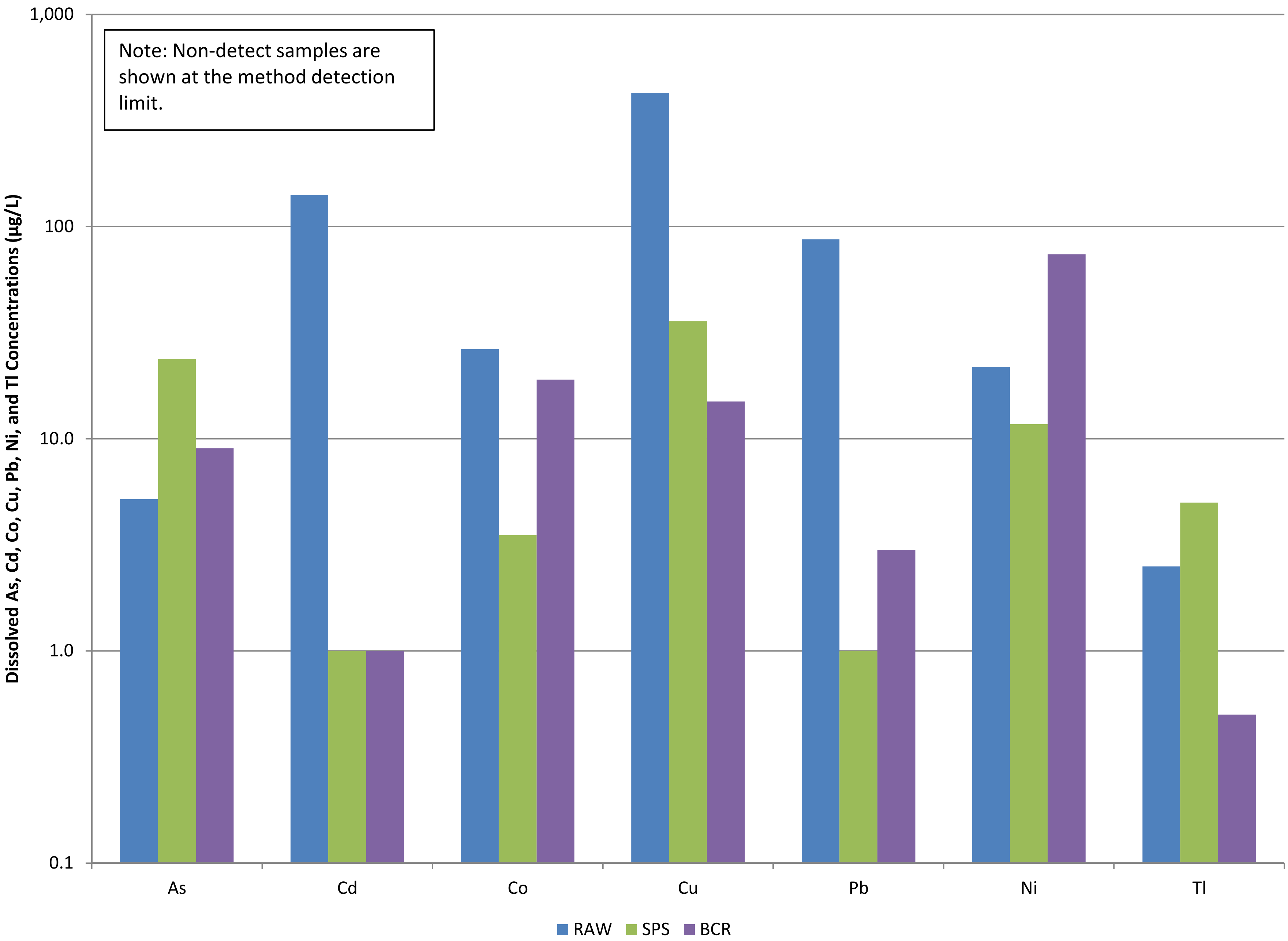


Figure 4.1-8a

Column 3 - No Pre-Treatment and SAPS, Page 1

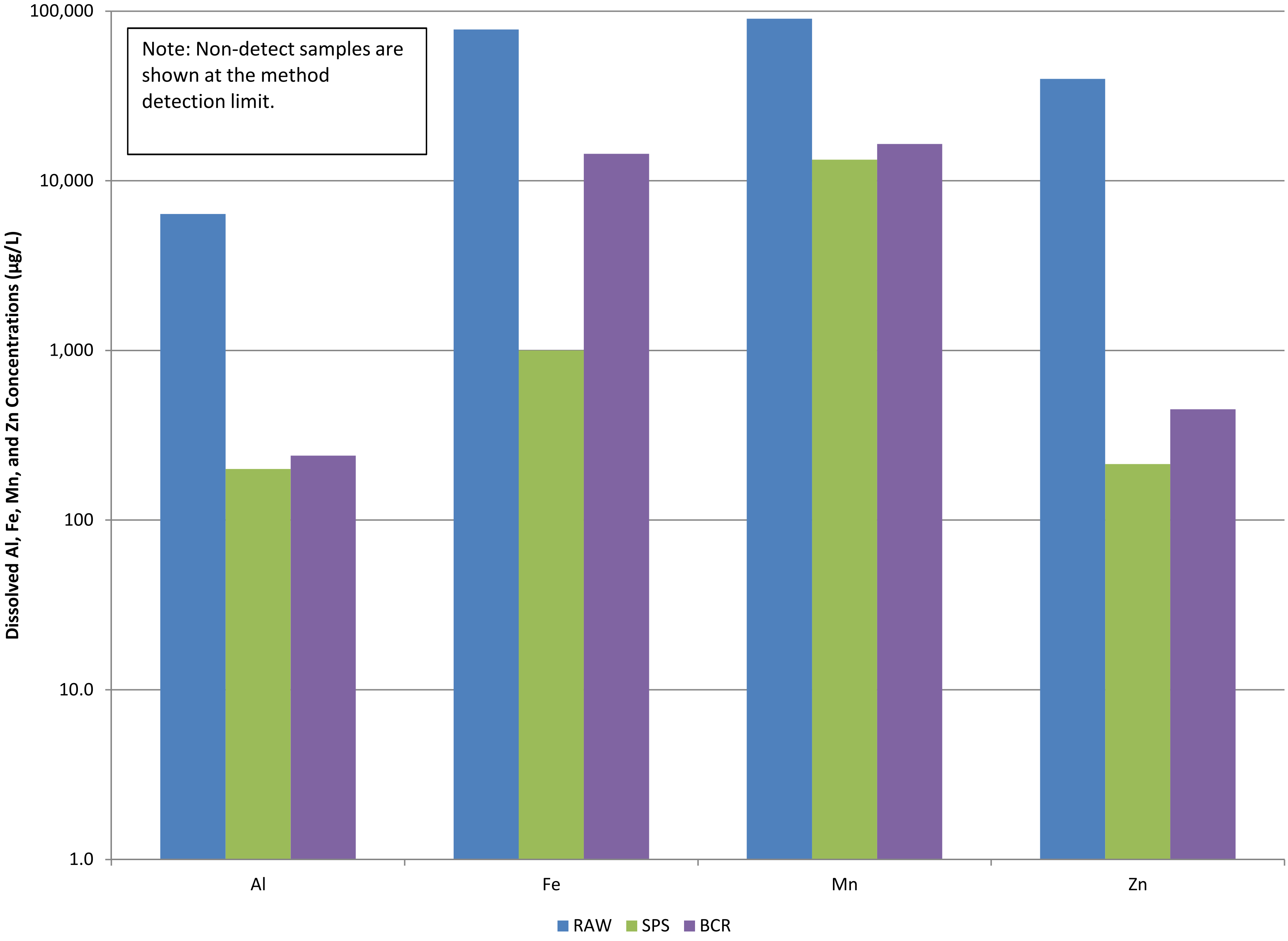


Figure 4.1-8b

Column 3 - No Pre-Treatment and SAPS, Page 2

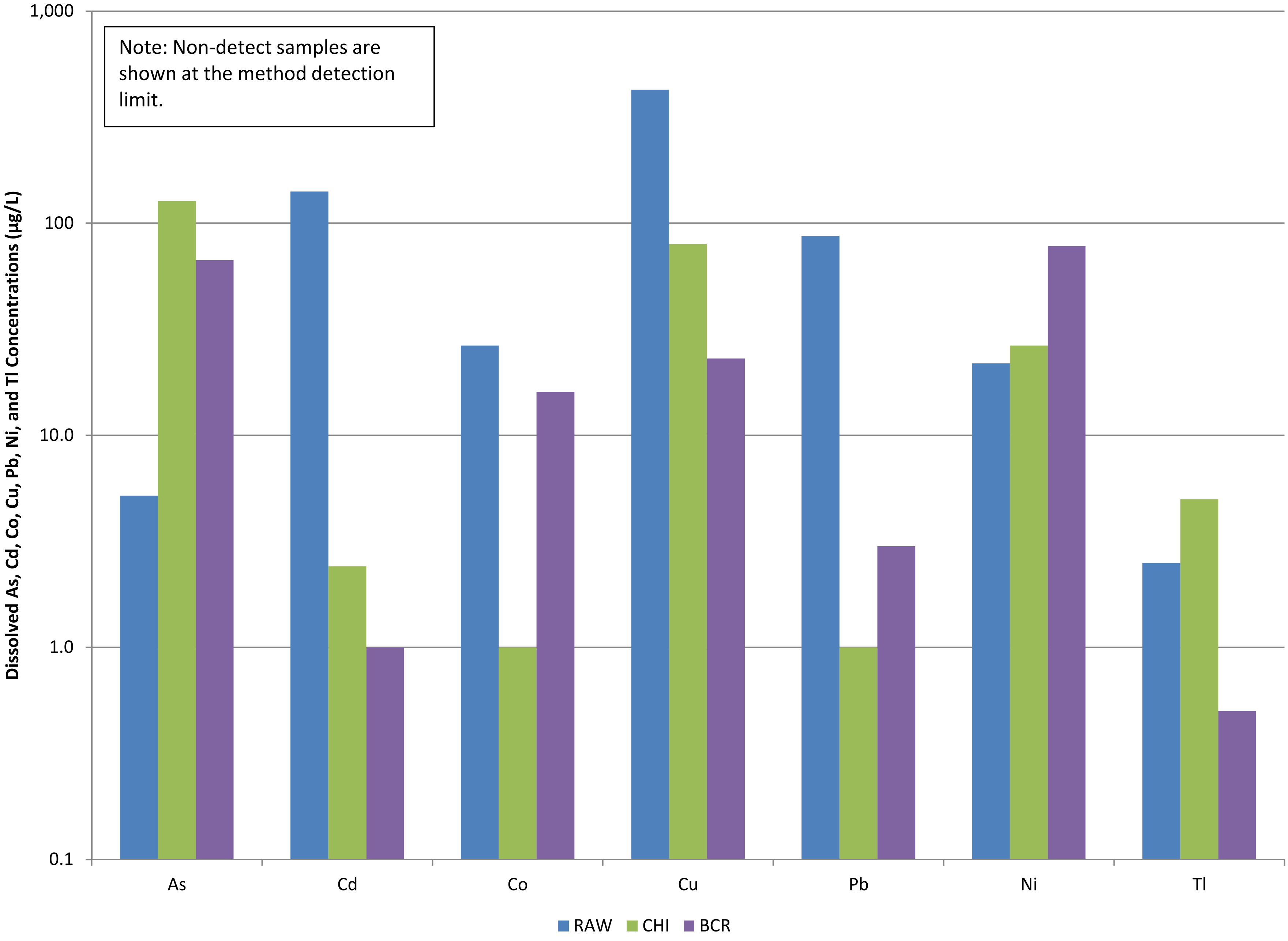


Figure 4.1-9a

Column 4 - Chitorem Pre-Treatment, Page 1

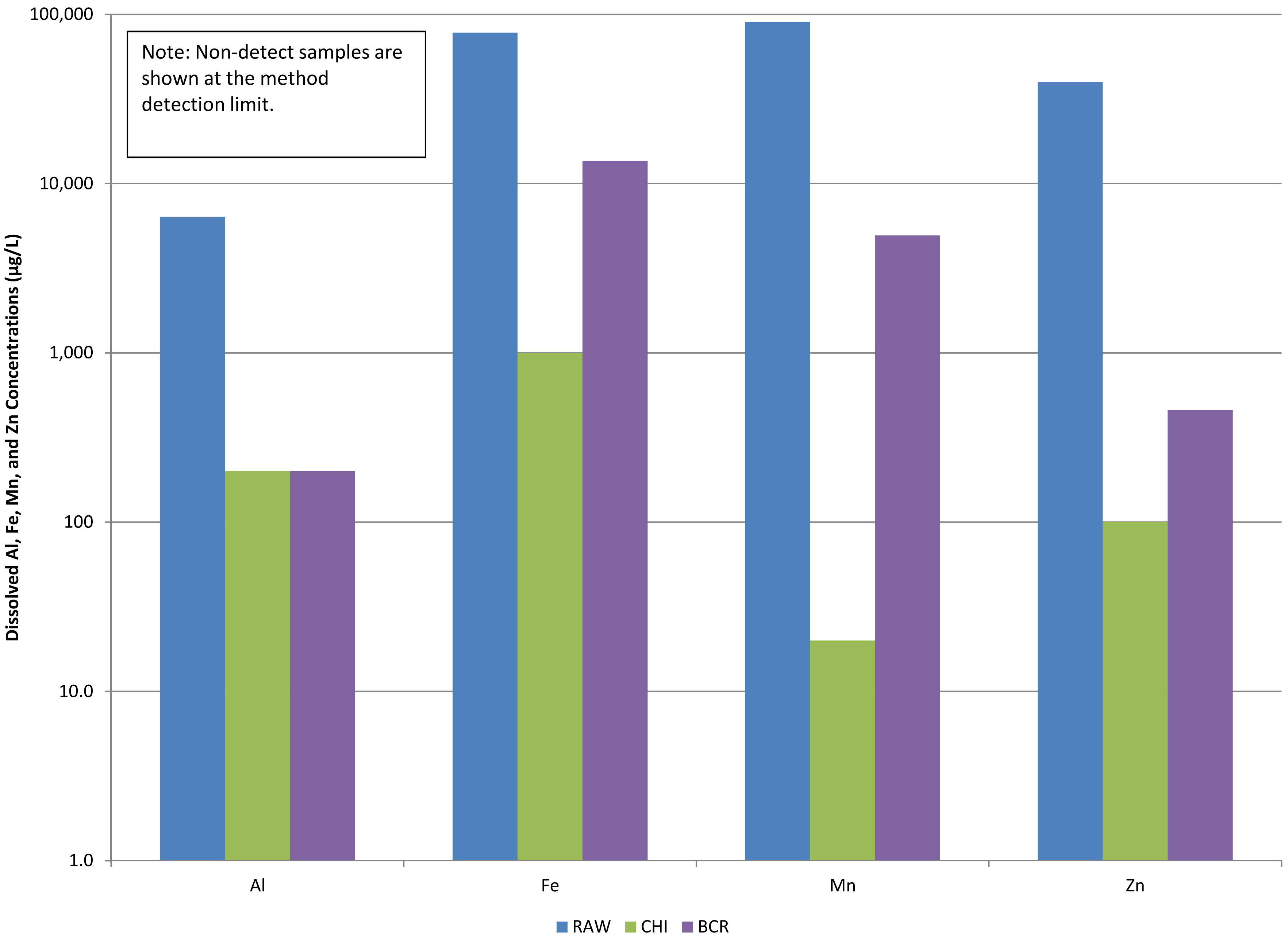


Figure 4.1-9b
Column 4 - Chitorem Pre-Treatment, Page 2

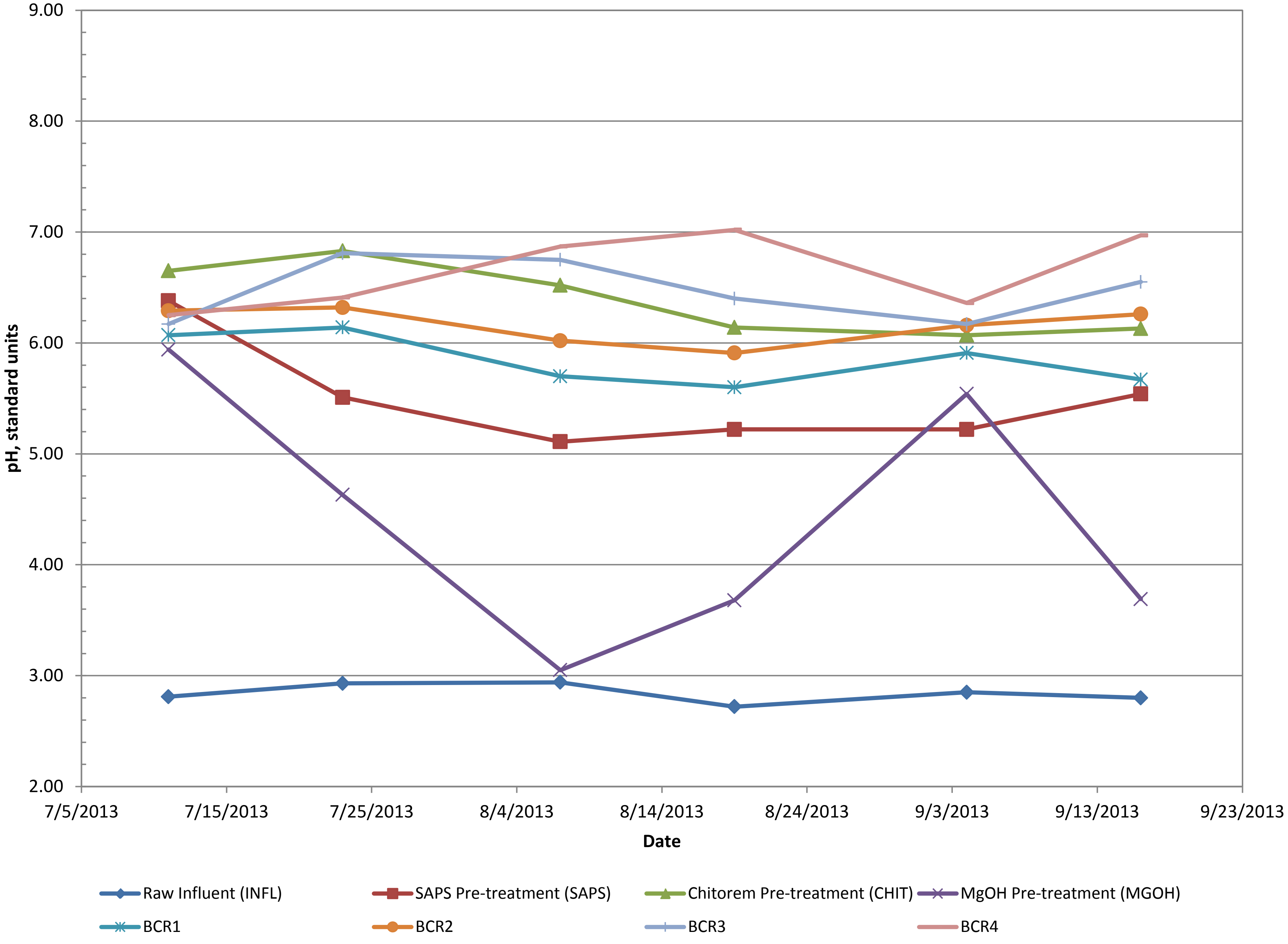


Figure 4.2-1
pH Measurements
Danny T Adit Treatability Study Year 1

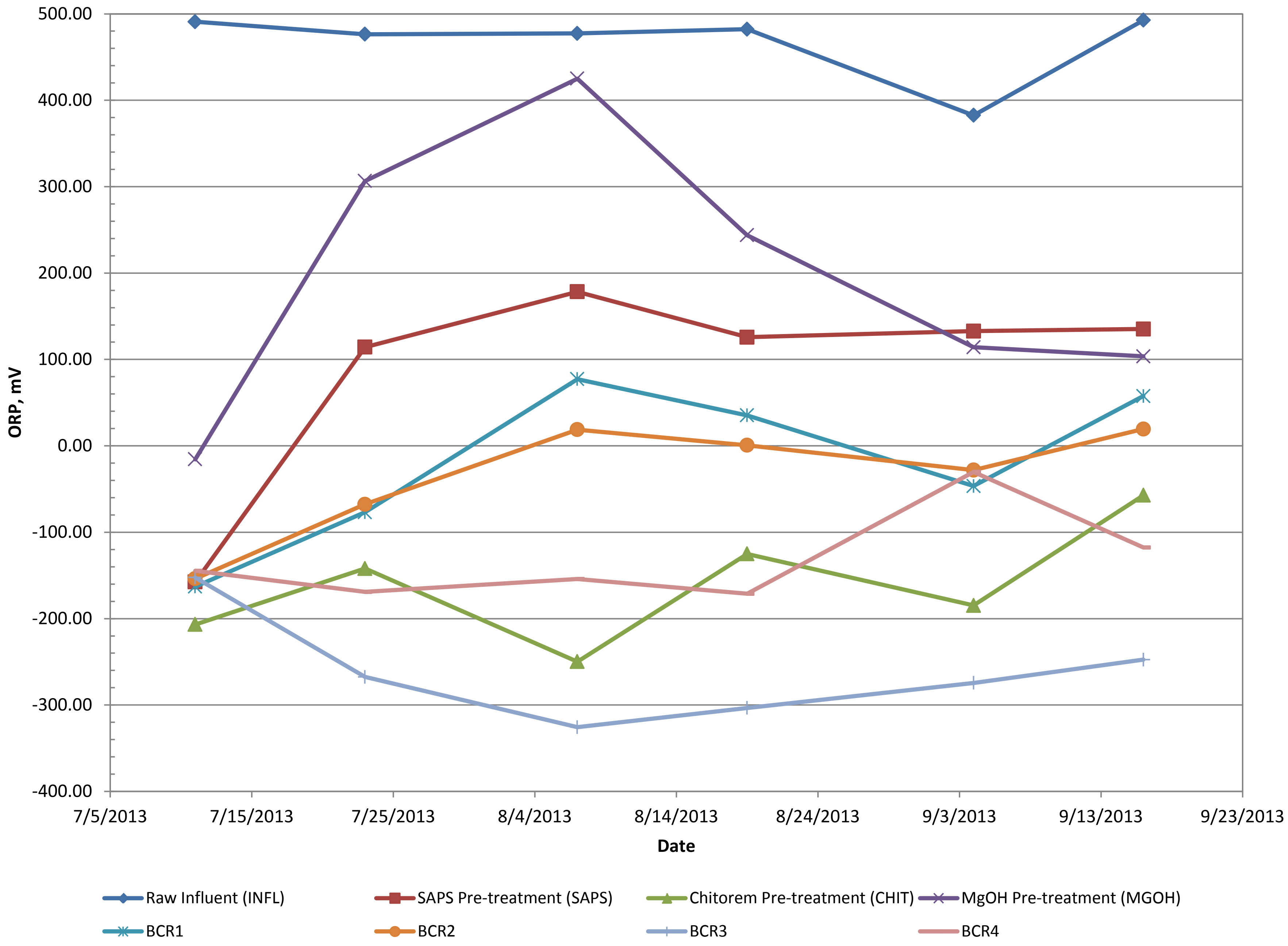


Figure 4.2-2
Oxidation Reduction Potential Measurements
Danny T Adit Treatability Study Year 1

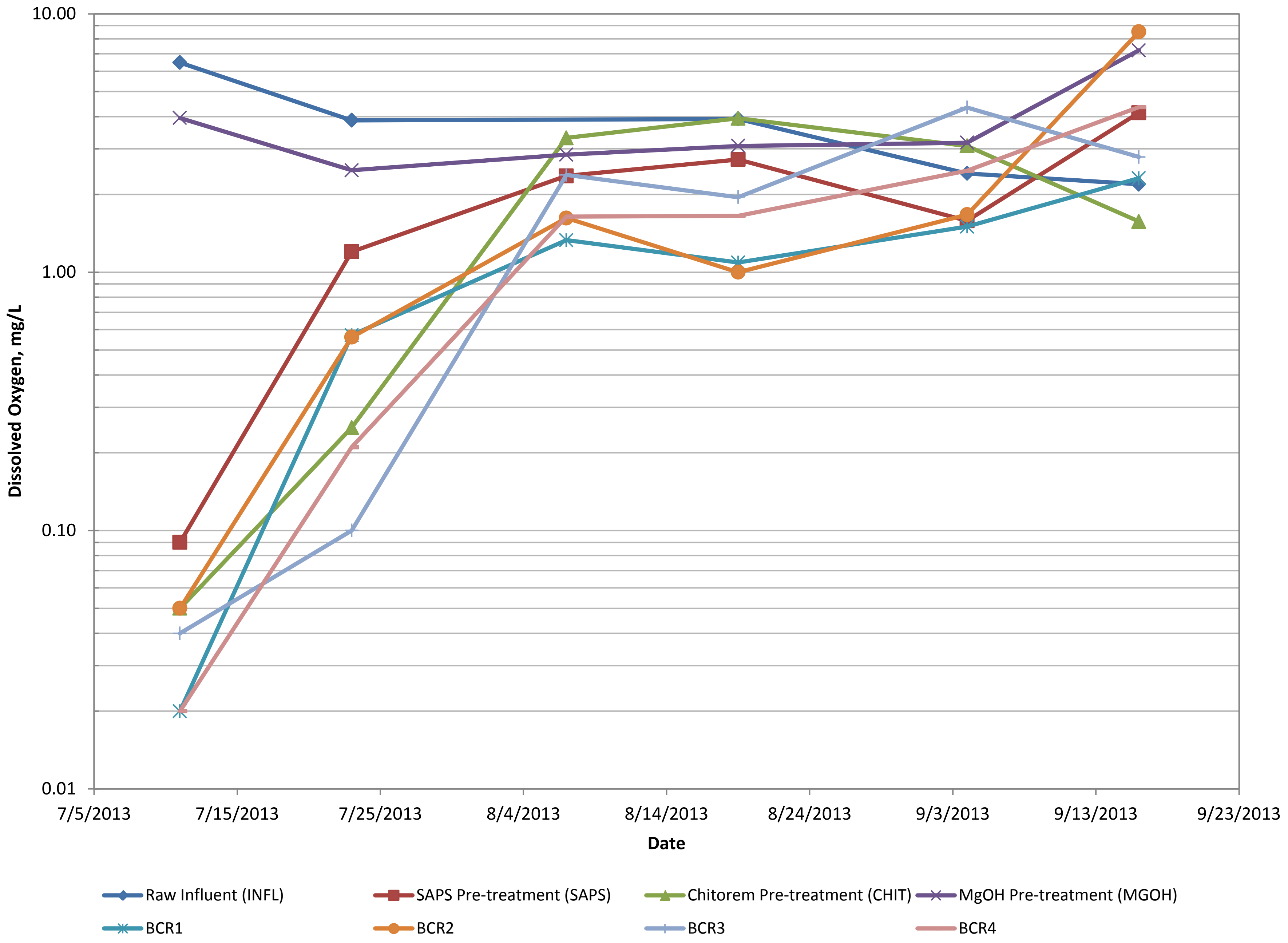


Figure 4.2-3
Dissolved Oxygen Measurements
Danny T Adit Treatability Study Year 1

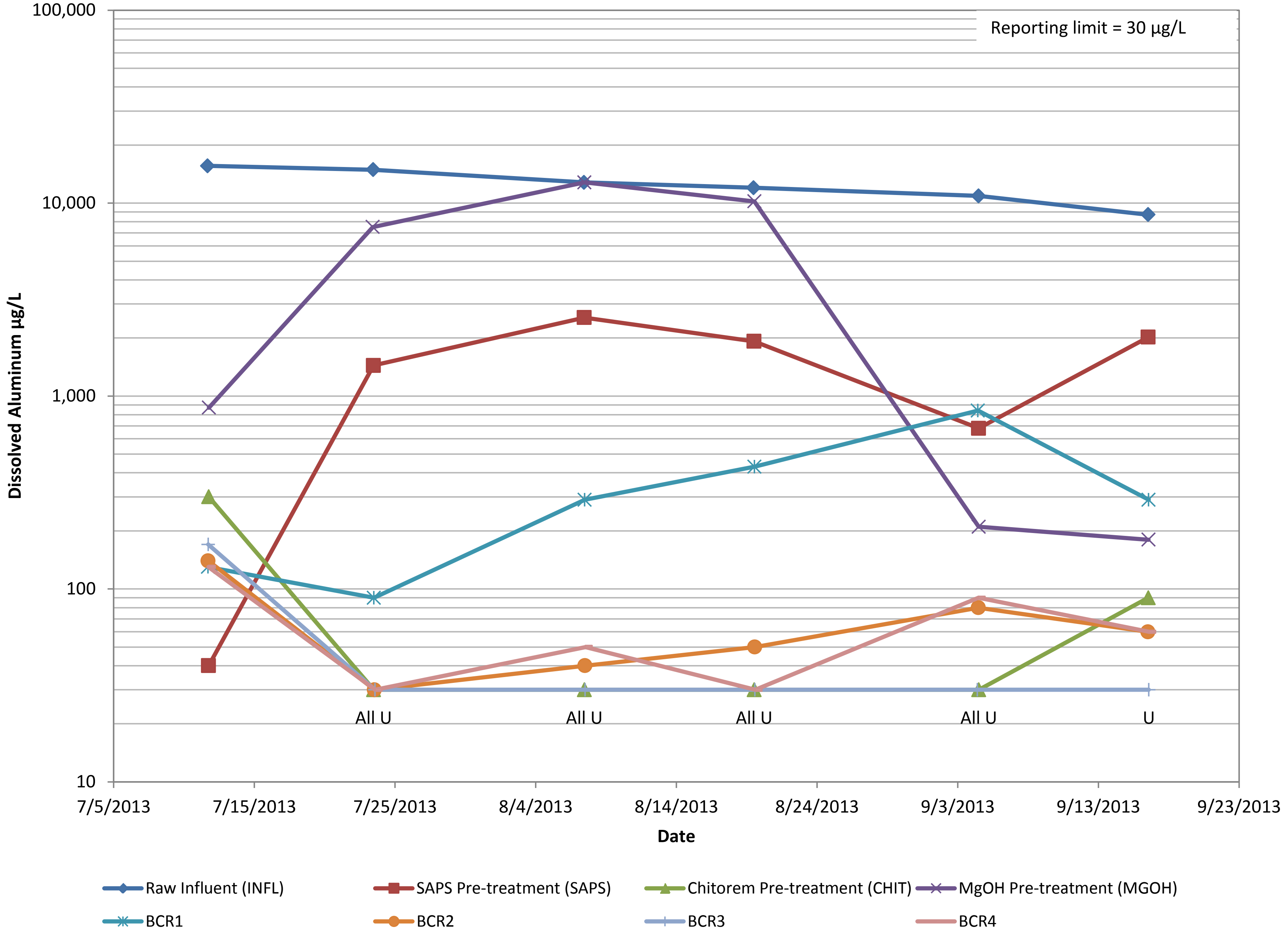


Figure 4.2-4
Dissolved Aluminum Concentrations
Danny T Adit Treatability Study Year 1

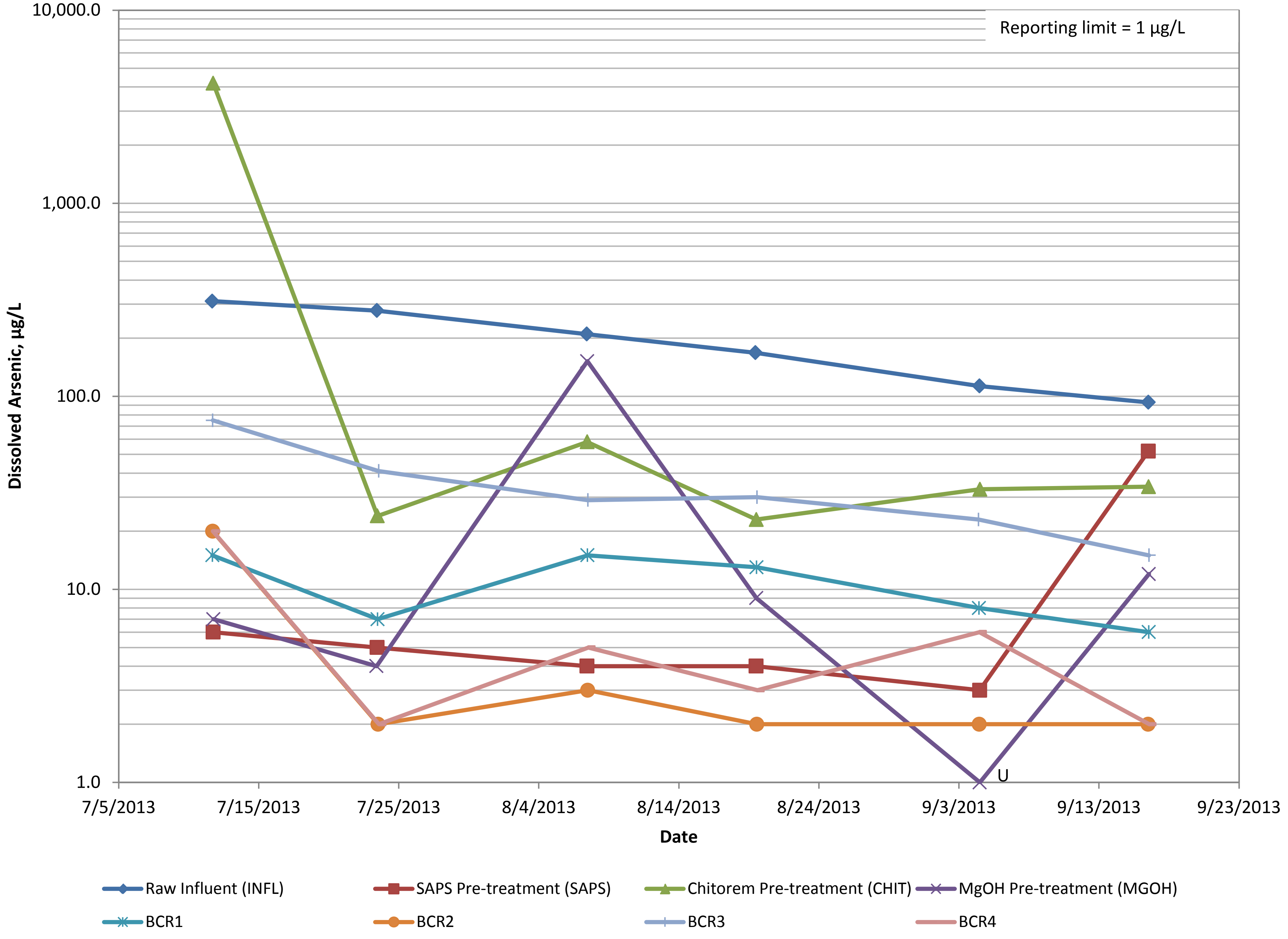


Figure 4.2-5
Dissolved Arsenic Concentrations
Danny T Adit Treatability Study Year 1

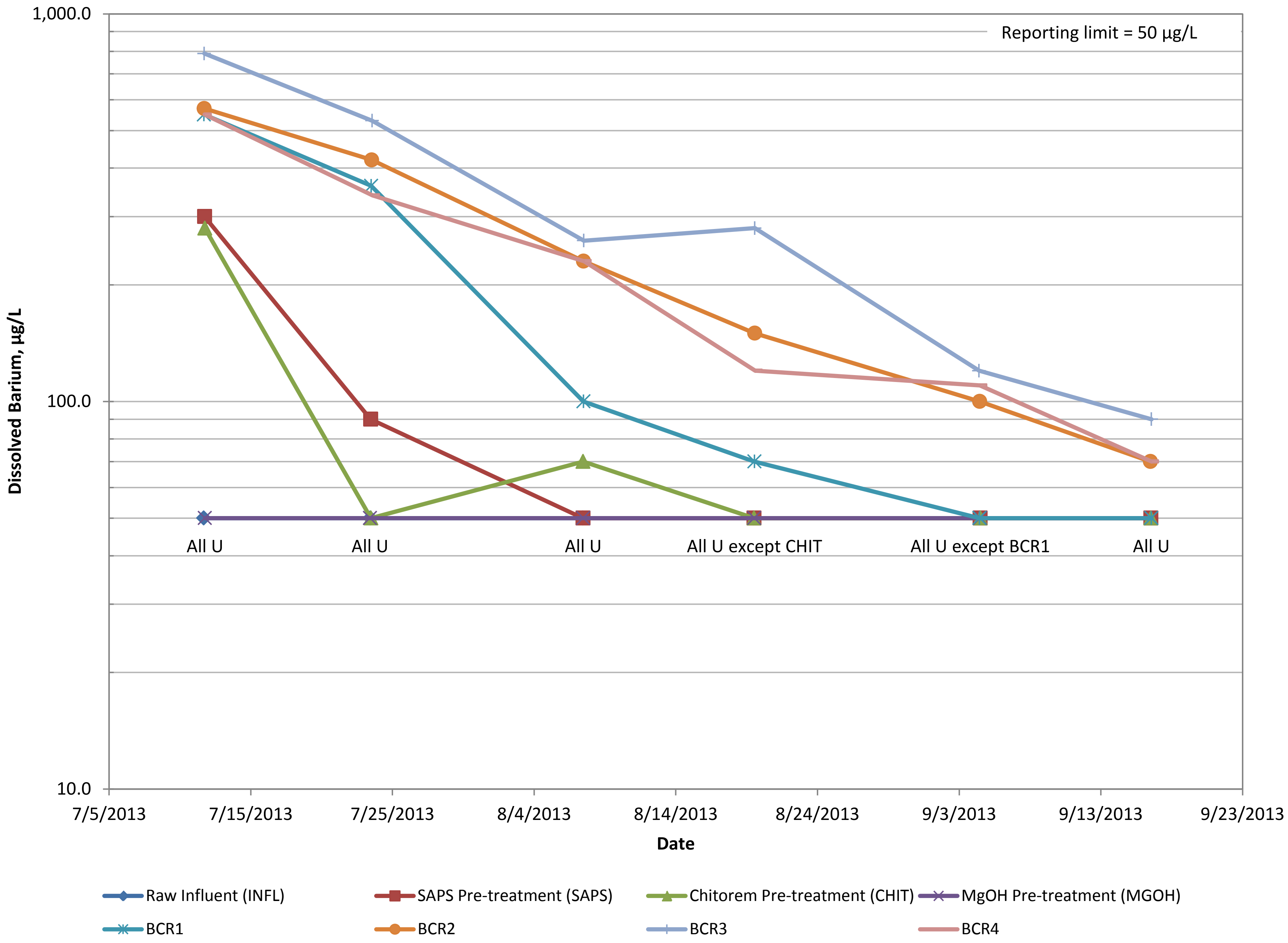


Figure 4.2-6
Dissolved Barium Concentrations
Danny T Adit Treatability Study Year 1

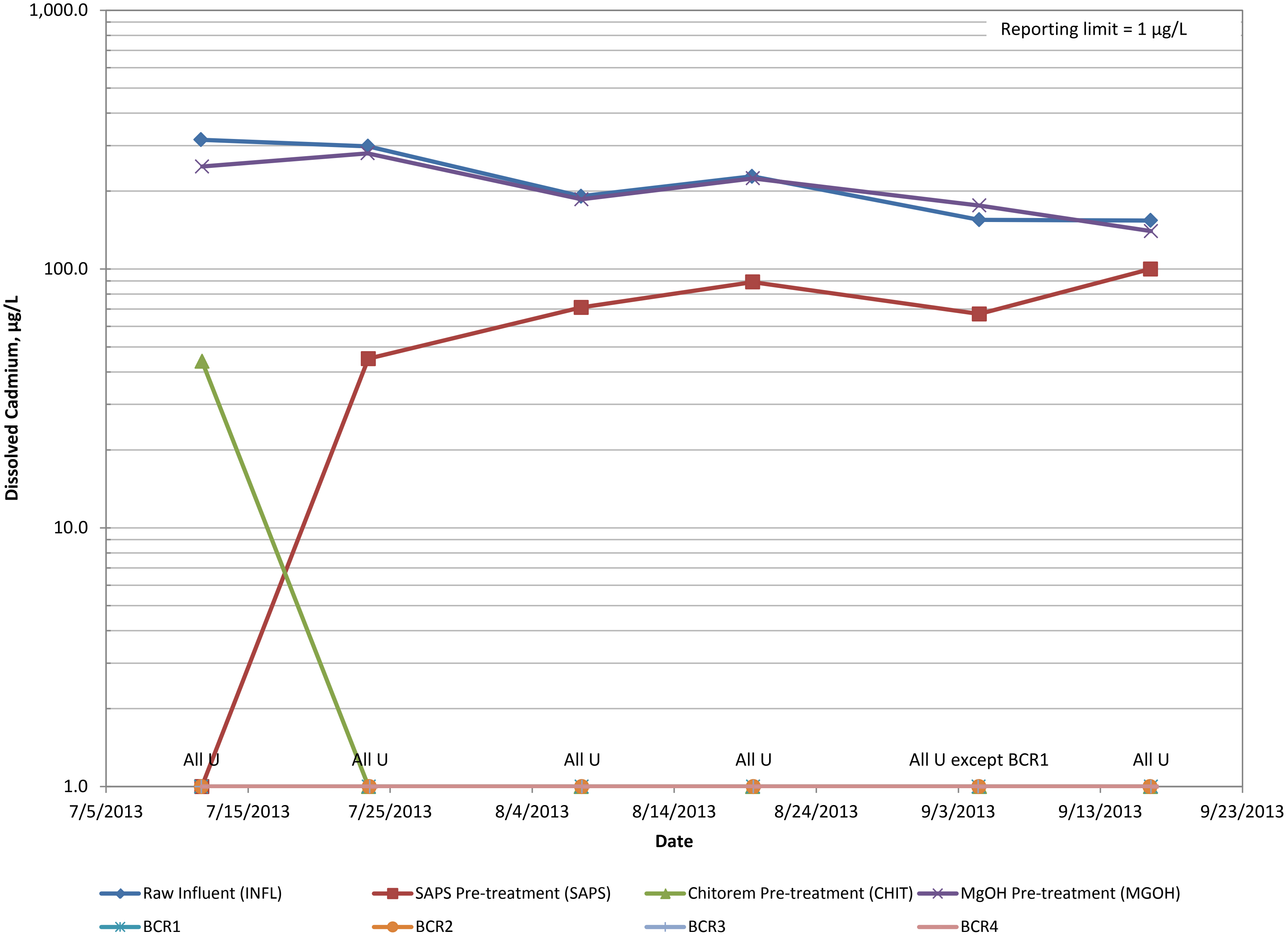


Figure 4.2-7
Dissolved Cadmium Concentrations
Danny T Adit Treatability Study Year 1

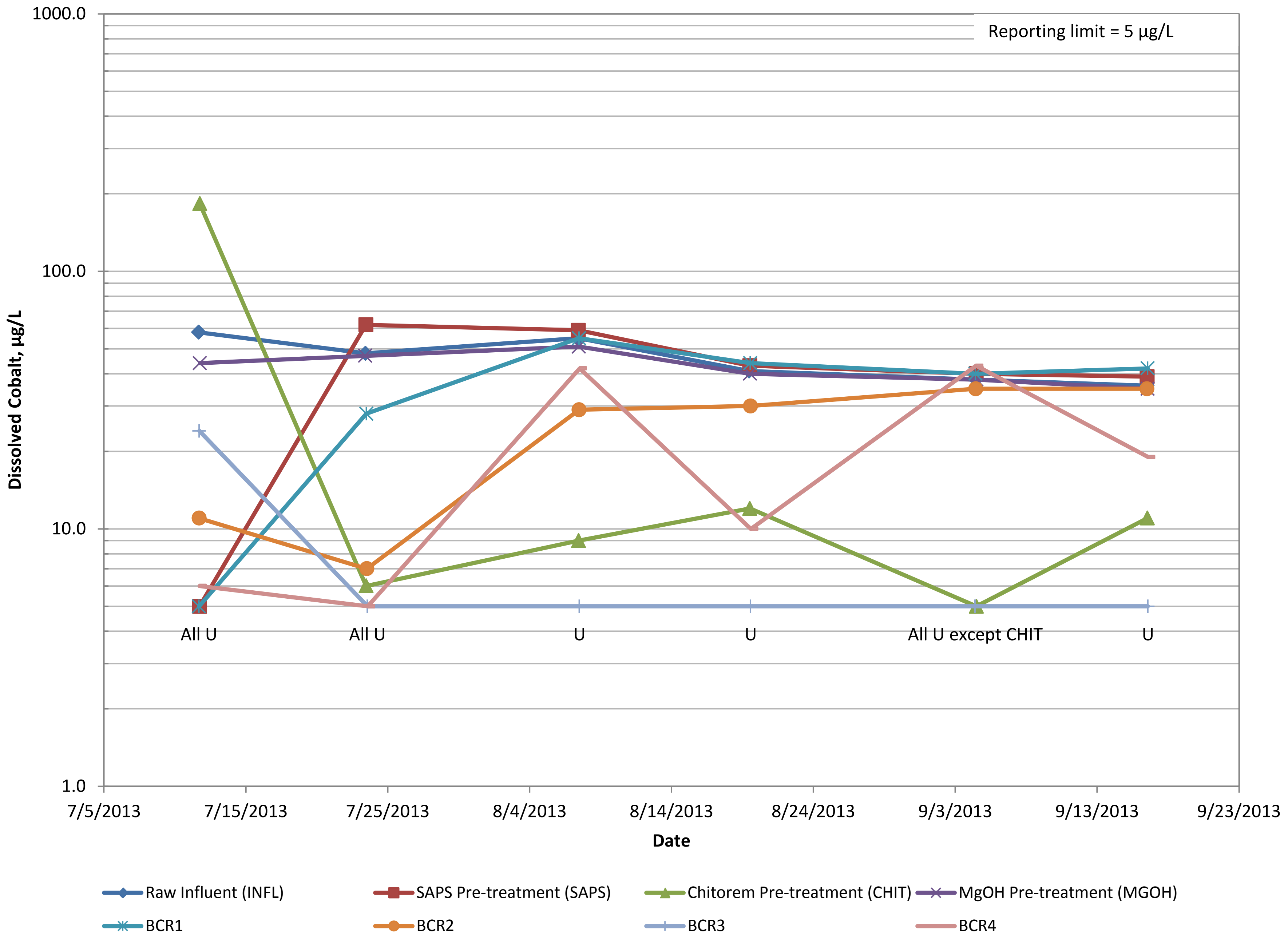


Figure 4.2-8
Dissolved Cobalt Concentrations
Danny T Adit Treatability Study Year 1

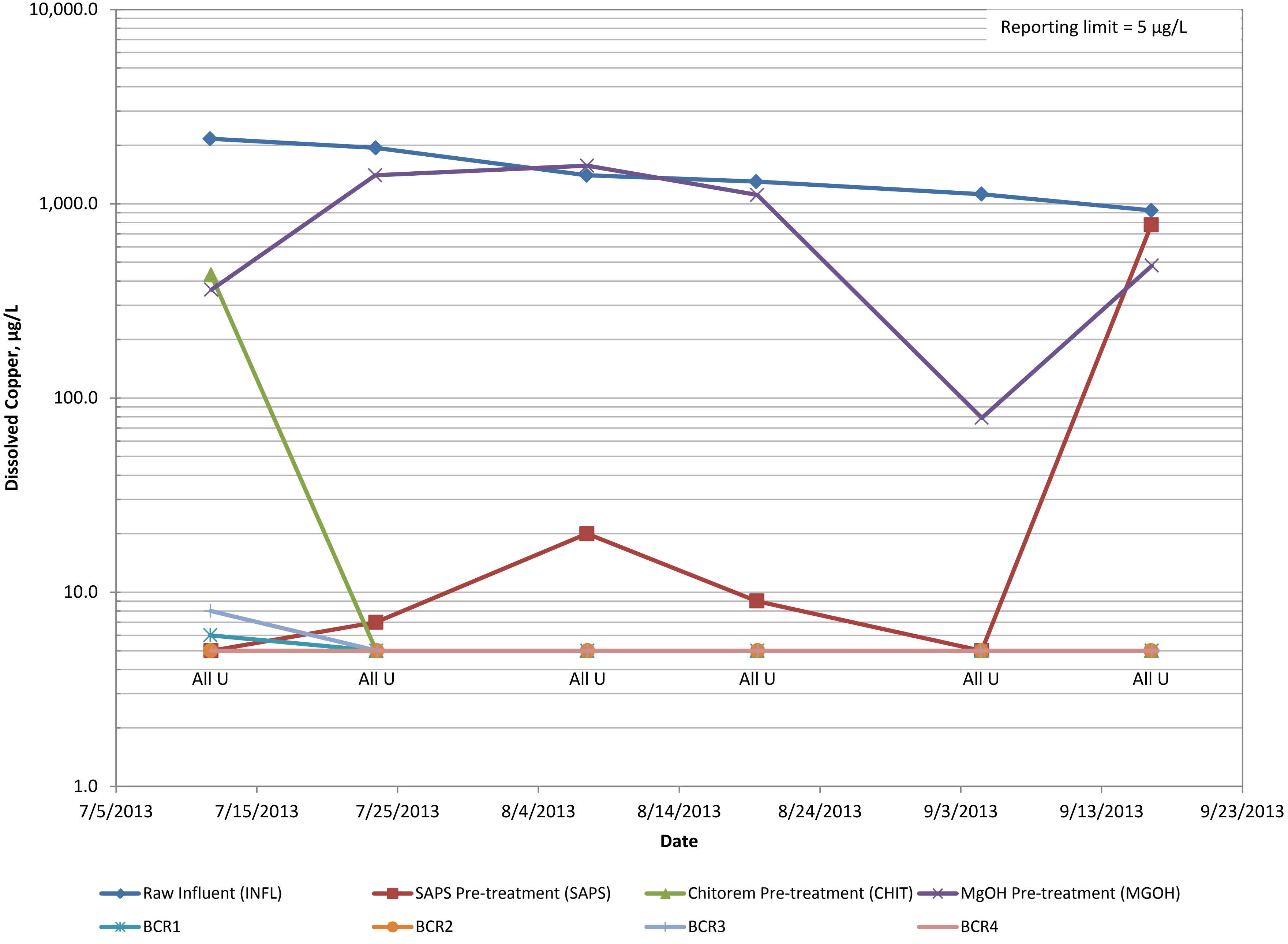


Figure 4.2-9
Dissolved Copper Concentrations
Danny T Adit Treatability Study Year 1

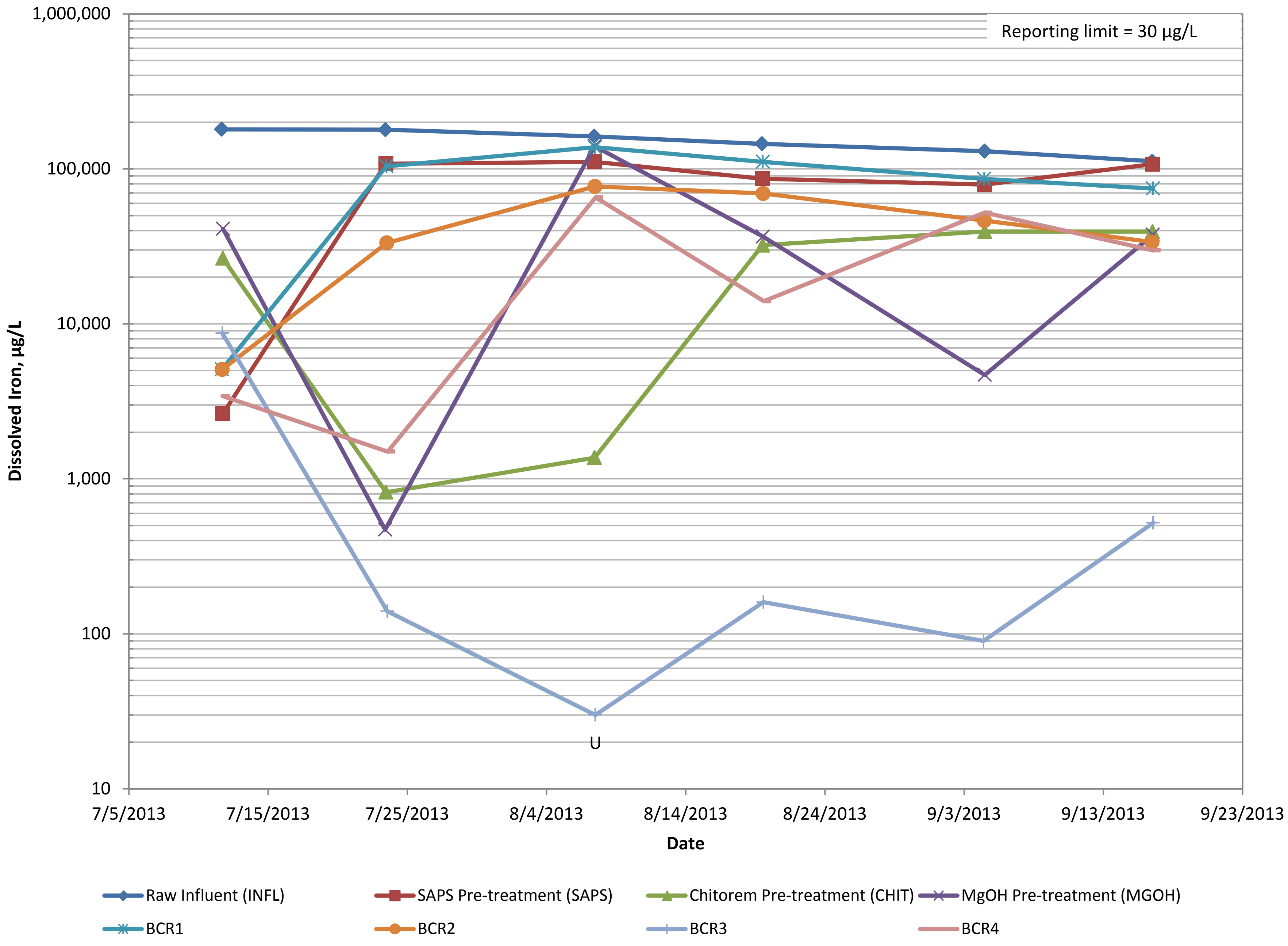


Figure 4.2-10

Dissolved Iron Concentrations

Danny T Adit Treatability Study Year 1

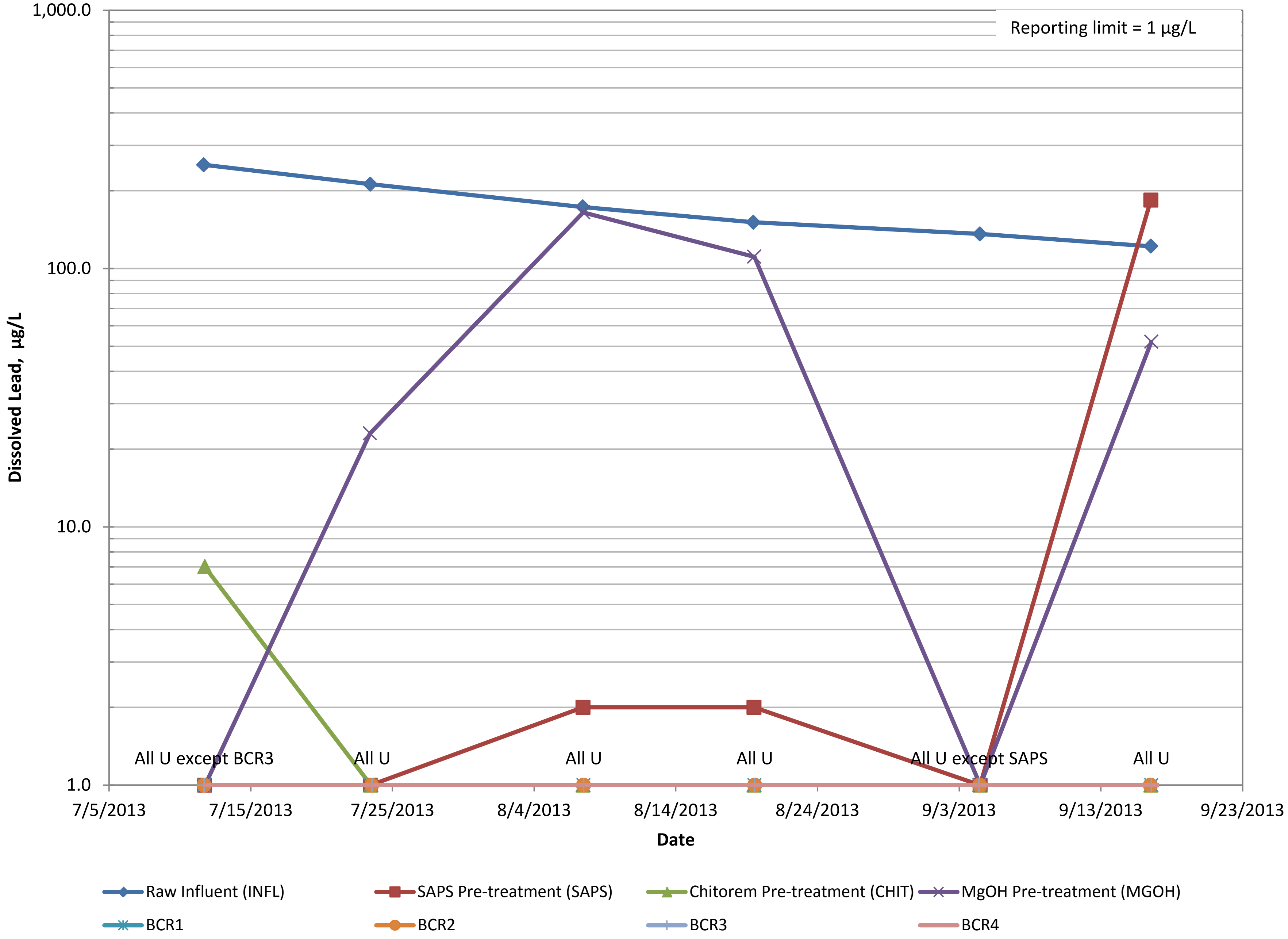


Figure 4.2-11
Dissolved Lead Concentrations
Danny T Adit Treatability Study Year 1

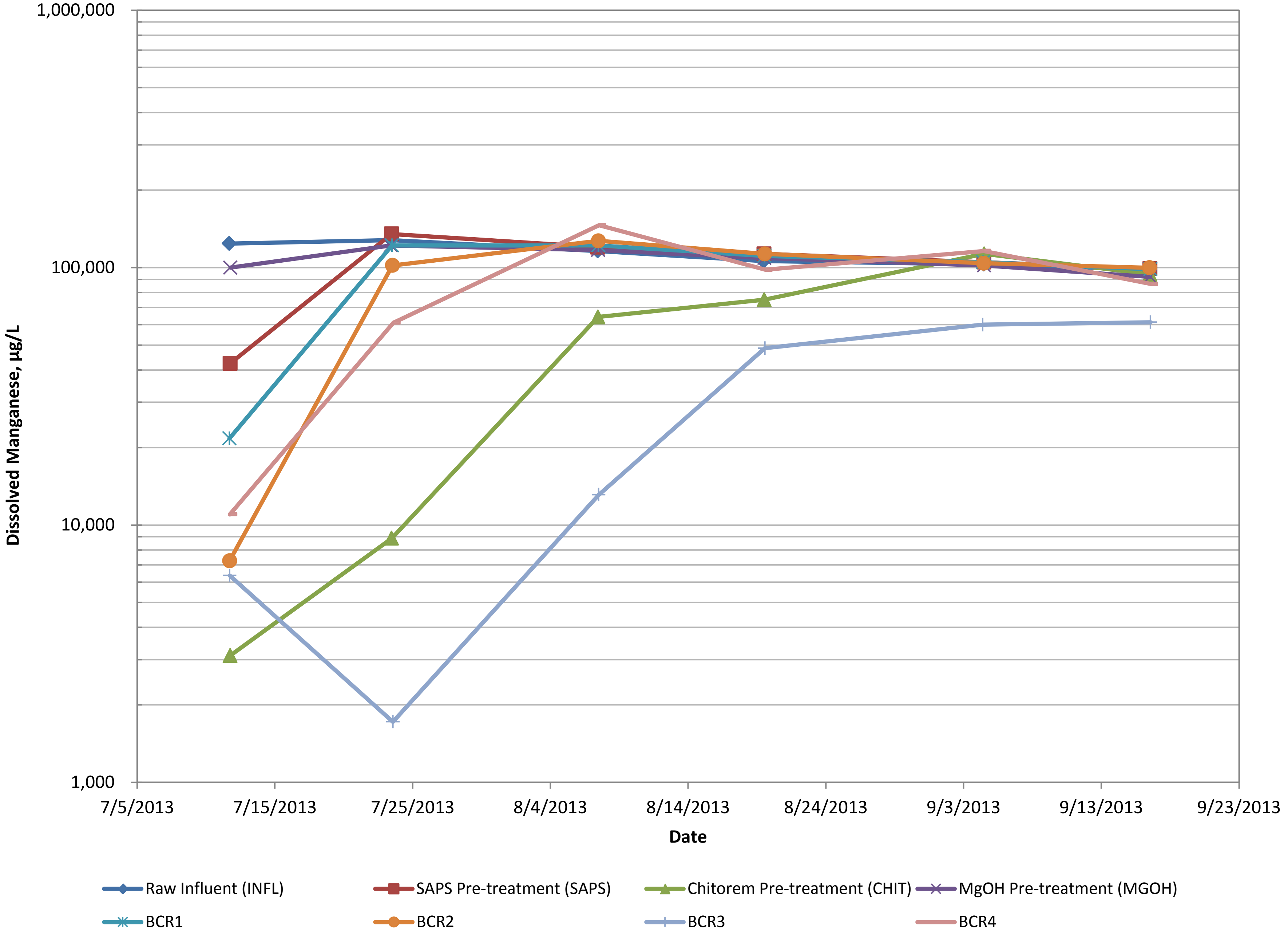


Figure 4.2-12
Dissolved Manganese Concentrations
Danny T Adit Treatability Study Year 1

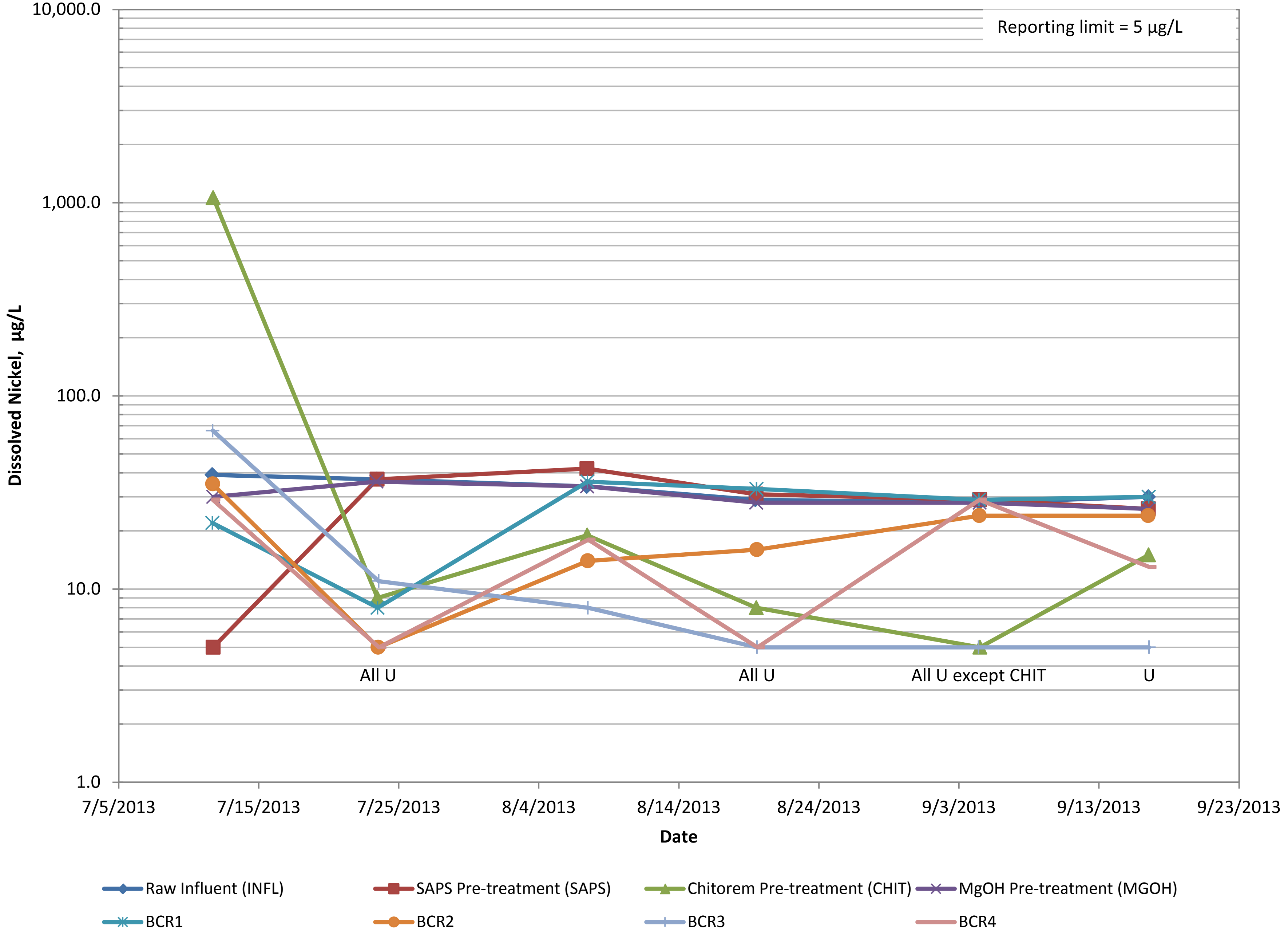


Figure 4.2-13
Dissolved Nickel Concentrations
Danny T Adit Treatability Study Year 1

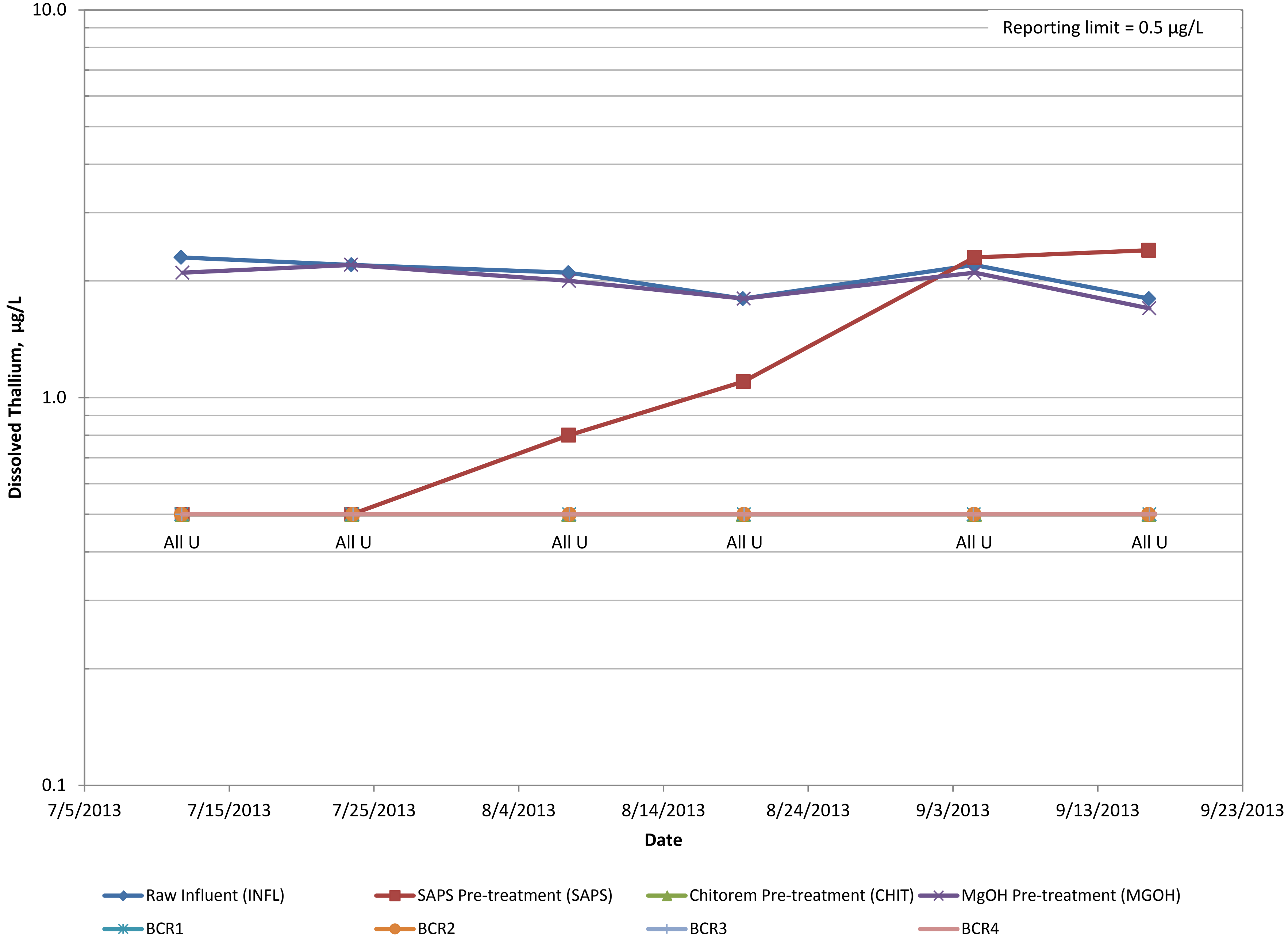


Figure 4.2-14
Dissolved Thallium Concentrations
Danny T Adit Treatability Study Year 1

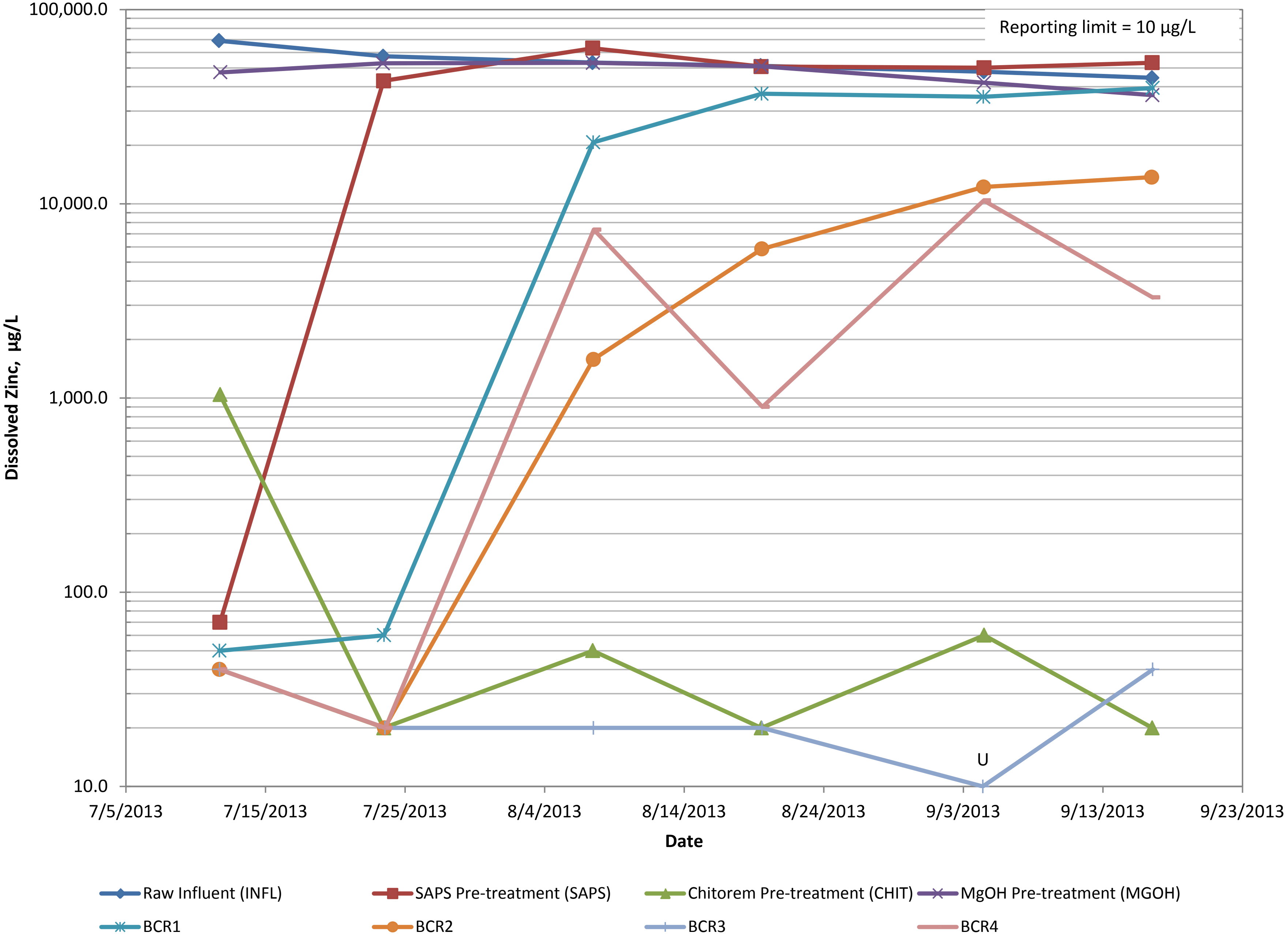


Figure 4.2-15
Dissolved Zinc Concentrations
Danny T Adit Treatability Study Year 1

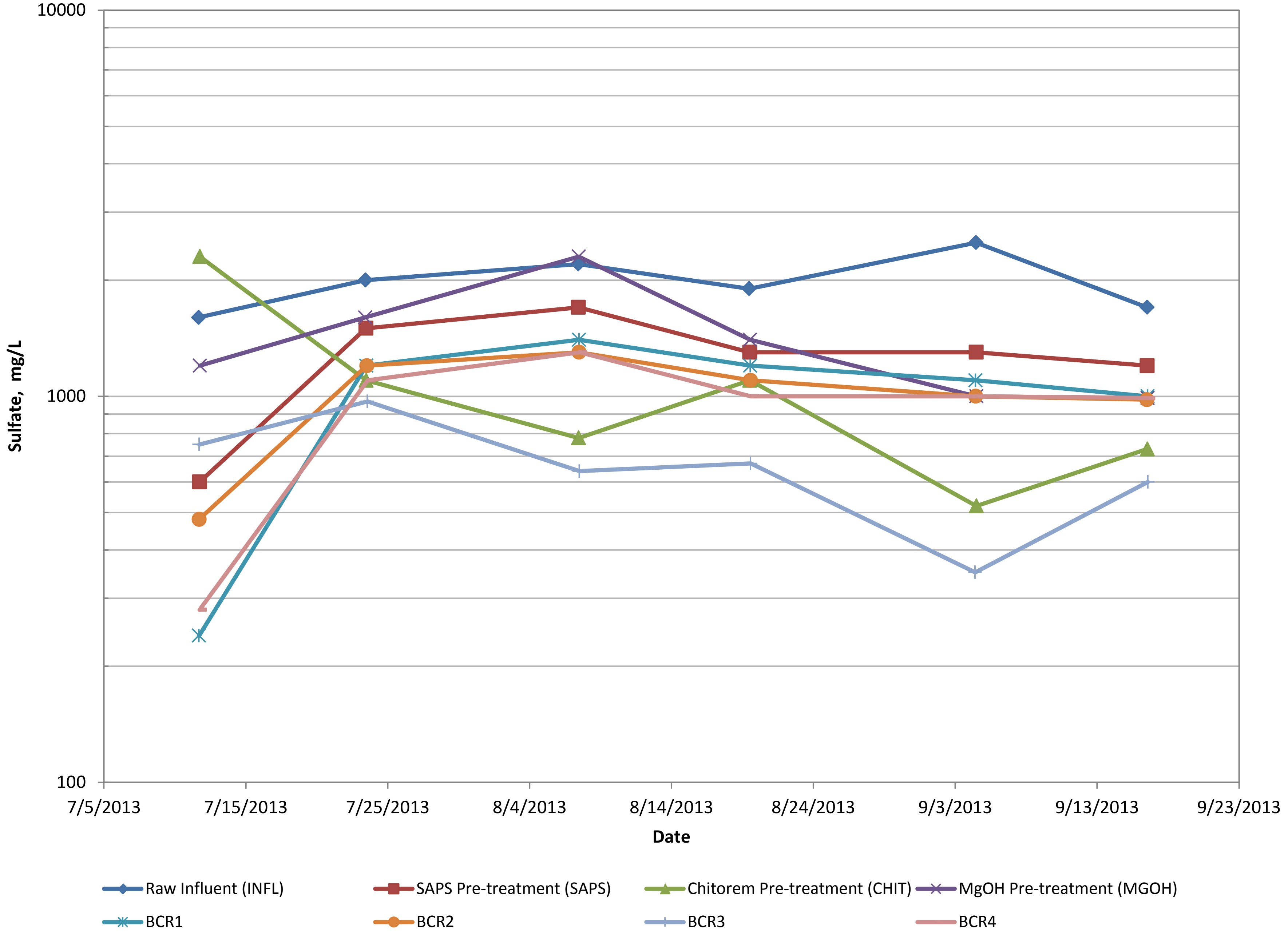


Figure 4.2-16
Sulfate Concentrations
Danny T Adit Treatability Study Year 1

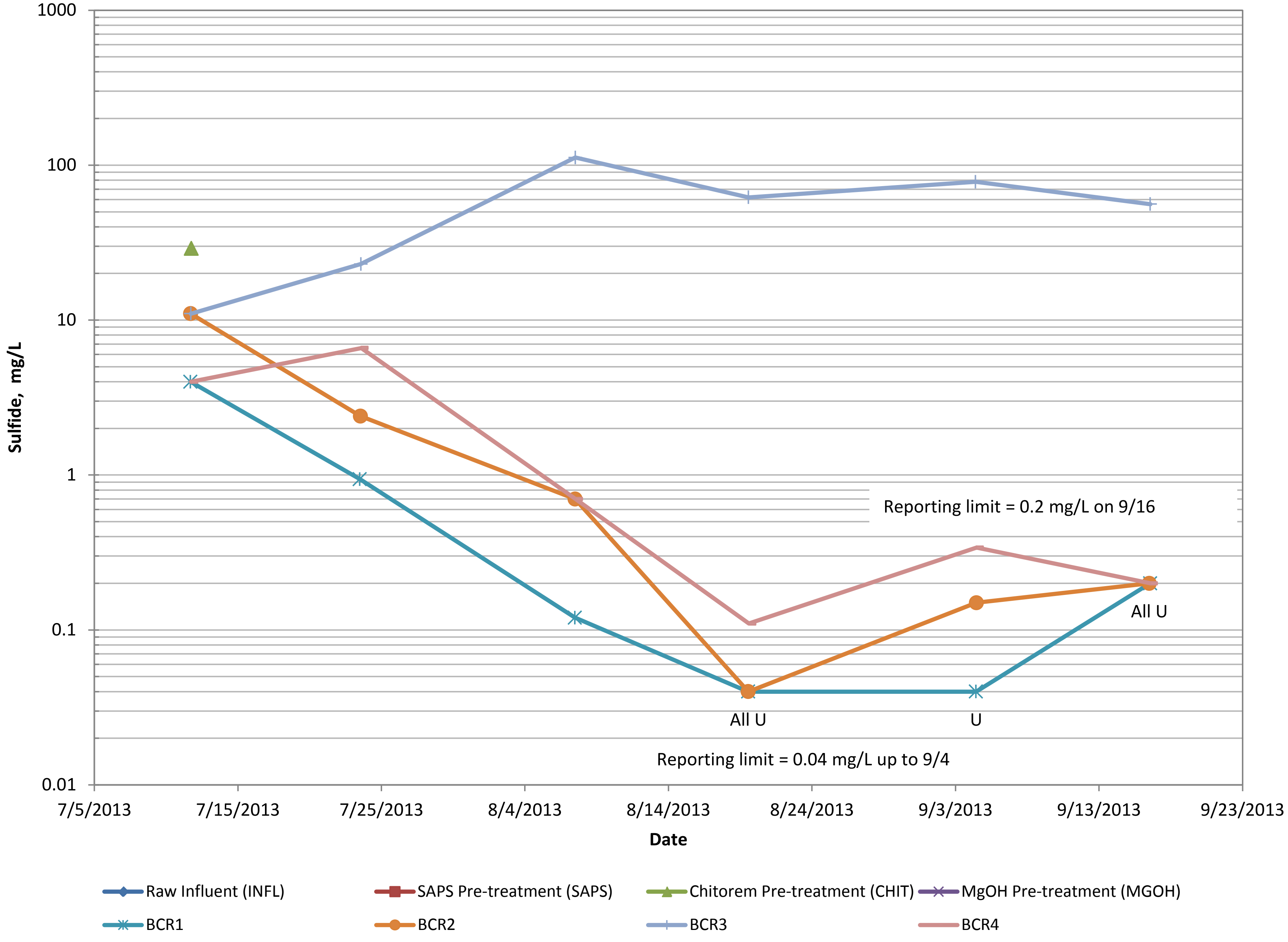


Figure 4.2-17
Sulfide Concentrations
Danny T Adit Treatability Study Year 1

CDM Smith

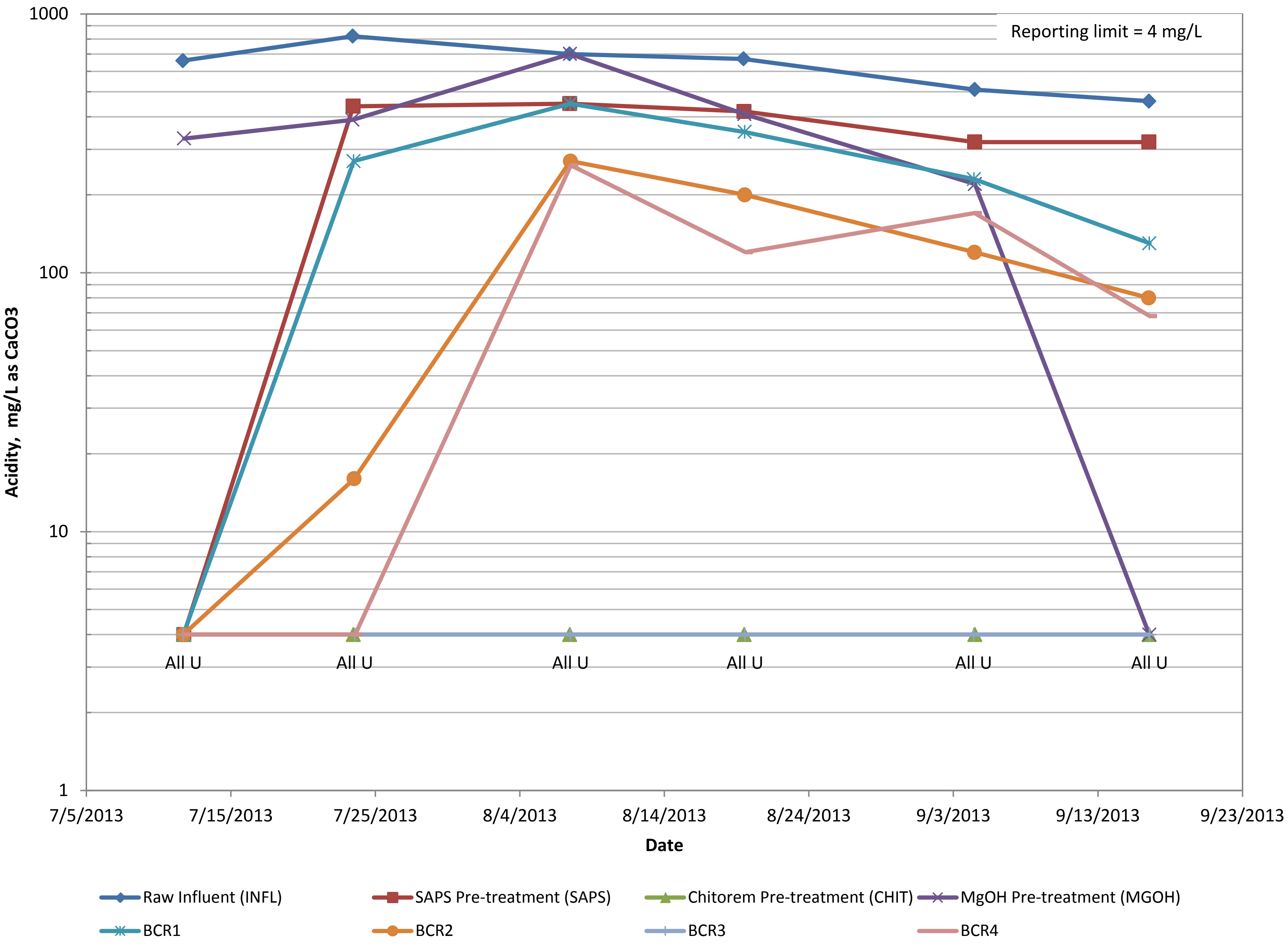


Figure 4.2-18
Acidity Concentrations
Danny T Adit Treatability Study Year 1

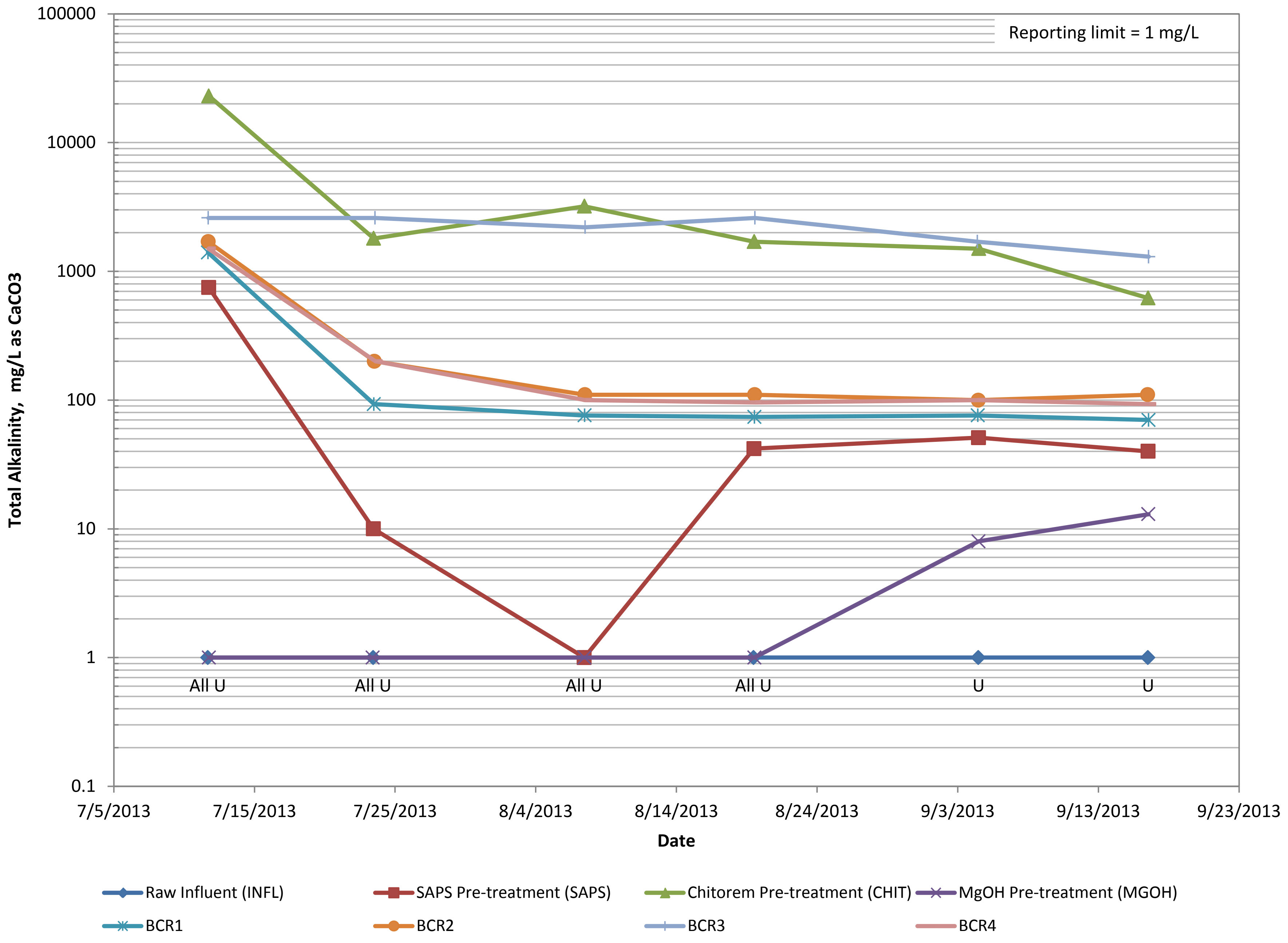
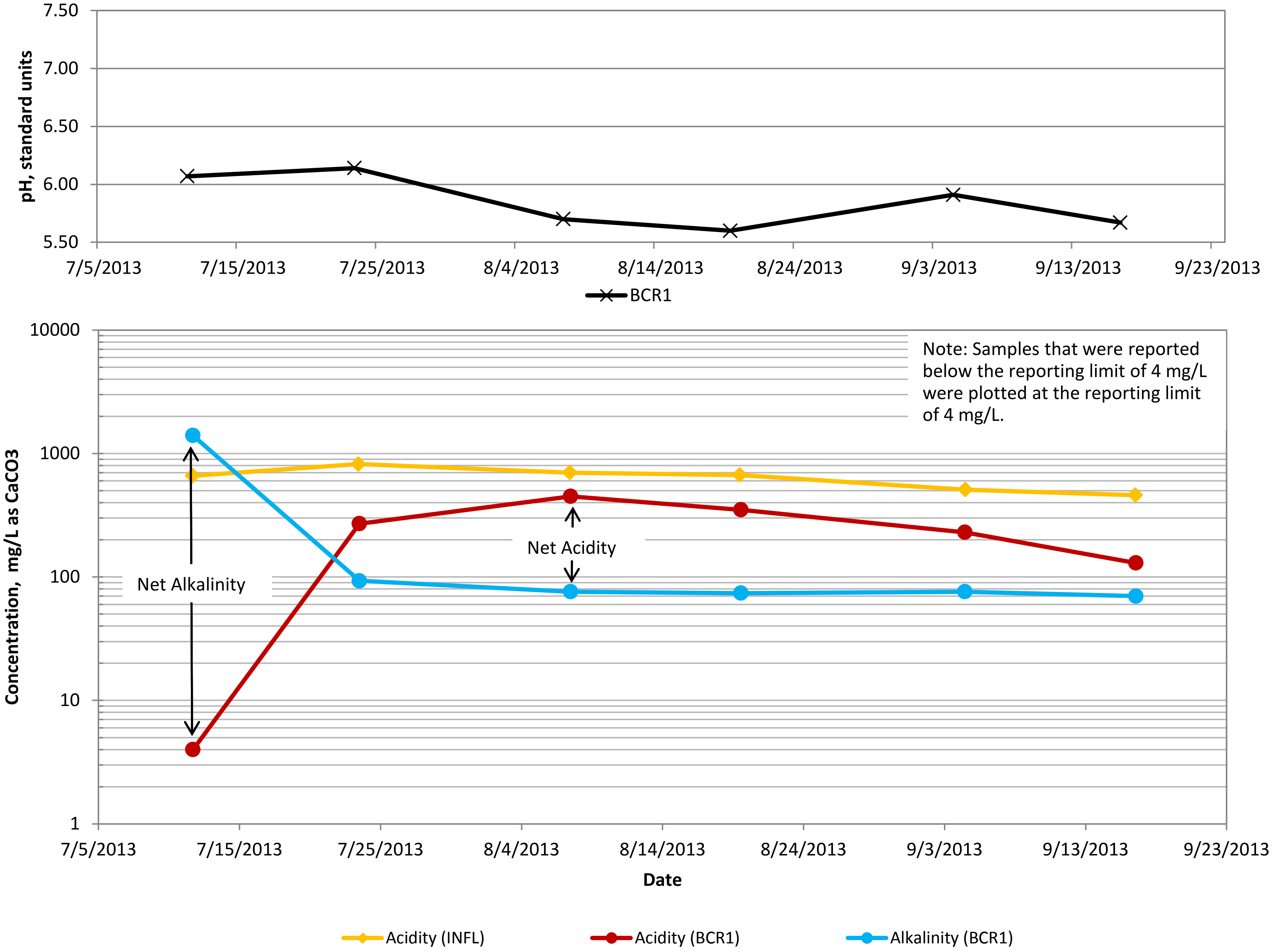


Figure 4.2-19
Alkalinity Concentrations
Danny T Adit Treatability Study Year 1



Note: Samples that were reported below the reporting limit of 4 mg/L were plotted at the reporting limit of 4 mg/L.

Figure 4.2-20
Trends in pH, Alkalinity and Acidity in BCR1
Danny T Adit Treatability Study Year 1

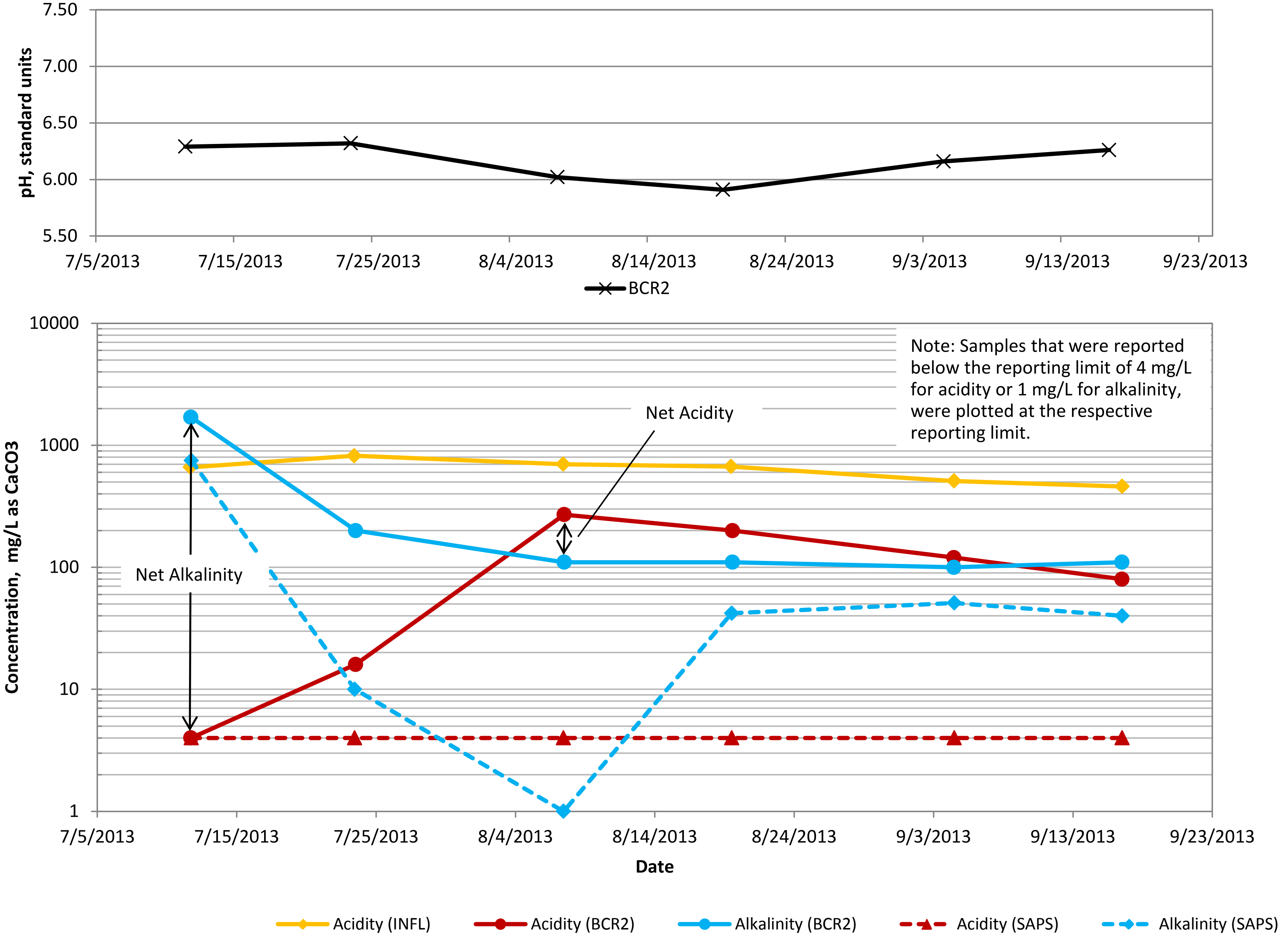
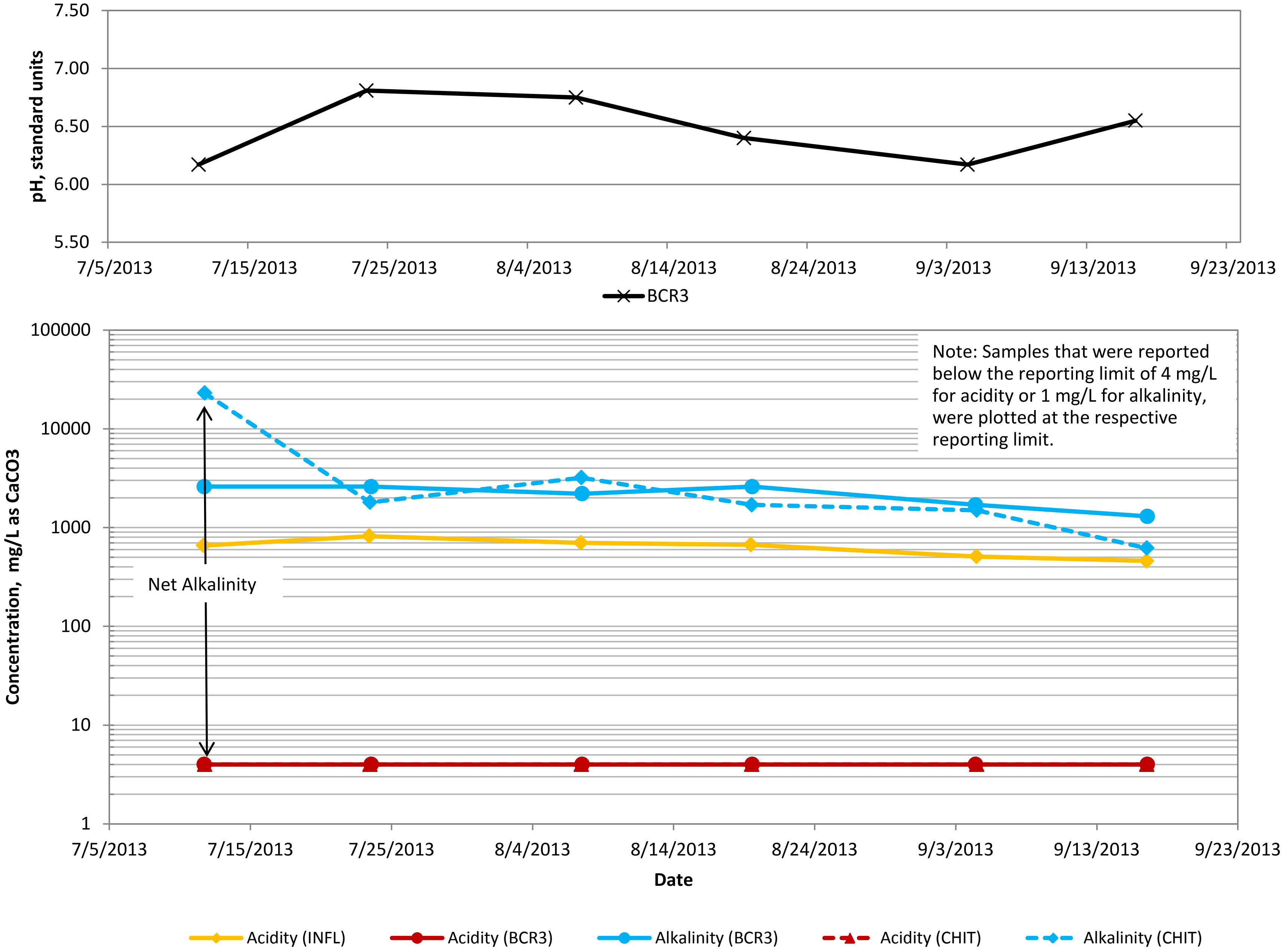
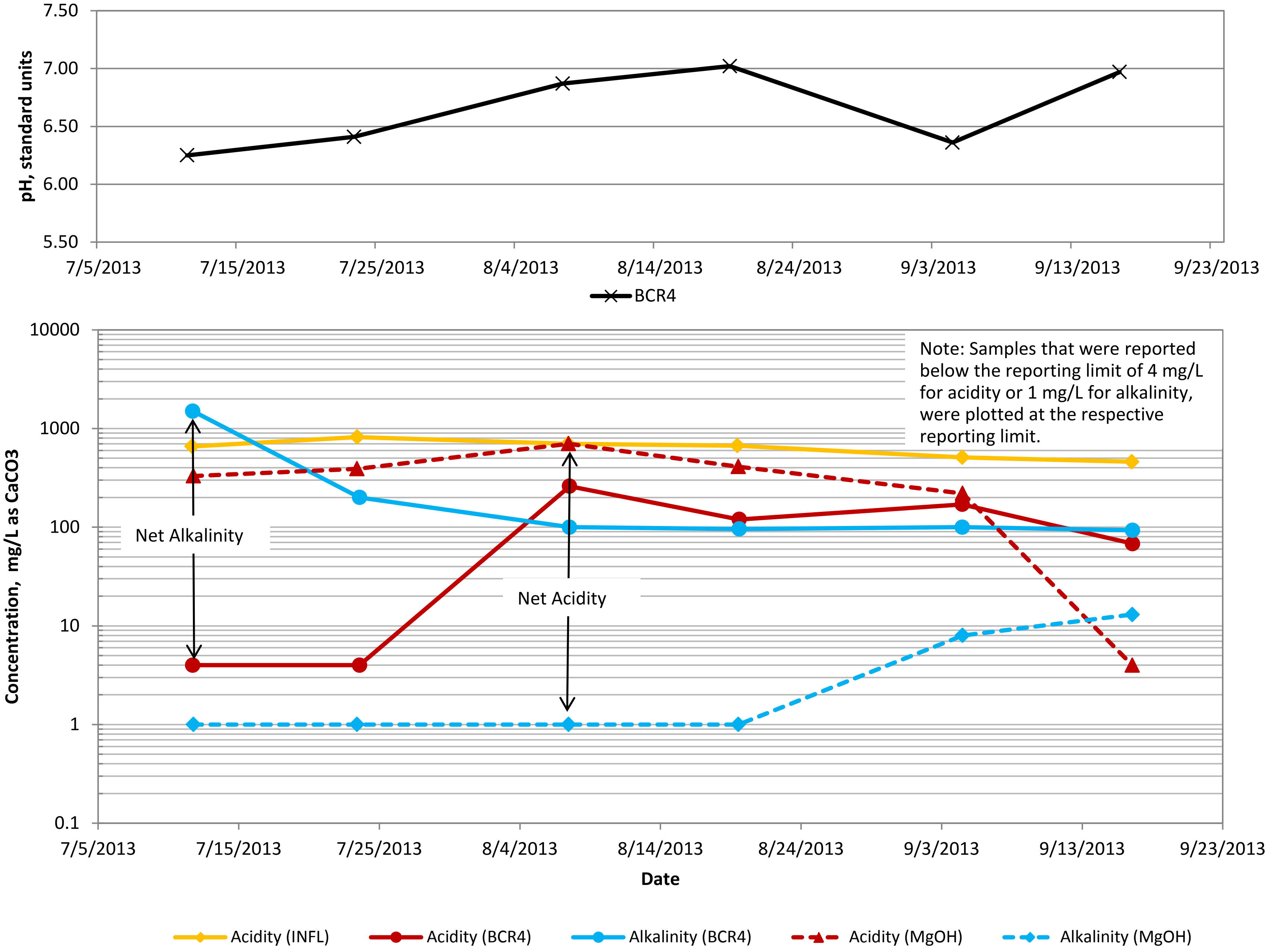


Figure 4.2-21
Trends in pH, Alkalinity and Acidity in BCR2
Danny T Adit Treatability Study Year 1



Note: Samples that were reported below the reporting limit of 4 mg/L for acidity or 1 mg/L for alkalinity, were plotted at the respective reporting limit.

Figure 4.2-22
Trends in pH, Alkalinity and Acidity in BCR3
Danny T Adit Treatability Study Year 1



Note: Samples that were reported below the reporting limit of 4 mg/L for acidity or 1 mg/L for alkalinity, were plotted at the respective reporting limit.

Figure 4.2-23

Trends in pH, Alkalinity and Acidity in BCR4

Danny T Adit Treatability Study Year 1

Appendix A

Data Evaluation Checklists

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Barker-Hughesville
Bench ScaleTreatability Study
Data Validation Worksheet
Stage 2A validation

Collection Date: 2/25-27/2013

Sample Delivery Group (SDG) Number: **C130301**
Laboratory: **Environmental Services Assistance Team (ESAT) Laboratory**

Matrix: Water

Analysis/Methods:

Dissolved Metals	EPA 200.7 and 200.8
Anions: Chloride, Fluoride and Sulfate	EPA 300.0
Total Suspended Solids	EPA 160.2
Alkalinity	EPA 310.1

Samples:

13BH-DT-BENCH-RAW
13BH-DT-BENCH-OXD
13BH-DT-BENCH-PH45-NAOH
13BH-DT-BENCH-PH45-CHIT
13BH-DT-BENCH-PH45-LIME
13BH-DT-BENCH-PH95-NAOH
13BH-DT-BENCH-PH95-CHIT
13BH-DT-BENCH-PH95-LIME
TSS only
13BH-DT-BENCH-PH45-NAOH-TSS
13BH-DT-BENCH-PH45-LIME-TSS
13BH-DT-BENCH-SPS-C1
13BH-DT-BENCH-SPS-C2
13BH-DT-BENCH-SPS-C3
13BH-DT-BENCH-CHI-C4

Reference Document Used in Data Validation:
USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review, January 2010 (NFGs)
Sampling and Analysis Plan Bench Scale Test of Passive Treatment of Danny T Discharge

Precision:	**Yes No N/A**
Are the field duplicate relative percent differences (RPD) acceptable?	**NA**
Are the laboratory duplicate (matrix duplicates) RPDs within the reporting limit (RL) absolute difference criteria when within 5x the RL?	**Yes**
Are the matrix spike duplicates RPD ≤ 20%?	**Yes**

Comments (note deviations):
Sample volume was limited and field duplicates were not collected, or required by the QAPP
Laboratory duplicate results are summarized below

Accuracy:	**Yes No N/A**
Were serial dilutions analyzed and within control limits of ±10% for waters (± for 15% for soils) or initial sample result less than 50x MDL?	**No**
Were matrix spike criteria met (frequency 20% and % recovery 75-125%)?	**Yes**
Was post digestion spike criteria met (if applicable)?	**Yes**
Was laboratory control sample criteria met?	**Yes**
Was laboratory blank criteria met (within control limits)?	**Yes**
Were ICV/CCV % recoveries within 90-110%?	**Yes**
Was a reporting limit standard analyzed?	**Yes**
Were ICSA/ICSAB % recoveries acceptable or within CRQL criteria?	**Yes**

Comments (note deviations):

Dissolved Method Blank 200.8

1303011-BLK1			RL
	selenium	0.62	1

LCS, MS/MSD all compliant

1303011-DUP1		3/7 - 3/8	C130301-1	MDL 2.5 (DF x 5)
			Duplicate	RPD
	selenium	7.14	5.14	33

RL = 1.0 x 5(DF), 20% does not apply

serial dilution
1303023-SRD1 All <10% C130301-1

1303010-BLK1 OE 200.7
all ND

LCS, Dup, MS/MSD all compliant 130310-DUP1 3/7 - 3/8

1303021-SRD1 Batch 1303021 - 1303010

	source	5x dilution	RPD
Copper	420.8	377.5	11

Total Method Blank

1303008-blk1 200.2 TR metals 200.8
all ND

1303008-DUP2 130301-22

		Duplicate	RL	RPD
Selenium	8.165	5.187	5	45
Thallium	34.63	9.886	5	111

RL = 1.0 x 5(DF), 20% does not apply

MS/MSD all compliant, post dig spike too all compliant

Serial Dilution

130301-22		Prep 3/6			
1303024-SRD1		source	5x dilution	MDL	RPD
	Arsenic	14.31	24.28	2.5	52
	Selenium	8.165	18.05	2.5	75
	Thallium	34.63	38.98	2.5	12

No outliers are > 50x the MDL. All compliant

1303008-blk1 200.2 TR metals 200.7
all ND

Lab dup see 1303008-DUP1 130301-22
all <2

MS/MSD all compliant, post dig spike too all compliant

Serial Dilution

130301-22	OE	3/6 - 3/8			
1303022-SRD1		source	5x dilution	MDL	RPD
	Copper	426.2	1469	10	110
	Sodium	5775	6864	1250	17

No outliers are > 50x the MDL. All compliant

Representativeness:	**Yes No N/A**
Were sampling procedures and design criteria met?	**Yes**
Were holding times met?	**Yes**
Was preservation criteria met? (4° C ± 2° C)?	**Yes**
Were Chain-of-Custody records complete and provided in data package?	**Yes**

Comments (note deviations):

Comparability:	**Yes No N/A**
Were analytical procedures and methods follows as defined in the QAPP or field change documentation?	**Yes**

Comments (note deviations):

Completeness (90%):	**Yes No N/A**
Are all data in this SDG usable?	**Yes**

Comments (note deviations):

Sensitivity:	**Yes No N/A**
Do the reporting limits meet project requirements?	**Yes**

Comments (note deviations):

Data Validator: Kimberly Zilis Date: 2/1/2014

Barker-Hughesville
Bench ScaleTreatability Study
Data Validation Worksheet
Stage 2A validation

Collection Date: 2/25-27/2013

Sample Delivery Group (SDG) Number: **H13030003**
Laboratory: **Energy Laboratories**

Matrix: Water
Analysis/Methods: Acidity SM 2310B

Samples:

13BH-DT-BENCH-RAW
13BH-DT-BENCH-OXD
13BH-DT-BENCH-PH45-NAOH
13BH-DT-BENCH-PH45-CHIT
13BH-DT-BENCH-PH45-LIME
13BH-DT-BENCH-PH95-NAOH
13BH-DT-BENCH-PH95-LIME
13BH-DT-BENCH-SPS-C1
13BH-DT-BENCH-SPS-C2
13BH-DT-BENCH-SPS-C3
13BH-DT-BENCH-CHI-C4

Reference Document Used in Data Validation:

USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review, January 2010 (NFGs)
Sampling and Analysis Plan Bench Scale Test of Passive Treatment of Danny T Discharge

Precision:	**Yes No N/A**
Are the field duplicate relative percent differences (RPD) acceptable?	**NA**
Are the laboratory duplicate (matrix duplicates) RPDs within the reporting limit (RL) absolute difference criteria when within 5x the RL?	**Yes**
Are the matrix spike duplicates RPD ≤ 20%?	**Yes**

Comments (note deviations):

Sample volume was limited and field duplicates were not collected, or required by the QAPP

Accuracy:	**Yes No N/A**
Was laboratory control sample criteria met?	**Yes**
Was laboratory blank criteria met (within control limits)?	**Yes**

Comments (note deviations):

Representativeness:	**Yes No N/A**
Were sampling procedures and design criteria met?	**Yes**
Were holding times met?	**Yes**
Was preservation criteria met? (4° C ± 2° C)?	**Yes**
Were Chain-of-Custody records complete and provided in data package?	**Yes**

Comments (note deviations):

Comparability:	**Yes No N/A**
Were analytical procedures and methods follows as defined in the QAPP or field change documentation?	**Yes**

Comments (note deviations):

Completeness (90%):	**Yes No N/A**
Are all data in this SDG usable?	**Yes**

Comments (note deviations):

Sensitivity:	**Yes No N/A**
Do the reporting limits meet project requirements?	**Yes**

Comments (note deviations):

Data Validator: Kimberly Zilis

Date: 2/1/2014

Barker-Hughesville
Treatability Study
Data Validation Worksheet
Stage 2A validation
End of Test Samples

Collection Date: 4/15/2013

Sample Delivery Group (SDG) Number:	**H13040227**
Laboratory:	**Energy Laboratories**

Matrix: Water

Analysis/Methods:

Dissolved Metals	EPA 200.7 and 200.8
Anions: Chloride and Sulfate	EPA 300.0
Fluoride	SM 4500-F C
Sulfide	SM 4500-S F
Total Suspended Solids	SM 2540D
Acidity	SM 2310B
Alkalinity	SM 2320B
Biological Oxygen Demand (BOD)	SM 5210B

Samples:

13BH-DT-BENCH-BCR-C1
13BH-DT-BENCH-BCR-C2
13BH-DT-BENCH-BCR-C3
13BH-DT-BENCH-BCR-C4

Reference Document Used in Data Validation:

USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review, January 2010 (NFGs)
Sampling and Analysis Plan Bench Scale Test of Passive Treatment of Danny T Discharge

Precision:	**Yes No N/A**
Are the field duplicate relative percent differences (RPD) acceptable?	**NA**
Are the laboratory duplicate RPDs ≤ 20% for water ≤35% for soils or within the reporting limit (RL) absolute difference criteria when within 5x the RL?	**Yes**
Are the matrix spike duplicates RPD ≤ 20%?	**Yes**

Comments (note deviations):

Laboratory Duplicates

Laboratory duplicates were available for alkalinity, TSS and BOD only, and compared within 20% RPD

Accuracy:	**Yes No N/A**
Were serial dilutions analyzed and within control limits of ±10% for waters (± for 15% for soils) or initial sample result less than 50x MDL?	**No**
Were matrix spike criteria met (frequency 20% and % recovery 75-125%)?	**Yes**
Was post digestion spike criteria met (if applicable)?	**N/A**
Was laboratory control sample criteria met?	**Yes**
Was laboratory blank criteria met (within control limits)?	**Yes**
Were ICV/CCV % recoveries within 90-110%?	**Yes**
Was a reporting limit standard analyzed?	**No**
Were ICSA/ICSAB % recoveries acceptable or within CRQL criteria?	**Yes**

Comments (note deviations):

Serial Dilution

The laboratory did not report results for a serial dilution.

Standards

As a level 2A validation, standards evaluation is not required. The laboratory did not report results for a reporting limit standard.

Blanks

Energy reports the method blank down to the MDL.

No analytes were reported in the method blank at a concentration greater than the RL, no sample values were within 5 times a reported blank value. No qualifiers have been applied

Reporting Limits and Analytical method

Calcium, Iron, Magnesium, Potassium and Sodium were reported from method 200.7, the rest of the analytes were reported from the ICP-MS method, 200.8

The method blank reporting limit is the MDL. The instrument reporting limit, or the practical reporting limit (PQL) is significantly higher than the MDL, and the same PQL is reported whether reported by ICP-MS or ICP-AES. The dilution factor was not reported. The PQL does not increase with the dilution until the MDL x the Dilution Factor (DF) is greater than the PQL. The lab does not provide "J" qualifiers. Therefore, when a dilution factor is not required (DF = 1) and an analyte is detected below the PQL, that analyte is not reported. However when a dilution is required, the diluted sample concentration can approach the MDL but will be reported without a "J" qualifier.

Matrix Spikes

Metals matrix spike recoveries outside the laboratory defined limits are summarized below. The laboratory provides results for multiple spike analyses without clear distinction between batch association, dilutions, sample or spiked concentrations. The outliers are presented below. Qualifiers have not been applied because the data presentation is insufficient, and with the exception of rejected data, qualifiers would not affect the use of the data.

	MS % recovery	MSD % recovery	Limit	**Qualifier**
Cadmium	20	19	70-130	None
Sulfate	111	110	90-110	

Neither of the above results were spike results from the bench scale samples. They are non-project samples.

Representativeness:	**Yes No N/A**
Were sampling procedures and design criteria met?	**Yes**
Were holding times met?	**Yes**
Was preservation criteria met? (4° C ± 2° C)?	**Yes**
Were Chain-of-Custody records complete and provided in data package?	**Yes**

Comments (note deviations):

Comparability:	**Yes No N/A**
Were analytical procedures and methods follows as defined in the QAPP or field change documentation?	**Yes**

Comments (note deviations):

Completeness (90%):	**Yes No N/A**
Are all data in this SDG usable?	**Yes**

Comments (note deviations):

Sensitivity:	**Yes No N/A**
Do the reporting limits meet project requirements?	**Yes**

Comments (note deviations):

Data Validator: Kimberly Zilis

Date: 1/20/2014

Barker-Hughesville
Treatability Study
Data Validation Worksheet
Stage 2A validation
Sampling Event 1

Collection Date: 7/11/2013

Sample Delivery Group (SDG) Number: **H13070211**
Laboratory: **Energy Laboratories**

Matrix: Water

Analysis/Methods:

Total and Dissolved Metals	EPA 200.7 and 200.8
Anions: Chloride and Sulfate	EPA 300.0
Fluoride	SM 4500-F C
ortho-Phosphate	SM 2540C
Sulfide	SM 4500-S D
Total Dissolved Solids	SM 2540C
Acidity	SM 2310B
Alkalinity	SM 2320B

Samples:

13BH-DT-PILOT-INFL-071113
13BH-DT-PILOT-INFLD-071113
13BH-DT-PILOT-BCR1-071113
13BH-DT-PILOT-BCR2-071113
13BH-DT-PILOT-BCR3-071113
13BH-DT-PILOT-BCR4-071113
13BH-DT-PILOT-SAPS-071113
13BH-DT-PILOT-CHIT-071113
13BH-DT-PILOT-MGOH-071113

Reference Document Used in Data Validation:

USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review, January 2010 (NFGs)
Sampling and Analysis Plan Bench Scale Test of Passive Treatment of Danny T Discharge

Metals

Precision:	**Yes No N/A**
Are the field duplicate relative percent differences (RPD) acceptable?	**No**
Are the laboratory duplicate RPDs ≤ 20% for water ≤35% for soils or within the reporting limit (RL) absolute difference criteria when within 5x the RL?	**Yes**
Are the matrix spike duplicates RPD ≤ 20%?	**Yes**

Comments (note deviations):

Not all methods used the same laboratory QC measures for precision. The following summarizes laboratory QC precision and accuracy measures:

sample dup/matrix spike	**matrix spike/matrix spike duplicate**
alkalinity	fluoride
TDS	sulfide
	metals
	chloride and sulfate
	ortho-phosphate

Field Duplicates

Field duplicate acceptance criteria is not defined in the SAP. The NFGs suggest ≤ 20% for water samples, but that may not be applicable to treatability samples. Results greater than 20% difference are summarized, but no qualifiers have been applied.

Sample 13BH-DT-PILOT-INFLD-071113 is a field duplicate of 13BH-DT-PILOT-INFL-071113

All results are in mg/L

	Sample	**Duplicate**		**Reporting Limit (RL)**	**Abs difference**
Dissolved Metals					
aluminum	15.6	7.87	**65.9**		
manganese	124	63.7	**64.3**		
sodium	6	4	**40.0**	Reporting limit is 1.0. Absolute difference comparison applies because one result is within 5 times the RL. Outside ± the RL (1.0)	
thallium	0.0023	0.0032	**32.7**	0.0005	**0.0009**
zinc	69.1	34.8	**66.0**		

Total Metals, and other analyses all compared within 20% RPD

Laboratory Duplicates

Laboratory duplicates were available for alkalinity and TDS only, and compared within 20% RPD

Accuracy:	**Yes No N/A**
Were serial dilutions analyzed and within control limits of ±10% for waters (± for 15% for soils) or initial sample result less than 50x MDL?	**No**
Were matrix spike criteria met (frequency 20% and % recovery 75-125%)?	**Yes**
Was post digestion spike criteria met (if applicable)?	**N/A**
Was laboratory control sample criteria met?	**Yes**
Was laboratory blank criteria met (within control limits)?	**Yes**
Were ICV/CCV % recoveries within 90-110%?	**Yes**
Was a reporting limit standard analyzed?	**No**
Were ICSA/ICSAB % recoveries acceptable or within CRQL criteria?	**Yes**

Comments (note deviations):

Serial Dilution

A serial dilution was not performed.

Blanks

Energy reports the method blank down to the MDL.

No analytes was reported in the method blank at a concentration greater than the RL with the exception of alkalinity on 7/17/2013, for the analysis of sample 13BH-DT-PILOT-MGOH-071113.

	Result	Reporting limit	Sample Result
Alkalinity	2	1	23,000

No qualifiers were applied on the basis of blank results

Reporting Limits and Analytical method

The laboratory uses Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) and Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES) (methods 200.7 and 200.8) interchangeably. Zinc and manganese may be reported by one method for the total fraction and by the other for the dissolved fraction.

The method blank reporting limit is the MDL. The instrument reporting limit, or the practical reporting limit (PQL) is significantly higher than the MDL, and the same PQL is reported whether the analysis was performed by ICP-MS or ICP-AES. The dilution factor was not reported and has been requested of the laboratory. The PQL does not increase with the dilution until the MDL x the Dilution Factor (DF) is greater than the PQL. The lab does not provide "J" qualifiers. Therefore, when a dilution factor is not required (DF = 1) and an analyte is detected below the PQL, that analyte is not reported. However when a dilution is required, the diluted sample concentration can approach the MDL but will be reported without a "J" qualifier.

Matrix Spikes

Matrix spike recoveries outside the laboratory defined limits are summarized below. The laboratory provides results for multiple spike analyses without clear distinction between dissolved and total, batch association, dilutions, sample or spiked concentrations. The outliers are presented below. Qualifiers have not been applied because the data presentation is insufficient, and with the exception of rejected data, qualifiers would not affect the use of the data.

	% Recovery	Limit
Dissolved Silver	65/61	70-130
Sulfate	67/69	90-110
ortho-Phosphate	115/119	90-110

Representativeness:	**Yes No N/A**
Were sampling procedures and design criteria met?	**Yes**
Were holding times met?	**Yes**
Was preservation criteria met? (4° C ± 2° C)?	**Yes**
Were Chain-of-Custody records complete and provided in data package?	**Yes**

Comments (note deviations):

Comparability:	**Yes No N/A**
Were analytical procedures and methods follows as defined in the QAPP or field change documentation?	**Yes**

Comments (note deviations):

Completeness (90%):	**Yes No N/A**
Are all data in this SDG usable?	**Yes**

Comments (note deviations):

Sensitivity:	**Yes No N/A**
Are MDLs present and reported?	**Yes**
Do the reporting limits meet project requirements?	**Yes**

Comments (note deviations):

Data Validator: Kimberly Zilis Date: 1/17/2014

Barker-Hughesville
Treatability Study
Data Validation Worksheet
Stage 2A validation
Sampling Event 2

Collection Date: 7/23/2013

Sample Delivery Group (SDG) Number: **H13070431**
Laboratory: **Energy Laboratories**

Matrix: Water

Analysis/Methods:

Dissolved Metals	EPA 200.7 and 200.8
Anions: Chloride and Sulfate	EPA 300.0
Fluoride	SM 4500-F C
ortho-Phosphate	SM 2540C
Sulfide	SM 4500-S D
Total Dissolved Solids	SM 2540C
Acidity	SM 2310B
Alkalinity	SM 2320B
Samples 13BH-DT-PILOT-BCR2-072313 and 13BH-DT-PILOT-BCR2-POST only	
Biological Oxygen Demand (BOD)	SM 5210B
Ammonia	EPA 350.1

Samples:

- 13BH-DT-PILOT-INFL-072313
- 13BH-DT-PILOT-MGOH-072313
- 13BH-DT-PILOT-SAPS-072313
- 13BH-DT-PILOT-CHIT-072313
- 13BH-DT-PILOT-BCR1-072313
- 13BH-DT-PILOT-BDR1-072313
- 13BH-DT-PILOT-BCR2-072313
- 13BH-DT-PILOT-BCR3-072313
- 13BH-DT-PILOT-BCR4-072313
- 13BH-DT-PILOT-BCR2-POST

Reference Document Used in Data Validation:

USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review, January 2010 (NFGs)
Sampling and Analysis Plan Bench Scale Test of Passive Treatment of Danny T Discharge

Precision:	**Yes No N/A**
Are the field duplicate relative percent differences (RPD) acceptable?	**No**
Are the laboratory duplicate RPDs ≤ 20% for water ≤35% for soils or within the reporting limit (RL) absolute difference criteria when within 5x the RL?	**Yes**
Are the matrix spike duplicates RPD ≤ 20%?	**Yes**

Comments (note deviations):

Not all methods used the same laboratory QC measures for precision. The following summarizes laboratory QC precision and accuracy measures:

sample dup/matrix spike	**matrix spike/matrix spike duplicate**
alkalinity	fluoride
TDS	sulfide
	metals
	chloride and sulfate
	ortho-phosphate

Field Duplicates

Field duplicate acceptance criteria is not defined in the SAP. The NFGs suggest ≤ 20% for water samples, but that may not be applicable to treatability samples. Results greater than 20% difference are summarized, but no qualifiers have been applied.

Sample 13BH-DT-PILOT-BDR1-072313 is a field duplicate of 13BH-DT-PILOT-BCR1-072313
All results are in mg/L
Note: Only dissolved metals are requested for this event.

	Sample	**Duplicate**		**Reporting Limit (RL)**	**Abs difference**
cobalt	0.028	0.04	**35.3**	0.005	NA

All other analytes compared within a 20% RPD

Laboratory Duplicates

Laboratory duplicates were available for alkalinity and TDS only, and compared within 20% RPD

Accuracy:	**Yes No N/A**
Were serial dilutions analyzed and within control limits of ±10% for waters (± for 15% for soils) or initial sample result less than 50x MDL?	**No**
Were matrix spike criteria met (frequency 20% and % recovery 75-125%)?	**Yes**
Was post digestion spike criteria met (if applicable)?	**N/A**
Was laboratory control sample criteria met?	**Yes**
Was laboratory blank criteria met (within control limits)?	**Yes**
Were ICV/CCV % recoveries within 90-110%?	**Yes**
Was a reporting limit standard analyzed?	**No**
Were ICSA/ICSAB % recoveries acceptable or within CRQL criteria?	**Yes**

Comments (note deviations):

Serial Dilution

A serial dilution was not performed.

Standards

As a level 2A validation, standard evaluation is not required. The laboratory did not report results for a reporting limit standard.

Blanks

Energy reports the method blank down to the MDL.
No analytes was reported in the method blank at a concentration greater than the RL, no sample values were within 5 times a reported blank value. No qualifiers have been applied

Reporting Limits and Analytical method

The laboratory uses Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) and Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES) (methods 200.7 and 200.8) interchangeably. Almost all data was reported from ICP-MS analysis except for Manganese which was reported entirely by ICP-AES, and aluminum and zinc for which the higher concentration samples were reported by ICP-AES.

The method blank reporting limit is the MDL. The instrument reporting limit, or the practical reporting limit (PQL) is significantly higher than the MDL, and the same PQL is reported whether the analysis was performed by ICP-MS or ICP-AES. The dilution factor was not reported and has been requested of the laboratory. The PQL does not increase with the dilution until the MDL x the Dilution Factor (DF) is greater than the PQL. The lab does not provide "J" qualifiers. Therefore, when a dilution factor is not required (DF = 1) and an analyte is detected below the PQL, that analyte is not reported. However when a dilution is required, the diluted sample concentration can approach the MDL but will be reported without a "J" qualifier.

Matrix Spikes

All matrix spike recoveries were within criteria.

Representativeness:	**Yes No N/A**
Were sampling procedures and design criteria met?	**Yes**
Were holding times met?	**Yes**
Was preservation criteria met? (4° C ± 2° C)?	**Yes**
Were Chain-of-Custody records complete and provided in data package?	**Yes**

Comments (note deviations):

Comparability:	**Yes No N/A**
Were analytical procedures and methods follows as defined in the QAPP or field change documentation?	**Yes**

Comments (note deviations):

Completeness (90%):	**Yes No N/A**
Are all data in this SDG usable?	**Yes**

Comments (note deviations):

Sensitivity:	**Yes No N/A**
Do the reporting limits meet project requirements?	**Yes**

Comments (note deviations):

Data Validator: Kimberly Zilis Date: 1/20/2014

Barker-Hughesville
Treatability Study
Data Validation Worksheet
Stage 2A validation
Sampling Event 3

Collection Date: 8/07/2013

Sample Delivery Group (SDG) Number: **H13080161**
Laboratory: **Energy Laboratories**

Matrix: Water

Analysis/Methods:		
	Dissolved Metals	EPA 200.7 and 200.8
	Anions: Chloride and Sulfate	EPA 300.0
	Fluoride	SM 4500-F C
	ortho-Phosphate	SM 2540C
	Sulfide	SM 4500-S D
	Total Dissolved Solids	SM 2540C
	Acidity	SM 2310B
	Alkalinity	SM 2320B
Samples 13BH-DT-PILOT-BCR3-080713 and 13BH-DT-PILOT-BCR3-POST-080713 only		
	Biological Oxygen Demand (BOD)	SM 5210B
	Ammonia	EPA 350.1

Samples:

13BH-DT-PILOT-INFL-080713
13BH-DT-PILOT-SAPS-080713
13BH-DT-PILOT-CHIT-080713
13BH-DT-PILOT-MGOH-080713
13BH-DT-PILOT-BCR1-080713
13BH-DT-PILOT-BCR2-080713
13BH-DT-PILOT-BCR3-080713
13BH-DT-PILOT-BCR4-080713
13BH-DT-PILOT-BDR4-080713
13BH-DT-PILOT-BCR3-POST-080713

Reference Document Used in Data Validation:

USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review, January 2010 (NFGs)
Sampling and Analysis Plan Bench Scale Test of Passive Treatment of Danny T Discharge

Precision:	**Yes No N/A**
Are the field duplicate relative percent differences (RPD) acceptable?	**No**
Are the laboratory duplicate RPDs ≤ 20% for water ≤35% for soils or within the reporting limit (RL) absolute difference criteria when within 5x the RL?	**Yes**
Are the matrix spike duplicates RPD ≤ 20%?	**Yes**

Comments (note deviations):

Not all methods used the same laboratory QC measures for precision. The following summarizes laboratory QC precision and accuracy measures:

sample dup/matrix spike	**matrix spike/matrix spike duplicate**
alkalinity	fluoride
TDS	sulfide
	metals
	chloride and sulfate
	ortho-phosphate

Field Duplicates

Field duplicate acceptance criteria is not defined in the SAP. The NFGs suggest ≤ 20% for water samples, but that may not be applicable to treatability samples. Results greater than 20% difference are summarized, but no qualifiers have been applied.

Sample 13BH-DT-PILOT-BDR4-080713 is a field duplicate of 13BH-DT-PILOT-BCR4-080713

All results are in mg/L

Note: Only dissolved metals are requested for this event.

All analytes compared within a 20% RPD

Laboratory Duplicates

Laboratory duplicates were available for alkalinity and TDS only, and compared within 20% RPD

Accuracy:	**Yes No N/A**
Were serial dilutions analyzed and within control limits of ±10% for waters (± for 15% for soils) or initial sample result less than 50x MDL?	**No**
Were matrix spike criteria met (frequency 20% and % recovery 75-125%)?	**Yes**
Was post digestion spike criteria met (if applicable)?	**N/A**
Was laboratory control sample criteria met?	**Yes**
Was laboratory blank criteria met (within control limits)?	**Yes**
Were ICV/CCV % recoveries within 90-110%?	**Yes**
Was a reporting limit standard analyzed?	**No**
Were ICSA/ICSAB % recoveries acceptable or within CRQL criteria?	**Yes**

Comments (note deviations):

Serial Dilution

The laboratory did not report results for a serial dilution.

Standards

As a level 2A validation, standards evaluation is not required. The laboratory did not report results for a reporting limit standard.

Blanks

Energy reports the method blank down to the MDL.
No analytes was reported in the method blank at a concentration greater than the RL, no sample values were within 5 times a reported blank value. No qualifiers have been applied

Reporting Limits and Analytical method

The laboratory uses Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) and Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES) (methods 200.7 and 200.8) interchangeably. Almost all data was reported from ICP-MS analysis except for Manganese which was reported entirely by ICP-AES, and aluminum and zinc for which the higher concentration samples were reported by ICP-AES.

The method blank reporting limit is the MDL. The instrument reporting limit, or the practical reporting limit (PQL) is significantly higher than the MDL, and the same PQL is reported whether the analysis was performed by ICP-MS or ICP-AES. The dilution factor was not reported and has been requested of the laboratory. The PQL does not increase with the dilution until the MDL x the Dilution Factor (DF) is greater than the PQL. The lab does not provide "J" qualifiers. Therefore, when a dilution factor is not required (DF = 1) and an analyte is detected below the PQL, that analyte is not reported. However when a dilution is required, the diluted sample concentration can approach the MDL but will be reported without a "J" qualifier.

Matrix Spikes

	MS % recovery	MSD % recovery	Limit	**Qualifier**
Fluoride	35	35	85-115	**J**

Metals matrix spike recoveries outside the laboratory defined limits are summarized below. The laboratory provides results for multiple spike analyses without clear distinction between batch association, dilutions, sample or spiked concentrations. The outliers are presented below. Qualifiers have not been applied because the data presentation is insufficient, and with the exception of rejected data, qualifiers would not affect the use of the data.

	MS % recovery	MSD % recovery	Limit	**Qualifier**
Silver	64	70	70-130	None

Representativeness:	**Yes No N/A**
Were sampling procedures and design criteria met?	**Yes**
Were holding times met?	**Yes**
Was preservation criteria met? (4° C ± 2° C)?	**Yes**
Were Chain-of-Custody records complete and provided in data package?	**Yes**

Comments (note deviations):

Comparability:	**Yes No N/A**
Were analytical procedures and methods follows as defined in the QAPP or field change documentation?	**Yes**

Comments (note deviations):

Completeness (90%):	**Yes No N/A**
Are all data in this SDG usable?	**Yes**

Comments (note deviations):

Sensitivity:	**Yes No N/A**
Do the reporting limits meet project requirements?	**Yes**

Comments (note deviations):

Data Validator: Kimberly Zilis

Date: 1/20/2014

Barker-Hughesville
Treatability Study
Data Validation Worksheet
Stage 2A validation
Sampling Event 4

Collection Date: 8/19/2013

Sample Delivery Group (SDG) Number: **H13080347**
Laboratory: **Energy Laboratories**

Matrix: Water
Analysis/Methods:

Dissolved Metals	EPA 200.7 and 200.8
Anions: Chloride and Sulfate	EPA 300.0
Fluoride	SM 4500-F C
ortho-Phosphate	SM 2540C
Sulfide	SM 4500-S D
Total Dissolved Solids	SM 2540C
Acidity	SM 2310B
Alkalinity	SM 2320B

Samples 13BH-DT-PILOT-BCR2-081913 and 13BH-DT-PILOT-BCR2-081913-POST only

Biological Oxygen Demand (BOD)	SM 5210B
Ammonia	EPA 350.1

Samples:

13BH-DT-PILOT-INFL-081913
13BH-DT-PILOT-SAPS-081913
13BH-DT-PILOT-CHIT-081913
13BH-DT-PILOT-MGOH-081913
13BH-DT-PILOT-BCR1-081913
13BH-DT-PILOT-BCR2-081913
13BH-DT-PILOT-BCR3-081913
13BH-DT-PILOT-BDR3-081913
13BH-DT-PILOT-BCR2-POST-081913
13BH-DT-PILOT-BCR4-081913

Reference Document Used in Data Validation:

USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review, January 2010 (NFGs)
Sampling and Analysis Plan Bench Scale Test of Passive Treatment of Danny T Discharge

Precision:	**Yes No N/A**
Are the field duplicate relative percent differences (RPD) acceptable?	**No**
Are the laboratory duplicate RPDs ≤ 20% for water ≤35% for soils or within the reporting limit (RL) absolute difference criteria when within 5x the RL?	**Yes**
Are the matrix spike duplicates RPD ≤ 20%?	**Yes**

Comments (note deviations):

Not all methods used the same laboratory QC measures for precision. The following summarizes laboratory QC precision and accuracy measures:

sample dup/matrix spike	**matrix spike/matrix spike duplicate**
alkalinity	fluoride
TDS	sulfide
	metals
	chloride and sulfate
	ortho-phosphate

Field Duplicates

Field duplicate acceptance criteria is not defined in the SAP. The NFGs suggest ≤ 20% for water samples, but that may not be applicable to treatability samples. Results greater than 20% difference are summarized, but no qualifiers have been applied.

Sample 13BH-DT-PILOT-BDR3-081913 is a field duplicate of 13BH-DT-PILOT-BCR3-081913

All results are in mg/L
Note: Only dissolved metals are requested for this event.

	Sample	**Duplicate**		**Reporting Limit (RL)**	**Abs difference**
zinc	0.02	<0.01	NA	0.01	NA

All other analytes compared within a 20% RPD

Laboratory Duplicates

Laboratory duplicates were available for alkalinity and TDS only, and compared within 20% RPD

Accuracy:	**Yes No N/A**
Were serial dilutions analyzed and within control limits of ±10% for waters (± for 15% for soils) or initial sample result less than 50x MDL?	**No**
Were matrix spike criteria met (frequency 20% and % recovery 75-125%)?	**Yes**
Was post digestion spike criteria met (if applicable)?	**N/A**
Was laboratory control sample criteria met?	**Yes**
Was laboratory blank criteria met (within control limits)?	**Yes**
Were ICV/CCV % recoveries within 90-110%?	**Yes**
Was a reporting limit standard analyzed?	**No**
Were ICSA/ICSAB % recoveries acceptable or within CRQL criteria?	**Yes**

Comments (note deviations):

Serial Dilution

The laboratory did not report results for a serial dilution.

Standards

As a level 2A validation, standards evaluation is not required. The laboratory did not report results for a reporting limit standard.

Blanks

Energy reports the method blank down to the MDL.
No analytes was reported in the method blank at a concentration greater than the RL, no sample values were within 5 times a reported blank value.
No qualifiers have been applied

Reporting Limits and Analytical method

The laboratory uses Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) and Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES) (methods 200.7 and 200.8) interchangeably. Generally the higher concentration samples were reported by ICP-AES but this is not consistent between Sampling events.

The method blank reporting limit is the MDL. The instrument reporting limit, or the practical reporting limit (PQL) is significantly higher than the MDL, and the same PQL is reported whether the analysis was performed by ICP-MS or ICP-AES. The dilution factor was not reported and has been requested of the laboratory. The PQL does not increase with the dilution until the MDL x the Dilution Factor (DF) is greater than the PQL. The lab does not provide "J" qualifiers. Therefore, when a dilution factor is not required (DF = 1) and an analyte is detected below the PQL, that analyte is not reported. However when a dilution is required, the diluted sample concentration can approach the MDL but will be reported without a "J" qualifier.

Matrix Spikes

	MS % recovery	MSD % recovery	Limit	**Qualifier**
Fluoride	84	85	85-115	None
orthophosphate	81	85	90-110	**J**

Representativeness:	**Yes No N/A**
Were sampling procedures and design criteria met?	**Yes**
Were holding times met?	**Yes**
Was preservation criteria met? (4° C ± 2° C)?	**Yes**
Were Chain-of-Custody records complete and provided in data package?	**Yes**

Comments (note deviations):

Comparability:	**Yes No N/A**
Were analytical procedures and methods follows as defined in the QAPP or field change documentation?	**Yes**

Comments (note deviations):

Completeness (90%):	**Yes No N/A**
Are all data in this SDG usable?	**Yes**

Comments (note deviations):

Sensitivity:	**Yes No N/A**
Do the reporting limits meet project requirements?	**Yes**

Comments (note deviations):

Data Validator: Kimberly Zilis Date: 1/20/2014

Barker-Hughesville
Treatability Study
Data Validation Worksheet
Stage 2A validation
Sampling Event 5

Collection Date: 9/04/2013

Sample Delivery Group (SDG) Number: **H13090077**
Laboratory: **Energy Laboratories**

Matrix: Water

Analysis/Methods:

Total and Dissolved Metals	EPA 200.7 and 200.8
Anions: Chloride and Sulfate	EPA 300.0
Fluoride	SM 4500-F C
ortho-Phosphate	SM 2540C
Sulfide	SM 4500-S D
Total Dissolved Solids	SM 2540C
Acidity	SM 2310B
Alkalinity	SM 2320B

Samples 13BH-DT-PILOT-BCR3-090413 and 13BH-DT-PILOT-BCR3-090413-POST only

Biological Oxygen Demand (BOD)	SM 5210B
Ammonia	EPA 350.1

Samples:

13BH-DT-PILOT-BCR3-090413
13BH-DT-PILOT-BCR1-090413
13BH-DT-PILOT-BDR1-090413
13BH-DT-PILOT-BCR2-090413
13BH-DT-PILOT-BCR4-090413
13BH-DT-PILOT-INFL-090413
13BH-DT-PILOT-SAPS-090413
13BH-DT-PILOT-MGOH-090413
13BH-DT-PILOT-CHIT-090413
13BH-DT-PILOT-BCR3-POST-090413

Reference Document Used in Data Validation:

USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review, January 2010 (NFGs)
Sampling and Analysis Plan Bench Scale Test of Passive Treatment of Danny T Discharge

Precision:	**Yes No N/A**
Are the field duplicate relative percent differences (RPD) acceptable?	**No**
Are the laboratory duplicate RPDs ≤ 20% for water ≤35% for soils or within the reporting limit (RL) absolute difference criteria when within 5x the RL?	**Yes**
Are the matrix spike duplicates RPD ≤ 20%?	**Yes**

Comments (note deviations):

Not all methods used the same laboratory QC measures for precision. The following summarizes laboratory QC precision and accuracy measures:

sample dup/matrix spike	**matrix spike/matrix spike duplicate**
alkalinity	fluoride
TDS	sulfide
	metals
	chloride and sulfate
	ortho-phosphate

Field Duplicates

Field duplicate acceptance criteria is not defined in the SAP. The NFGs suggest ≤ 20% for water samples, but that may not be applicable to treatability samples. Results greater than 20% difference are summarized, but no qualifiers have been applied.

Sample 13BH-DT-PILOT-BDR1-090413 is a field duplicate of 13BH-DT-PILOT-BCR1-090413

All results are in mg/L
All analytes compared within a 20% RPD

	Sample	**Duplicate**	**RPD**	**Reporting Limit (RL)**	**Abs difference**
aluminum-diss	0.84	1.22	**36.9**	0.03	NA
aluminum-tot	0.87	1.01	**14.9**	0.03	

Laboratory Duplicates

Laboratory duplicates were available for alkalinity and TDS only, and compared within 20% RPD

Accuracy:	**Yes No N/A**
Were serial dilutions analyzed and within control limits of ±10% for waters (± for 15% for soils) or initial sample result less than 50x MDL?	**No**
Were matrix spike criteria met (frequency 20% and % recovery 75-125%)?	**Yes**
Was post digestion spike criteria met (if applicable)?	**N/A**
Was laboratory control sample criteria met?	**Yes**
Was laboratory blank criteria met (within control limits)?	**Yes**
Were ICV/CCV % recoveries within 90-110%?	**Yes**
Was a reporting limit standard analyzed?	**No**
Were ICSA/ICSAB % recoveries acceptable or within CRQL criteria?	**Yes**

Comments (note deviations):

Serial Dilution

The laboratory did not report results for a serial dilution.

Standards

As a level 2A validation, standards evaluation is not required. The laboratory did not report results for a reporting limit standard.

Blanks

Energy reports the method blank down to the MDL.
No analytes was reported in the method blank at a concentration greater than the RL, no sample values were within 5 times a reported blank value.
No qualifiers have been applied

Reporting Limits and Analytical method

The laboratory uses Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) and Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES) (methods 200.7 and 200.8) interchangeably. Generally the higher concentration samples were reported by ICP-AES but this is not consistent between Sampling events.

The method blank reporting limit is the MDL. The instrument reporting limit, or the practical reporting limit (PQL) is significantly higher than the MDL, and the same PQL is reported whether the analysis was performed by ICP-MS or ICP-AES. The dilution factor was not reported and has been requested of the laboratory. The PQL does not increase with the dilution until the MDL x the Dilution Factor (DF) is greater than the PQL. The lab does not provide "J" qualifiers. Therefore, when a dilution factor is not required (DF = 1) and an analyte is detected below the PQL, that analyte is not reported. However when a dilution is required, the diluted sample concentration can approach the MDL but will be reported without a "J" qualifier.

Matrix Spikes

	MS % recovery	MSD % recovery	Limit	**Qualifier**
Fluoride	84	85	85-115	None
orthophosphate	81	85	90-110	**J**

Metals matrix spike recoveries outside the laboratory defined limits are summarized below. The laboratory provides results for multiple spike analyses without clear distinction between batch association, dilutions, sample or spiked concentrations. The outliers are presented below. Qualifiers have not been applied because the data presentation is insufficient, and with the exception of rejected data, qualifiers would not affect the use of the data.

	MS % recovery	MSD % recovery	Limit	**Qualifier**
Lead	132	138	70-130	None
Thallium	129	135	70-130	None
Silver	69	70	70-130	

Representativeness:	**Yes No N/A**
Were sampling procedures and design criteria met?	**Yes**
Were holding times met?	**Yes**
Was preservation criteria met? (4° C ± 2° C)?	**Yes**
Were Chain-of-Custody records complete and provided in data package?	**Yes**

Comments (note deviations):

Comparability:	**Yes No N/A**
Were analytical procedures and methods follows as defined in the QAPP or field change documentation?	**Yes**

Comments (note deviations):

Completeness (90%):	**Yes No N/A**
Are all data in this SDG usable?	**Yes**

Comments (note deviations):

Sensitivity:	**Yes No N/A**
Do the reporting limits meet project requirements?	**Yes**

Comments (note deviations):

Data Validator: Kimberly Zilis Date: 1/20/2014

Barker-Hughesville
Treatability Study
Data Validation Worksheet
Stage 2A validation
Sampling Event 6

Collection Date: 9/16/2013

Sample Delivery Group (SDG) Number: **H13090305**
Laboratory: **Energy Laboratories**

Matrix: Water

Analysis/Methods:

Total and Dissolved Metals	EPA 200.7 and 200.8
Anions: Chloride and Sulfate	EPA 300.0
Fluoride	SM 4500-F C
ortho-Phosphate	SM 2540C
Sulfide	SM 4500-S D
Total Dissolved Solids	SM 2540C
Acidity	SM 2310B
Alkalinity	SM 2320B

Samples 13BH-DT-PILOT-BCR3-090413 and 13BH-DT-PILOT-BCR3-090413-POST only

Biological Oxygen Demand (BOD)	SM 5210B
Ammonia	EPA 350.1

Samples:

13BH-DT-PILOT-BCR2-091613
13BH-DT-PILOT-INFL-091613
13BH-DT-PILOT-SAPS-091613
13BH-DT-PILOT-CHIT-091613
13BH-DT-PILOT-MGOH-091613
13BH-DT-PILOT-BCR1-091613
13BH-DT-PILOT-BCR3-091613
13BH-DT-PILOT-BDR3-091613
13BH-DT-PILOT-BCR4-091613
13BH-DT-PILOT-BCR2-POST-091613

Reference Document Used in Data Validation:

USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review, January 2010 (NFGs)
Sampling and Analysis Plan Bench Scale Test of Passive Treatment of Danny T Discharge

Precision:	**Yes No N/A**
Are the field duplicate relative percent differences (RPD) acceptable?	**No**
Are the laboratory duplicate RPDs ≤ 20% for water ≤35% for soils or within the reporting limit (RL) absolute difference criteria when within 5x the RL?	**Yes**
Are the matrix spike duplicates RPD ≤ 20%?	**Yes**

Comments (note deviations):

Not all methods used the same laboratory QC measures for precision. The following summarizes laboratory QC precision and accuracy measures:

sample dup/matrix spike	**matrix spike/matrix spike duplicate**
alkalinity	fluoride
TDS	sulfide
	metals
	chloride and sulfate
	ortho-phosphate

Field Duplicates

Field duplicate acceptance criteria is not defined in the SAP. The NFGs suggest ≤ 20% for water samples, but that may not be applicable to treatability samples. Results greater than 20% difference are summarized, but no qualifiers have been applied.

Sample 13BH-DT-PILOT-BDR3-091613 is a field duplicate of 13BH-DT-PILOT-BCR3-091613

All results are in mg/L
All analytes compared within a 20% RPD

	Sample	**Duplicate**	**RPD**	**Reporting Limit (RL)**	**Abs difference**
sulfate	600	450	**28.6**	1	NA
ortho phosphorus	26	36	**32.3**	1	
iron	0.52	0.1	**135.5**	0.03	**0.42**
potassium	6	4	**40.0**	1	**2**

Laboratory Duplicates

Laboratory duplicates were available for alkalinity and TDS only, and compared within 20% RPD

Accuracy:	**Yes No N/A**
Were serial dilutions analyzed and within control limits of ±10% for waters (± for 15% for soils) or initial sample result less than 50x MDL?	**No**
Were matrix spike criteria met (frequency 20% and % recovery 75-125%)?	**Yes**
Was post digestion spike criteria met (if applicable)?	**N/A**
Was laboratory control sample criteria met?	**Yes**
Was laboratory blank criteria met (within control limits)?	**Yes**
Were ICV/CCV % recoveries within 90-110%?	**Yes**
Was a reporting limit standard analyzed?	**No**
Were ICSA/ICSAB % recoveries acceptable or within CRQL criteria?	**Yes**

Comments (note deviations):

Serial Dilution

The laboratory did not report results for a serial dilution.

Standards

As a level 2A validation, standards evaluation is not required. The laboratory did not report results for a reporting limit standard.

Blanks

Energy reports the method blank down to the MDL.
No analytes was reported in the method blank at a concentration greater than the RL, no sample values were within 5 times a reported blank value.
No qualifiers have been applied

Reporting Limits and Analytical method

The laboratory uses Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) and Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES) (methods 200.7 and 200.8) interchangeably. Generally the higher concentration samples were reported by ICP-AES but this is not consistent between Sampling events.

The method blank reporting limit is the MDL. The instrument reporting limit, or the practical reporting limit (PQL) is significantly higher than the MDL, and the same PQL is reported whether the analysis was performed by ICP-MS or ICP-AES. The dilution factor was not reported and has been requested of the laboratory. The PQL does not increase with the dilution until the MDL x the Dilution Factor (DF) is greater than the PQL. The lab does not provide "J" qualifiers. Therefore, when a dilution factor is not required (DF = 1) and an analyte is detected below the PQL, that analyte is not reported. However when a dilution is required, the diluted sample concentration can approach the MDL but will be reported without a "J" qualifier.

Matrix Spikes

	MS % recovery	MSD % recovery	Limit	**Qualifier**
Fluoride	84	85	85-115	None
orthophosphate	81	85	90-110	**J**

Metals matrix spike recoveries outside the laboratory defined limits are summarized below. The laboratory provides results for multiple spike analyses without clear distinction between batch association, dilutions, sample or spiked concentrations. The outliers are presented below. Qualifiers have not been applied because the data presentation is insufficient, and with the exception of rejected data, qualifiers would not affect the use of the data.

	MS % recovery	MSD % recovery	Limit	**Qualifier**
Lead	132	138	70-130	None
Thallium	129	135	70-130	None
Silver	69	70	70-130	

Representativeness:	**Yes No N/A**
Were sampling procedures and design criteria met?	**Yes**
Were holding times met?	**No**
Was preservation criteria met? (4° C ± 2° C)?	**Yes**
Were Chain-of-Custody records complete and provided in data package?	**Yes**

Comments (note deviations):

BOD was analyzed on 9/18/13 at 15:19. Collection was 9/16 at 14:15. The holding time of 48 hours was exceeed by a little over an hour. No qualifiers have been applied.

Comparability:	**Yes No N/A**
Were analytical procedures and methods follows as defined in the QAPP or field change documentation?	**Yes**

Comments (note deviations):

Completeness (90%):	**Yes No N/A**
Are all data in this SDG usable?	**Yes**

Comments (note deviations):

Sensitivity:	**Yes No N/A**
Do the reporting limits meet project requirements?	**Yes**

Comments (note deviations):

Data Validator: Kimberly Zilis Date: 1/20/2014

Barker-Hughesville
Treatability Study
Data Validation Worksheet
Stage 2A validation
SPLP

Collection Date: 9/24/2013

Sample Delivery Group (SDG) Number: **H13090479**
Laboratory: **Energy Laboratories**

Matrix: Water

Analysis/Methods:	SPLP Extraction	modified SW846 method 1312
	Total Metals	SW846 methods 6010 and 6020

Samples:

13BH-DT-PILOT-COMP-SPLP
13BH-DT-PILOT-WOOD-SPLP
13BH-DT-PILOT-SDST-SPLP
13BH-DT-PILOT-CHIT-SPLP

Reference Document Used in Data Validation:

USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review, January 2010 (NFGs)
Sampling and Analysis Plan Bench Scale Test of Passive Treatment of Danny T Discharge

Precision:	**Yes No N/A**
Are the field duplicate relative percent differences (RPD) acceptable?	**NA**
Are the laboratory duplicate RPDs ≤ 20% for water ≤35% for soils or within the reporting limit (RL) absolute difference criteria when within 5x the RL?	**Yes**
Are the matrix spike duplicates RPD ≤ 20%?	**Yes**

Comments (note deviations):

Accuracy:	**Yes No N/A**
Were serial dilutions analyzed and within control limits of ±10% for waters (± for 15% for soils) or initial sample result less than 50x MDL?	**NA**
Were matrix spike criteria met (frequency 20% and % recovery 75-125%)?	**Yes**
Was post digestion spike criteria met (if applicable)?	**NA**
Was laboratory control sample criteria met?	**Yes**
Was laboratory blank criteria met (within control limits)?	**Yes**
Were ICV/CCV % recoveries within 90-110%?	**Yes**
Was a reporting limit standard analyzed?	**NA**
Were ICSA/ICSAB % recoveries acceptable or within CRQL criteria?	**Yes**

Comments (note deviations):

Serial Dilution

The laboratory provides a serial dilution criteria of 20 RPD, the NFGs state 10%.

	RPD	RPD criteria	**Qualifier**
aluminum	32	10	**J**
cobalt	13	10	**J**
copper	21	10	**J**
manganese	15	10	**J**
nickel	17	10	**J**
zinc	29	10	**J**
arsenic	16	10	**J**
barium	15	10	**J**
cadmium	25	10	**J**

Data has been qualified as estimated.

Standards

As a level 2A validation, standards evaluation is not required. The laboratory did not report results for a reporting limit standard.

Blanks

All results are in mg/L

	Method Blank	Sample RL	5x blank
calcium	0.6	1	3
iron	0.009	0.03	0.045
magnesium	0.05	1	0.25
potassium	0.07	1	0.35
sodium	9	10	45

All sample results are greater than 5 x the concentration reported in the blank

Reporting Limits and Analytical method

Calcium, iron, magnesium, potassium and sodium were analyzed by Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES) (method 6010).

Matrix Spikes

Matrix spike recoveries outside the laboratory defined limits are summarized below. The laboratory provides results for multiple spike analyses without clear definition of batch association, dilutions, sample or spiked concentrations. The outliers are presented below. Qualifiers have not been applied because the data presentation is insufficient, and with the exception of rejected data, qualifiers would not affect the use of the data.

H13090479-004

	% recovery	**limits**
magnesium	37	75-125
zinc	74	

Magnesium and zinc recoveries were within criteria in the spike of sample H13090479-002.

Representativeness:	**Yes No N/A**
Were sampling procedures and design criteria met?	**Yes**
Were holding times met?	**Yes**
Was preservation criteria met? (4° C ± 2° C)?	**Yes**
Were Chain-of-Custody records complete and provided in data package?	**Yes**

Comments (note deviations):

Comparability:	**Yes No N/A**
Were analytical procedures and methods follows as defined in the QAPP or field change documentation?	**Yes**

Comments (note deviations):

Completeness (90%):	**Yes No N/A**
Are all data in this SDG usable?	**Yes**

Comments (note deviations):

Sensitivity:	**Yes No N/A**
Do the reporting limits meet project requirements?	**Yes**

Comments (note deviations):

Data Validator: Kimberly Zilis

Date: 1/20/2014

Appendix B

Laboratory Data Packages

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Appendix B.1

Bench-Scale Laboratory Data Packages

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U.S. Environmental Protection Agency
Region 8
Technical and Management Services

Laboratory Services Program

Certificate of Analysis

Ref: 8TMS-L

MEMORANDUM

Date: 03/21/13

Subject: Analytical Results--- **Barker-Hughesville_Pilot Study_MAR 2013_D353 / DG-353**

From: Don Goodrich; EPA Region 8 Analytical Chemistry WAM

To: Roger Hoogerheide
Superfund
8 MO

Received Sample Set(s), [Work Order : Date Received]:
[C130301 : 02/28/2013]

Attached are the analytical results for the samples received from the Barker-Hughesville_Pilot Study_MAR 2013_D353 sampling event, according to TDF DG-353. All analyses were performed within their method specified holding times unless otherwise noted in the following narrative.

These samples were prepared, analyzed, and verified by the Environmental Services Assistance Team Laboratory (ESAT) according to the requirements of the Technical Direction Form (TDF).

Note: The laboratory herewith transmits this deliverable to the program/project partner for determination of "final data usability" which may include data validation and data quality asessment per and in accordance with EPA QA/G-8, *Guidance on Environmental Data Verification and Data Validation*, November 2002, EPA/240/R-02/004. Laboratory data qualifiers are applied based on the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* October 2004, referred to as "NFGI".

Laboratory policy is to dispose of any remaining sample 60 days after data analysis packages are delivered to EPA. If you would like the laboratory to retain the samples for a period longer than 60 days, please contact Don Goodrich within the 60 day period at (303) 312-6687.

Case Narrative

C130301

Quality Assessment: Unless indicated by exception, the QA/QC associated with this sample set produced data within the TDF-specified criteria.

Holding Times: All samples were analyzed within their method-specified technical holding time(s).

1. Initial and Continuing calibration blanks (ICBs and CCBs).
   Exceptions: None.
2. Preparation (PB) / Method blanks (MB)
   Exceptions: None.
3. Interference Checks (ICSA / ICSAB) for ICP-MS and ICP-OE analyses only.
   Exceptions: None.
4. Initial and Continuing calibration verification analyses (ICVs and CCVs).
   Exceptions: None.
5. Laboratory Control Sample (LCS) or second source analysis or SRM.
   Exceptions: None.
6. Laboratory Fortified blank (LFB) / Blank spike (BS), same source as used for the matrix spikes. PBS performed with analyses/methods requiring preparation or digestion prior to analysis.
   Exceptions: None.
7. Contract Reporting Detection Limit Standard, labeled as CRA, CRDL or CRL.
   Exceptions: None.
8. Laboratory Duplicate (DUP). "Source" identifies field sample duplicated in the laboratory. If either the "source" or the duplicate result is <5X the reporting limit, the %D limit of 20% does not apply.
   Exceptions: None.
9. Laboratory Matrix Spike (MS) and spike duplicate (MSD). "Source" defines original field sample fortified prior to analysis. Percent recovery (%R) limits do not apply when sample concentration(s) exceed the corresponding analyte spike level by a factor of 4 or greater.
   Exceptions: None.
10. Serial Dilution sample analysis (SRD). "Source" is parent field sample diluted 1:5 in the laboratory. Performed for ICP-OE and ICP-MS metals analyses. Percent difference (%D) limits do not apply when analyte concentration(s) are below 50x the source sample's MDL (or 10x it's PQL).
    Exceptions: None.
11. Internal standards, criteria specified for ICP-MS analyses only, monitored at the instrument.
    Exceptions: None.
12. Any calibration using more than two-points produced a correlation coefficient equal to or greater than 0.995.
    Exceptions: None.

Acronyms and Definitions:

ESAT	Environmental Services Assistance Team
J	Data Estimated qualifier (also applied to all data less than PQL, greater than or equal to MDL)
MDL	Method Detection Limit
PQL	Practical Quantitation Limit, also known as reporting limit.
RPD	Relative Percent Difference (difference divided by the mean)
%D	Percent difference, serial dilution criteria unit, difference divided by the original result.
%R	Percent recovery, analyzed (less sample contribution) divided by true value
<	Analyte NOT DETECTED at or above the Method Detection Limit (MDL)
mg/L	Parts per million (millligrams per liter). Solids equivalent = mg/Kg.
ug/L	Parts per billion (micrograms per liter). Solids equivalent = ug/Kg.
NR	No Recovery (matrix spike) - Often seen for calcium/magnesium when their concentration exceeds the spike level by > 4x.
NFGI	*USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* October 2004
RE	Sample Re-analysis. Usually seen on raw data and sequences for required sample dilutions due to over-range analytes.
U	Analyte not detected at or above MDL qualifier
D	Diluted value qualifier.

Method(s) Summary:

As defined in the Technical Direction Form (TDF), some or all of the methods listed below were used for the determination of the reported target analytes.

From EPA's *Methods for the Determination of Metals in Environmental Samples*, Supplement I, May 1994, dissolved, total, and/or total recoverable metals were determined by:

- Method 200.7 / 6010B using a PE Optima ICP-OE (ICP).
- Method 200.8 / 6020 using a Perkin-Elmer Elan 6000 ICP-MS.
- Method 200.2 for total recoverable metals (only) digestion.
- Method 245.1 using a Perkin-Elmer FIMS CVAA (aqueous mercury only).

From *Standard Methods for the Examination of Water and Wastewater*, 18th Edition, 1992, Method 2340B was used for the calculated hardness determination. Hardness is reported as mg (milligram) equivalent $CaCO_3$ per liter (L) determined as follows:

Calculated hardness = 2.497 * (Calcium, mg/L) + 4.118 * (Magnesium, mg/L).

From *EPA's Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846*,

- Method 3015A was used for microwave assisted total metals digestion.
- Method 7473 was used for mercury in solids.

From EPA's *Determination of Inorganic Anions by Ion Chromatography*, Revision 2.1, 1993, Method 300.0 was used to determine the anions.

From EPA's *Methods for Chemical Analysis of Water and Wastes*, March 1983:

- Method 310.1 was followed for the alkalinity determination.
- Method 160.1 was followed for gravimetric total dissolved solids (TDS) determination.
- Method 160.2 was used for gravimetric total suspended solids (TSS) determination.
- Method 415.3 was used for total organic carbon (TOC) determination using either an Apollo 9000 or Phoenix 8000 Non-Dispersive IR (NDIR) system. Also known as dissolved organic carbon (DOC) when performed on the dissolved sample fraction.

The quality control procedures listed in the TDF request were utilized by ESAT to verify accuracy of the results and to evaluate any matrix interferences.

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: 13BH-BENCH-OXD **Date / Time Sampled:** 02/25/13 16:00 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-A **Matrix:** Surface Water **Lab Number:** C130301-01 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**6250**		ug/L	100	5	03/08/2013	SV	1303010
200.7	Beryllium	< 25.0	U	ug/L	10.0	5	03/08/2013	SV	1303010
200.7	**Calcium**	**95900**		ug/L	500	5	03/08/2013	SV	1303010
200.7	**Copper**	**421**		ug/L	10.0	5	03/08/2013	SV	1303010
200.7	**Iron**	**79200**		ug/L	500	5	03/08/2013	SV	1303010
200.7	**Magnesium**	**20900**		ug/L	500	5	03/08/2013	SV	1303010
200.7	**Manganese**	**91200**		ug/L	10.0	5	03/08/2013	SV	1303010
200.7	**Potassium**	**2110**	J	ug/L	1250	5	03/08/2013	SV	1303010
200.7	**Sodium**	**8310**		ug/L	1250	5	03/08/2013	SV	1303010
200.7	**Zinc**	**40700**		ug/L	50.0	5	03/08/2013	SV	1303010
200.8	Antimony	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	**Arsenic**	**4.81**	J	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Barium	< 50.0	U	ug/L	25.0	5	03/08/2013	SV	1303011
200.8	**Cadmium**	**138**		ug/L	0.500	5	03/08/2013	SV	1303011
200.8	Chromium	< 10.0	U	ug/L	5.00	5	03/08/2013	SV	1303011
200.8	**Cobalt**	**27.7**		ug/L	0.500	5	03/08/2013	SV	1303011
200.8	**Lead**	**82.6**		ug/L	0.500	5	03/08/2013	SV	1303011
200.8	**Nickel**	**26.4**		ug/L	2.50	5	03/08/2013	SV	1303011
200.8	**Selenium**	**5.14**		ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Silver	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Thallium	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Vanadium	< 15.0	U	ug/L	10.0	5	03/08/2013	SV	1303011
2340B	**Hardness**	**325**		mg/L	8	5	03/08/2013	SV	1303010

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: 13BH-DT-BENCH-PH45-CHIT **Date / Time Sampled:** 02/26/13 12:00 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-A **Matrix:** Surface Water **Lab Number:** C130301-04 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**3810**		ug/L	100	5	03/08/2013	SV	1303010
200.7	Beryllium	< 25.0	U	ug/L	10.0	5	03/08/2013	SV	1303010
200.7	**Calcium**	**186000**		ug/L	500	5	03/08/2013	SV	1303010
200.7	**Copper**	**307**		ug/L	10.0	5	03/08/2013	SV	1303010
200.7	Iron	< 1250	U	ug/L	500	5	03/08/2013	SV	1303010
200.7	**Magnesium**	**27900**		ug/L	500	5	03/08/2013	SV	1303010
200.7	**Manganese**	**87400**		ug/L	10.0	5	03/08/2013	SV	1303010
200.7	**Potassium**	**5190**		ug/L	1250	5	03/08/2013	SV	1303010
200.7	**Sodium**	**22500**		ug/L	1250	5	03/08/2013	SV	1303010
200.7	**Zinc**	**37300**		ug/L	50.0	5	03/08/2013	SV	1303010
200.8	Antimony	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	**Arsenic**	**5.06**	J	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Barium	< 50.0	U	ug/L	25.0	5	03/08/2013	SV	1303011
200.8	**Cadmium**	**129**		ug/L	0.500	5	03/08/2013	SV	1303011
200.8	Chromium	< 10.0	U	ug/L	5.00	5	03/08/2013	SV	1303011
200.8	**Cobalt**	**24.4**		ug/L	0.500	5	03/08/2013	SV	1303011
200.8	**Lead**	**1.51**		ug/L	0.500	5	03/08/2013	SV	1303011
200.8	**Nickel**	**21.9**		ug/L	2.50	5	03/08/2013	SV	1303011
200.8	**Selenium**	**4.85**	J	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Silver	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Thallium	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Vanadium	< 15.0	U	ug/L	10.0	5	03/08/2013	SV	1303011
2340B	**Hardness**	**579**		mg/L	8	5	03/08/2013	SV	1303010

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: 13BH-DT-BENCH-PH45-LIME **Date / Time Sampled:** 02/25/13 18:30 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-A **Matrix:** Surface Water **Lab Number:** C130301-07 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**5520**		ug/L	100	5	03/08/2013	SV	1303010
200.7	Beryllium	< 25.0	U	ug/L	10.0	5	03/08/2013	SV	1303010
200.7	**Calcium**	**189000**		ug/L	500	5	03/08/2013	SV	1303010
200.7	**Copper**	**397**		ug/L	10.0	5	03/08/2013	SV	1303010
200.7	Iron	< 1250	U	ug/L	500	5	03/08/2013	SV	1303010
200.7	**Magnesium**	**21900**		ug/L	500	5	03/08/2013	SV	1303010
200.7	**Manganese**	**89100**		ug/L	10.0	5	03/08/2013	SV	1303010
200.7	**Potassium**	**1320**	J	ug/L	1250	5	03/08/2013	SV	1303010
200.7	**Sodium**	**8260**		ug/L	1250	5	03/08/2013	SV	1303010
200.7	**Zinc**	**40000**		ug/L	50.0	5	03/08/2013	SV	1303010
200.8	Antimony	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Arsenic	< 10.0	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Barium	< 50.0	U	ug/L	25.0	5	03/08/2013	SV	1303011
200.8	**Cadmium**	**137**		ug/L	0.500	5	03/08/2013	SV	1303011
200.8	Chromium	< 10.0	U	ug/L	5.00	5	03/08/2013	SV	1303011
200.8	**Cobalt**	**26.5**		ug/L	0.500	5	03/08/2013	SV	1303011
200.8	**Lead**	**18.5**		ug/L	0.500	5	03/08/2013	SV	1303011
200.8	**Nickel**	**25.2**		ug/L	2.50	5	03/08/2013	SV	1303011
200.8	**Selenium**	**4.83**	J	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Silver	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Thallium	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Vanadium	< 15.0	U	ug/L	10.0	5	03/08/2013	SV	1303011
2340B	**Hardness**	**562**		mg/L	8	5	03/08/2013	SV	1303010

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: 13BH-DT-BENCH-PH45-NAOH **Date / Time Sampled:** 02/25/13 16:45 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-A **Matrix:** Surface Water **Lab Number:** C130301-11 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**5190**		ug/L	100	5	03/08/2013	SV	1303010
200.7	Beryllium	< 25.0	U	ug/L	10.0	5	03/08/2013	SV	1303010
200.7	**Calcium**	**95400**		ug/L	500	5	03/08/2013	SV	1303010
200.7	**Copper**	**406**		ug/L	10.0	5	03/08/2013	SV	1303010
200.7	Iron	< 1250	U	ug/L	500	5	03/08/2013	SV	1303010
200.7	**Magnesium**	**20900**		ug/L	500	5	03/08/2013	SV	1303010
200.7	**Manganese**	**87100**		ug/L	10.0	5	03/08/2013	SV	1303010
200.7	**Potassium**	**1440**	J	ug/L	1250	5	03/08/2013	SV	1303010
200.7	**Sodium**	**121000**		ug/L	1250	5	03/08/2013	SV	1303010
200.7	**Zinc**	**39700**		ug/L	50.0	5	03/08/2013	SV	1303010
200.8	Antimony	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	**Arsenic**	**2.96**	J	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Barium	< 50.0	U	ug/L	25.0	5	03/08/2013	SV	1303011
200.8	**Cadmium**	**148**		ug/L	0.500	5	03/08/2013	SV	1303011
200.8	Chromium	< 10.0	U	ug/L	5.00	5	03/08/2013	SV	1303011
200.8	**Cobalt**	**27.3**		ug/L	0.500	5	03/08/2013	SV	1303011
200.8	**Lead**	**7.52**		ug/L	0.500	5	03/08/2013	SV	1303011
200.8	**Nickel**	**26.2**		ug/L	2.50	5	03/08/2013	SV	1303011
200.8	**Selenium**	**8.73**		ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Silver	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Thallium	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Vanadium	< 15.0	U	ug/L	10.0	5	03/08/2013	SV	1303011
2340B	**Hardness**	**324**		mg/L	8	5	03/08/2013	SV	1303010

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: 13BH-DT-BENCH-PH95-LIME **Date / Time Sampled:** 02/27/13 10:30 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-A **Matrix:** Surface Water **Lab Number:** C130301-15 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	Aluminum	< 250	U	ug/L	100	5	03/08/2013	SV	1303010
200.7	Beryllium	< 25.0	U	ug/L	10.0	5	03/08/2013	SV	1303010
200.7	**Calcium**	**303000**		ug/L	500	5	03/08/2013	SV	1303010
200.7	Copper	< 10.0	U	ug/L	10.0	5	03/08/2013	SV	1303010
200.7	Iron	< 1250	U	ug/L	500	5	03/08/2013	SV	1303010
200.7	**Magnesium**	**20600**		ug/L	500	5	03/08/2013	SV	1303010
200.7	**Manganese**	**3030**		ug/L	10.0	5	03/08/2013	SV	1303010
200.7	**Potassium**	**1600**	J	ug/L	1250	5	03/08/2013	SV	1303010
200.7	**Sodium**	**8260**		ug/L	1250	5	03/08/2013	SV	1303010
200.7	**Zinc**	**57.7**	J	ug/L	50.0	5	03/08/2013	SV	1303010
200.8	Antimony	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Arsenic	< 10.0	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Barium	< 50.0	U	ug/L	25.0	5	03/08/2013	SV	1303011
200.8	**Cadmium**	**0.708**	J	ug/L	0.500	5	03/08/2013	SV	1303011
200.8	Chromium	< 10.0	U	ug/L	5.00	5	03/08/2013	SV	1303011
200.8	Cobalt	< 1.00	U	ug/L	0.500	5	03/08/2013	SV	1303011
200.8	Lead	< 1.00	U	ug/L	0.500	5	03/08/2013	SV	1303011
200.8	**Nickel**	**3.56**	J	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	**Selenium**	**3.56**	J	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Silver	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Thallium	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Vanadium	< 15.0	U	ug/L	10.0	5	03/08/2013	SV	1303011
2340B	**Hardness**	**842**		mg/L	8	5	03/08/2013	SV	1303010

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: 13BH-DT-BENCH-PH95-NAOH **Date / Time Sampled:** 02/26/13 16:00 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-A **Matrix:** Surface Water **Lab Number:** C130301-18 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**121**	J	ug/L	100	5	03/08/2013	SV	1303010
200.7	Beryllium	< 25.0	U	ug/L	10.0	5	03/08/2013	SV	1303010
200.7	**Calcium**	**90200**		ug/L	500	5	03/08/2013	SV	1303010
200.7	Copper	< 10.0	U	ug/L	10.0	5	03/08/2013	SV	1303010
200.7	Iron	< 1250	U	ug/L	500	5	03/08/2013	SV	1303010
200.7	**Magnesium**	**17400**		ug/L	500	5	03/08/2013	SV	1303010
200.7	**Manganese**	**2690**		ug/L	10.0	5	03/08/2013	SV	1303010
200.7	**Potassium**	**1500**	J	ug/L	1250	5	03/08/2013	SV	1303010
200.7	**Sodium**	**269000**		ug/L	1250	5	03/08/2013	SV	1303010
200.7	Zinc	< 100	U	ug/L	50.0	5	03/08/2013	SV	1303010
200.8	Antimony	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Arsenic	< 10.0	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Barium	< 50.0	U	ug/L	25.0	5	03/08/2013	SV	1303011
200.8	Cadmium	< 1.00	U	ug/L	0.500	5	03/08/2013	SV	1303011
200.8	Chromium	< 10.0	U	ug/L	5.00	5	03/08/2013	SV	1303011
200.8	Cobalt	< 1.00	U	ug/L	0.500	5	03/08/2013	SV	1303011
200.8	Lead	< 1.00	U	ug/L	0.500	5	03/08/2013	SV	1303011
200.8	Nickel	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Selenium	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Silver	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Thallium	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Vanadium	< 15.0	U	ug/L	10.0	5	03/08/2013	SV	1303011
2340B	**Hardness**	**297**		mg/L	8	5	03/08/2013	SV	1303010

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: 13BH-DT-BENCH-RAW **Date / Time Sampled:** 02/25/13 14:00 **Workorder:** C130301

EPA Tag No.: No Tag Prefix-A **Matrix:** Surface Water **Lab Number:** C130301-21 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**6370**		ug/L	100	5	03/08/2013	SV	1303010
200.7	Beryllium	< 25.0	U	ug/L	10.0	5	03/08/2013	SV	1303010
200.7	**Calcium**	**95600**		ug/L	500	5	03/08/2013	SV	1303010
200.7	**Copper**	**426**		ug/L	10.0	5	03/08/2013	SV	1303010
200.7	**Iron**	**78000**		ug/L	500	5	03/08/2013	SV	1303010
200.7	**Magnesium**	**20700**		ug/L	500	5	03/08/2013	SV	1303010
200.7	**Manganese**	**90200**		ug/L	10.0	5	03/08/2013	SV	1303010
200.7	Potassium	< 5000	U	ug/L	1250	5	03/08/2013	SV	1303010
200.7	**Sodium**	**7930**		ug/L	1250	5	03/08/2013	SV	1303010
200.7	**Zinc**	**39800**		ug/L	50.0	5	03/08/2013	SV	1303010
200.8	Antimony	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	**Arsenic**	**5.19**	J	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Barium	< 50.0	U	ug/L	25.0	5	03/08/2013	SV	1303011
200.8	**Cadmium**	**141**		ug/L	0.500	5	03/08/2013	SV	1303011
200.8	Chromium	< 10.0	U	ug/L	5.00	5	03/08/2013	SV	1303011
200.8	**Cobalt**	**26.5**		ug/L	0.500	5	03/08/2013	SV	1303011
200.8	**Lead**	**87.1**		ug/L	0.500	5	03/08/2013	SV	1303011
200.8	**Nickel**	**21.8**		ug/L	2.50	5	03/08/2013	SV	1303011
200.8	**Selenium**	**4.18**	J	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Silver	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Thallium	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303011
200.8	Vanadium	< 15.0	U	ug/L	10.0	5	03/08/2013	SV	1303011
2340B	**Hardness**	**324**		mg/L	8	5	03/08/2013	SV	1303010

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: 13BH-DT-BENCH-SPS-C1 **Date / Time Sampled:** 02/27/13 14:05 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-A **Matrix:** Surface Water **Lab Number:** C130301-24 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	Aluminum	< 500	U	ug/L	200	10	03/08/2013	SV	1303010
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	03/08/2013	SV	1303010
200.7	**Calcium**	**99200**		ug/L	1000	10	03/08/2013	SV	1303010
200.7	**Copper**	**34.9**		ug/L	20.0	10	03/08/2013	SV	1303010
200.7	Iron	< 2500	U	ug/L	1000	10	03/08/2013	SV	1303010
200.7	**Magnesium**	**65600**		ug/L	1000	10	03/08/2013	SV	1303010
200.7	**Manganese**	**7270**		ug/L	20.0	10	03/08/2013	SV	1303010
200.7	**Potassium**	**253000**		ug/L	2500	10	03/08/2013	SV	1303010
200.7	**Sodium**	**156000**		ug/L	2500	10	03/08/2013	SV	1303010
200.7	**Zinc**	**189**	J	ug/L	100	10	03/08/2013	SV	1303010
200.8	Antimony	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303011
200.8	**Arsenic**	**29.3**		ug/L	5.00	10	03/08/2013	SV	1303011
200.8	**Barium**	**60.4**	J	ug/L	50.0	10	03/08/2013	SV	1303011
200.8	Cadmium	< 2.00	U	ug/L	1.00	10	03/08/2013	SV	1303011
200.8	Chromium	< 20.0	U	ug/L	10.0	10	03/08/2013	SV	1303011
200.8	**Cobalt**	**5.40**		ug/L	1.00	10	03/08/2013	SV	1303011
200.8	**Lead**	**1.90**	J	ug/L	1.00	10	03/08/2013	SV	1303011
200.8	**Nickel**	**16.7**		ug/L	5.00	10	03/08/2013	SV	1303011
200.8	Selenium	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303011
200.8	Silver	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303011
200.8	Thallium	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303011
200.8	**Vanadium**	**48.4**		ug/L	20.0	10	03/08/2013	SV	1303011
2340B	**Hardness**	**518**		mg/L	15	10	03/08/2013	SV	1303010

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: 13BH-DT-BENCH-SPS-C2 **Date / Time Sampled:** 02/27/13 14:15 **Workorder:** C130301

EPA Tag No.: No Tag Prefix-A **Matrix:** Surface Water **Lab Number:** C130301-27 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	Aluminum	< 500	U	ug/L	200	10	03/08/2013	SV	1303010
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	03/08/2013	SV	1303010
200.7	**Calcium**	**172000**		ug/L	1000	10	03/08/2013	SV	1303010
200.7	**Copper**	**26.6**		ug/L	20.0	10	03/08/2013	SV	1303010
200.7	Iron	< 2500	U	ug/L	1000	10	03/08/2013	SV	1303010
200.7	**Magnesium**	**73000**		ug/L	1000	10	03/08/2013	SV	1303010
200.7	**Manganese**	**17900**		ug/L	20.0	10	03/08/2013	SV	1303010
200.7	**Potassium**	**221000**		ug/L	2500	10	03/08/2013	SV	1303010
200.7	**Sodium**	**52500**		ug/L	2500	10	03/08/2013	SV	1303010
200.7	**Zinc**	**301**		ug/L	100	10	03/08/2013	SV	1303010
200.8	Antimony	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303011
200.8	**Arsenic**	**27.5**		ug/L	5.00	10	03/08/2013	SV	1303011
200.8	**Barium**	**59.3**	J	ug/L	50.0	10	03/08/2013	SV	1303011
200.8	Cadmium	< 2.00	U	ug/L	1.00	10	03/08/2013	SV	1303011
200.8	Chromium	< 20.0	U	ug/L	10.0	10	03/08/2013	SV	1303011
200.8	**Cobalt**	**4.35**		ug/L	1.00	10	03/08/2013	SV	1303011
200.8	**Lead**	**1.13**	J	ug/L	1.00	10	03/08/2013	SV	1303011
200.8	**Nickel**	**13.4**		ug/L	5.00	10	03/08/2013	SV	1303011
200.8	**Selenium**	**11.4**		ug/L	5.00	10	03/08/2013	SV	1303011
200.8	Silver	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303011
200.8	Thallium	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303011
200.8	**Vanadium**	**39.0**		ug/L	20.0	10	03/08/2013	SV	1303011
2340B	**Hardness**	**730**		mg/L	15	10	03/08/2013	SV	1303010

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: 13BH-DT-BENCH-SPS-C3 **Date / Time Sampled:** 02/27/13 14:25 **Workorder:** C130301

EPA Tag No.: No Tag Prefix-A **Matrix:** Surface Water **Lab Number:** C130301-30 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	Aluminum	< 500	U	ug/L	200	10	03/08/2013	SV	1303010
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	03/08/2013	SV	1303010
200.7	**Calcium**	**160000**		ug/L	1000	10	03/08/2013	SV	1303010
200.7	**Copper**	**35.8**		ug/L	20.0	10	03/08/2013	SV	1303010
200.7	Iron	< 2500	U	ug/L	1000	10	03/08/2013	SV	1303010
200.7	**Magnesium**	**81800**		ug/L	1000	10	03/08/2013	SV	1303010
200.7	**Manganese**	**13300**		ug/L	20.0	10	03/08/2013	SV	1303010
200.7	**Potassium**	**231000**		ug/L	2500	10	03/08/2013	SV	1303010
200.7	**Sodium**	**49400**		ug/L	2500	10	03/08/2013	SV	1303010
200.7	**Zinc**	**214**		ug/L	100	10	03/08/2013	SV	1303010
200.8	Antimony	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303011
200.8	**Arsenic**	**23.8**		ug/L	5.00	10	03/08/2013	SV	1303011
200.8	**Barium**	**61.0**	J	ug/L	50.0	10	03/08/2013	SV	1303011
200.8	Cadmium	< 2.00	U	ug/L	1.00	10	03/08/2013	SV	1303011
200.8	Chromium	< 20.0	U	ug/L	10.0	10	03/08/2013	SV	1303011
200.8	**Cobalt**	**3.52**		ug/L	1.00	10	03/08/2013	SV	1303011
200.8	Lead	< 2.00	U	ug/L	1.00	10	03/08/2013	SV	1303011
200.8	**Nickel**	**11.7**		ug/L	5.00	10	03/08/2013	SV	1303011
200.8	Selenium	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303011
200.8	Silver	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303011
200.8	Thallium	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303011
200.8	**Vanadium**	**37.8**		ug/L	20.0	10	03/08/2013	SV	1303011
2340B	**Hardness**	**737**		mg/L	15	10	03/08/2013	SV	1303010

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: 13BH-DT-BENCH-SPS-C4 **Date / Time Sampled:** 02/27/13 14:35 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-A **Matrix:** Surface Water **Lab Number:** C130301-33 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	Aluminum	< 500	U	ug/L	200	10	03/08/2013	SV	1303010
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	03/08/2013	SV	1303010
200.7	**Calcium**	**198000**		ug/L	1000	10	03/08/2013	SV	1303010
200.7	**Copper**	**79.8**		ug/L	20.0	10	03/08/2013	SV	1303010
200.7	Iron	< 2500	U	ug/L	1000	10	03/08/2013	SV	1303010
200.7	**Magnesium**	**103000**		ug/L	1000	10	03/08/2013	SV	1303010
200.7	Manganese	< 50.0	U	ug/L	20.0	10	03/08/2013	SV	1303010
200.7	**Potassium**	**138000**		ug/L	2500	10	03/08/2013	SV	1303010
200.7	**Sodium**	**424000**		ug/L	2500	10	03/08/2013	SV	1303010
200.7	Zinc	< 200	U	ug/L	100	10	03/08/2013	SV	1303010
200.8	Antimony	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303011
200.8	**Arsenic**	**127**		ug/L	5.00	10	03/08/2013	SV	1303011
200.8	Barium	< 100	U	ug/L	50.0	10	03/08/2013	SV	1303011
200.8	**Cadmium**	**2.41**		ug/L	1.00	10	03/08/2013	SV	1303011
200.8	**Chromium**	**24.8**		ug/L	10.0	10	03/08/2013	SV	1303011
200.8	Cobalt	< 2.00	U	ug/L	1.00	10	03/08/2013	SV	1303011
200.8	Lead	< 2.00	U	ug/L	1.00	10	03/08/2013	SV	1303011
200.8	**Nickel**	**26.5**		ug/L	5.00	10	03/08/2013	SV	1303011
200.8	**Selenium**	**49.6**		ug/L	5.00	10	03/08/2013	SV	1303011
200.8	Silver	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303011
200.8	Thallium	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303011
200.8	**Vanadium**	**28.3**	J	ug/L	20.0	10	03/08/2013	SV	1303011
2340B	**Hardness**	**918**		mg/L	15	10	03/08/2013	SV	1303010

"J" Qualifier indicates an estimated value

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: 13BH-BENCH-OXD **Date / Time Sampled:** 02/25/13 16:00 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-B **Matrix:** Surface Water **Lab Number:** C130301-02 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**6440**		ug/L	100	5	03/08/2013	SV	1303008
200.7	Beryllium	< 25.0	U	ug/L	10.0	5	03/08/2013	SV	1303008
200.7	**Calcium**	**94100**		ug/L	500	5	03/08/2013	SV	1303008
200.7	**Copper**	**399**		ug/L	10.0	5	03/08/2013	SV	1303008
200.7	**Iron**	**77900**		ug/L	500	5	03/08/2013	SV	1303008
200.7	**Magnesium**	**20400**		ug/L	500	5	03/08/2013	SV	1303008
200.7	**Manganese**	**89400**		ug/L	10.0	5	03/08/2013	SV	1303008
200.7	**Potassium**	**1630**	J	ug/L	1250	5	03/08/2013	SV	1303008
200.7	**Sodium**	**5980**		ug/L	1250	5	03/08/2013	SV	1303008
200.7	**Zinc**	**38700**		ug/L	50.0	5	03/08/2013	SV	1303008
200.8	Antimony	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	**Arsenic**	**8.10**	J	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Barium	< 50.0	U	ug/L	25.0	5	03/08/2013	SV	1303008
200.8	**Cadmium**	**136**		ug/L	0.500	5	03/08/2013	SV	1303008
200.8	Chromium	< 10.0	U	ug/L	5.00	5	03/08/2013	SV	1303008
200.8	**Cobalt**	**25.4**		ug/L	0.500	5	03/08/2013	SV	1303008
200.8	**Lead**	**74.7**		ug/L	0.500	5	03/08/2013	SV	1303008
200.8	**Nickel**	**25.9**		ug/L	2.50	5	03/08/2013	SV	1303008
200.8	**Selenium**	**7.59**		ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Silver	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	**Thallium**	**6.89**		ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Vanadium	< 15.0	U	ug/L	10.0	5	03/08/2013	SV	1303008

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: 13BH-DT-BENCH-PH45-CHIT **Date / Time Sampled:** 02/26/13 12:00 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-B **Matrix:** Surface Water **Lab Number:** C130301-05 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**5070**		ug/L	100	5	03/08/2013	SV	1303008
200.7	Beryllium	< 25.0	U	ug/L	10.0	5	03/08/2013	SV	1303008
200.7	**Calcium**	**188000**		ug/L	500	5	03/08/2013	SV	1303008
200.7	**Copper**	**331**		ug/L	10.0	5	03/08/2013	SV	1303008
200.7	**Iron**	**40800**		ug/L	500	5	03/08/2013	SV	1303008
200.7	**Magnesium**	**27200**		ug/L	500	5	03/08/2013	SV	1303008
200.7	**Manganese**	**88000**		ug/L	10.0	5	03/08/2013	SV	1303008
200.7	**Potassium**	**4270**	J	ug/L	1250	5	03/08/2013	SV	1303008
200.7	**Sodium**	**19000**		ug/L	1250	5	03/08/2013	SV	1303008
200.7	**Zinc**	**37100**		ug/L	50.0	5	03/08/2013	SV	1303008
200.8	Antimony	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	**Arsenic**	**10.1**		ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Barium	< 50.0	U	ug/L	25.0	5	03/08/2013	SV	1303008
200.8	**Cadmium**	**130**		ug/L	0.500	5	03/08/2013	SV	1303008
200.8	Chromium	< 10.0	U	ug/L	5.00	5	03/08/2013	SV	1303008
200.8	**Cobalt**	**24.6**		ug/L	0.500	5	03/08/2013	SV	1303008
200.8	**Lead**	**28.2**		ug/L	0.500	5	03/08/2013	SV	1303008
200.8	**Nickel**	**21.9**		ug/L	2.50	5	03/08/2013	SV	1303008
200.8	**Selenium**	**7.46**		ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Silver	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	**Thallium**	**3.46**	J	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Vanadium	< 15.0	U	ug/L	10.0	5	03/08/2013	SV	1303008

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: 13BH-DT-BENCH-PH45-LIME **Date / Time Sampled:** 02/25/13 18:30 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-B **Matrix:** Surface Water **Lab Number:** C130301-08 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**5740**		ug/L	100	5	03/08/2013	SV	1303008
200.7	Beryllium	< 25.0	U	ug/L	10.0	5	03/08/2013	SV	1303008
200.7	**Calcium**	**185000**		ug/L	500	5	03/08/2013	SV	1303008
200.7	**Copper**	**400**		ug/L	10.0	5	03/08/2013	SV	1303008
200.7	**Iron**	**20900**		ug/L	500	5	03/08/2013	SV	1303008
200.7	**Magnesium**	**21100**		ug/L	500	5	03/08/2013	SV	1303008
200.7	**Manganese**	**88300**		ug/L	10.0	5	03/08/2013	SV	1303008
200.7	Potassium	< 5000	U	ug/L	1250	5	03/08/2013	SV	1303008
200.7	**Sodium**	**5860**		ug/L	1250	5	03/08/2013	SV	1303008
200.7	**Zinc**	**38700**		ug/L	50.0	5	03/08/2013	SV	1303008
200.8	Antimony	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	**Arsenic**	**3.04**	J	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Barium	< 50.0	U	ug/L	25.0	5	03/08/2013	SV	1303008
200.8	**Cadmium**	**138**		ug/L	0.500	5	03/08/2013	SV	1303008
200.8	Chromium	< 10.0	U	ug/L	5.00	5	03/08/2013	SV	1303008
200.8	**Cobalt**	**25.3**		ug/L	0.500	5	03/08/2013	SV	1303008
200.8	**Lead**	**35.8**		ug/L	0.500	5	03/08/2013	SV	1303008
200.8	**Nickel**	**27.1**		ug/L	2.50	5	03/08/2013	SV	1303008
200.8	**Selenium**	**10.5**		ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Silver	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	**Thallium**	**3.33**	J	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Vanadium	< 15.0	U	ug/L	10.0	5	03/08/2013	SV	1303008

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: 13BH-DT-BENCH-PH45-NAOH **Date / Time Sampled:** 02/25/13 16:45 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-B **Matrix:** Surface Water **Lab Number:** C130301-12 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**5240**		ug/L	100	5	03/08/2013	SV	1303008
200.7	Beryllium	< 25.0	U	ug/L	10.0	5	03/08/2013	SV	1303008
200.7	**Calcium**	**93200**		ug/L	500	5	03/08/2013	SV	1303008
200.7	**Copper**	**402**		ug/L	10.0	5	03/08/2013	SV	1303008
200.7	**Iron**	**11900**		ug/L	500	5	03/08/2013	SV	1303008
200.7	**Magnesium**	**20300**		ug/L	500	5	03/08/2013	SV	1303008
200.7	**Manganese**	**87800**		ug/L	10.0	5	03/08/2013	SV	1303008
200.7	Potassium	< 5000	U	ug/L	1250	5	03/08/2013	SV	1303008
200.7	**Sodium**	**123000**		ug/L	1250	5	03/08/2013	SV	1303008
200.7	**Zinc**	**39200**		ug/L	50.0	5	03/08/2013	SV	1303008
200.8	Antimony	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	**Arsenic**	**3.10**	J	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Barium	< 50.0	U	ug/L	25.0	5	03/08/2013	SV	1303008
200.8	**Cadmium**	**138**		ug/L	0.500	5	03/08/2013	SV	1303008
200.8	Chromium	< 10.0	U	ug/L	5.00	5	03/08/2013	SV	1303008
200.8	**Cobalt**	**26.2**		ug/L	0.500	5	03/08/2013	SV	1303008
200.8	**Lead**	**19.2**		ug/L	0.500	5	03/08/2013	SV	1303008
200.8	**Nickel**	**23.8**		ug/L	2.50	5	03/08/2013	SV	1303008
200.8	**Selenium**	**7.23**		ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Silver	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	**Thallium**	**2.83**	J	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Vanadium	< 15.0	U	ug/L	10.0	5	03/08/2013	SV	1303008

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: 13BH-DT-BENCH-PH95-LIME **Date / Time Sampled:** 02/27/13 10:30 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-B **Matrix:** Surface Water **Lab Number:** C130301-16 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**123**	J	ug/L	100	5	03/08/2013	SV	1303008
200.7	Beryllium	< 25.0	U	ug/L	10.0	5	03/08/2013	SV	1303008
200.7	**Calcium**	**296000**		ug/L	500	5	03/08/2013	SV	1303008
200.7	**Copper**	**10.2**		ug/L	10.0	5	03/08/2013	SV	1303008
200.7	Iron	< 1250	U	ug/L	500	5	03/08/2013	SV	1303008
200.7	**Magnesium**	**19700**		ug/L	500	5	03/08/2013	SV	1303008
200.7	**Manganese**	**3770**		ug/L	10.0	5	03/08/2013	SV	1303008
200.7	Potassium	< 5000	U	ug/L	1250	5	03/08/2013	SV	1303008
200.7	**Sodium**	**5710**		ug/L	1250	5	03/08/2013	SV	1303008
200.7	**Zinc**	**268**		ug/L	50.0	5	03/08/2013	SV	1303008
200.8	Antimony	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Arsenic	< 10.0	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Barium	< 50.0	U	ug/L	25.0	5	03/08/2013	SV	1303008
200.8	**Cadmium**	**1.44**		ug/L	0.500	5	03/08/2013	SV	1303008
200.8	Chromium	< 10.0	U	ug/L	5.00	5	03/08/2013	SV	1303008
200.8	Cobalt	< 1.00	U	ug/L	0.500	5	03/08/2013	SV	1303008
200.8	**Lead**	**0.575**	J	ug/L	0.500	5	03/08/2013	SV	1303008
200.8	Nickel	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Selenium	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Silver	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Thallium	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Vanadium	< 15.0	U	ug/L	10.0	5	03/08/2013	SV	1303008

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: 13BH-DT-BENCH-PH95-NAOH **Date / Time Sampled:** 02/26/13 16:00 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-B **Matrix:** Surface Water **Lab Number:** C130301-19 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**321**		ug/L	100	5	03/08/2013	SV	1303008
200.7	Beryllium	< 25.0	U	ug/L	10.0	5	03/08/2013	SV	1303008
200.7	**Calcium**	**89700**		ug/L	500	5	03/08/2013	SV	1303008
200.7	**Copper**	**21.2**		ug/L	10.0	5	03/08/2013	SV	1303008
200.7	**Iron**	**2180**		ug/L	500	5	03/08/2013	SV	1303008
200.7	**Magnesium**	**17100**		ug/L	500	5	03/08/2013	SV	1303008
200.7	**Manganese**	**5690**		ug/L	10.0	5	03/08/2013	SV	1303008
200.7	Potassium	< 5000	U	ug/L	1250	5	03/08/2013	SV	1303008
200.7	**Sodium**	**266000**		ug/L	1250	5	03/08/2013	SV	1303008
200.7	**Zinc**	**1240**		ug/L	50.0	5	03/08/2013	SV	1303008
200.8	Antimony	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Arsenic	< 10.0	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Barium	< 50.0	U	ug/L	25.0	5	03/08/2013	SV	1303008
200.8	**Cadmium**	**4.49**		ug/L	0.500	5	03/08/2013	SV	1303008
200.8	Chromium	< 10.0	U	ug/L	5.00	5	03/08/2013	SV	1303008
200.8	Cobalt	< 1.00	U	ug/L	0.500	5	03/08/2013	SV	1303008
200.8	**Lead**	**2.41**		ug/L	0.500	5	03/08/2013	SV	1303008
200.8	Nickel	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	**Selenium**	**3.22**	J	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Silver	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Thallium	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Vanadium	< 15.0	U	ug/L	10.0	5	03/08/2013	SV	1303008

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: 13BH-DT-BENCH-RAW **Date / Time Sampled:** 02/25/13 14:00 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-B **Matrix:** Surface Water **Lab Number:** C130301-22 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**6490**		ug/L	100	5	03/08/2013	SV	1303008
200.7	Beryllium	< 25.0	U	ug/L	10.0	5	03/08/2013	SV	1303008
200.7	**Calcium**	**94600**		ug/L	500	5	03/08/2013	SV	1303008
200.7	**Copper**	**426**		ug/L	10.0	5	03/08/2013	SV	1303008
200.7	**Iron**	**82400**		ug/L	500	5	03/08/2013	SV	1303008
200.7	**Magnesium**	**20500**		ug/L	500	5	03/08/2013	SV	1303008
200.7	**Manganese**	**89700**		ug/L	10.0	5	03/08/2013	SV	1303008
200.7	Potassium	< 5000	U	ug/L	1250	5	03/08/2013	SV	1303008
200.7	**Sodium**	**5780**		ug/L	1250	5	03/08/2013	SV	1303008
200.7	**Zinc**	**39100**		ug/L	50.0	5	03/08/2013	SV	1303008
200.8	Antimony	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	**Arsenic**	**14.3**		ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Barium	< 50.0	U	ug/L	25.0	5	03/08/2013	SV	1303008
200.8	**Cadmium**	**134**		ug/L	0.500	5	03/08/2013	SV	1303008
200.8	Chromium	< 10.0	U	ug/L	5.00	5	03/08/2013	SV	1303008
200.8	**Cobalt**	**25.5**		ug/L	0.500	5	03/08/2013	SV	1303008
200.8	**Lead**	**80.3**		ug/L	0.500	5	03/08/2013	SV	1303008
200.8	**Nickel**	**19.7**		ug/L	2.50	5	03/08/2013	SV	1303008
200.8	**Selenium**	**8.16**		ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Silver	< 5.00	U	ug/L	2.50	5	03/08/2013	SV	1303008
200.8	**Thallium**	**34.6**		ug/L	2.50	5	03/08/2013	SV	1303008
200.8	Vanadium	< 15.0	U	ug/L	10.0	5	03/08/2013	SV	1303008

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: 13BH-DT-BENCH-SPS-C1 **Date / Time Sampled:** 02/27/13 14:05 **Workorder:** C130301

EPA Tag No.: No Tag Prefix-B **Matrix:** Surface Water **Lab Number:** C130301-25 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**414**	J	ug/L	200	10	03/08/2013	SV	1303008
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	03/08/2013	SV	1303008
200.7	**Calcium**	**97200**		ug/L	1000	10	03/08/2013	SV	1303008
200.7	**Copper**	**50.6**		ug/L	20.0	10	03/08/2013	SV	1303008
200.7	Iron	< 2500	U	ug/L	1000	10	03/08/2013	SV	1303008
200.7	**Magnesium**	**63200**		ug/L	1000	10	03/08/2013	SV	1303008
200.7	**Manganese**	**7320**		ug/L	20.0	10	03/08/2013	SV	1303008
200.7	**Potassium**	**239000**		ug/L	2500	10	03/08/2013	SV	1303008
200.7	**Sodium**	**153000**		ug/L	2500	10	03/08/2013	SV	1303008
200.7	**Zinc**	**192**	J	ug/L	100	10	03/08/2013	SV	1303008
200.8	Antimony	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303008
200.8	**Arsenic**	**35.0**		ug/L	5.00	10	03/08/2013	SV	1303008
200.8	**Barium**	**63.3**	J	ug/L	50.0	10	03/08/2013	SV	1303008
200.8	Cadmium	< 2.00	U	ug/L	1.00	10	03/08/2013	SV	1303008
200.8	Chromium	< 20.0	U	ug/L	10.0	10	03/08/2013	SV	1303008
200.8	**Cobalt**	**5.72**		ug/L	1.00	10	03/08/2013	SV	1303008
200.8	**Lead**	**3.13**		ug/L	1.00	10	03/08/2013	SV	1303008
200.8	**Nickel**	**15.0**		ug/L	5.00	10	03/08/2013	SV	1303008
200.8	**Selenium**	**10.9**		ug/L	5.00	10	03/08/2013	SV	1303008
200.8	Silver	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303008
200.8	Thallium	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303008
200.8	**Vanadium**	**44.4**		ug/L	20.0	10	03/08/2013	SV	1303008

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: 13BH-DT-BENCH-SPS-C2 **Date / Time Sampled:** 02/27/13 14:15 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-B **Matrix:** Surface Water **Lab Number:** C130301-28 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**485**	J	ug/L	200	10	03/08/2013	SV	1303008
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	03/08/2013	SV	1303008
200.7	**Calcium**	**169000**		ug/L	1000	10	03/08/2013	SV	1303008
200.7	**Copper**	**47.7**		ug/L	20.0	10	03/08/2013	SV	1303008
200.7	Iron	< 2500	U	ug/L	1000	10	03/08/2013	SV	1303008
200.7	**Magnesium**	**71900**		ug/L	1000	10	03/08/2013	SV	1303008
200.7	**Manganese**	**17900**		ug/L	20.0	10	03/08/2013	SV	1303008
200.7	**Potassium**	**219000**		ug/L	2500	10	03/08/2013	SV	1303008
200.7	**Sodium**	**49300**		ug/L	2500	10	03/08/2013	SV	1303008
200.7	**Zinc**	**376**		ug/L	100	10	03/08/2013	SV	1303008
200.8	Antimony	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303008
200.8	**Arsenic**	**26.7**		ug/L	5.00	10	03/08/2013	SV	1303008
200.8	**Barium**	**65.7**	J	ug/L	50.0	10	03/08/2013	SV	1303008
200.8	Cadmium	< 2.00	U	ug/L	1.00	10	03/08/2013	SV	1303008
200.8	Chromium	< 20.0	U	ug/L	10.0	10	03/08/2013	SV	1303008
200.8	**Cobalt**	**4.63**		ug/L	1.00	10	03/08/2013	SV	1303008
200.8	**Lead**	**2.35**		ug/L	1.00	10	03/08/2013	SV	1303008
200.8	**Nickel**	**15.8**		ug/L	5.00	10	03/08/2013	SV	1303008
200.8	Selenium	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303008
200.8	Silver	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303008
200.8	Thallium	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303008
200.8	**Vanadium**	**29.8**	J	ug/L	20.0	10	03/08/2013	SV	1303008

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: 13BH-DT-BENCH-SPS-C3 **Date / Time Sampled:** 02/27/13 14:25 **Workorder:** C130301

EPA Tag No.: No Tag Prefix-B **Matrix:** Surface Water **Lab Number:** C130301-31 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**414**	J	ug/L	200	10	03/08/2013	SV	1303008
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	03/08/2013	SV	1303008
200.7	**Calcium**	**154000**		ug/L	1000	10	03/08/2013	SV	1303008
200.7	**Copper**	**64.8**		ug/L	20.0	10	03/08/2013	SV	1303008
200.7	Iron	< 2500	U	ug/L	1000	10	03/08/2013	SV	1303008
200.7	**Magnesium**	**77400**		ug/L	1000	10	03/08/2013	SV	1303008
200.7	**Manganese**	**13000**		ug/L	20.0	10	03/08/2013	SV	1303008
200.7	**Potassium**	**221000**		ug/L	2500	10	03/08/2013	SV	1303008
200.7	**Sodium**	**43300**		ug/L	2500	10	03/08/2013	SV	1303008
200.7	**Zinc**	**242**		ug/L	100	10	03/08/2013	SV	1303008
200.8	Antimony	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303008
200.8	**Arsenic**	**27.5**		ug/L	5.00	10	03/08/2013	SV	1303008
200.8	**Barium**	**63.4**	J	ug/L	50.0	10	03/08/2013	SV	1303008
200.8	Cadmium	< 2.00	U	ug/L	1.00	10	03/08/2013	SV	1303008
200.8	Chromium	< 20.0	U	ug/L	10.0	10	03/08/2013	SV	1303008
200.8	**Cobalt**	**3.65**		ug/L	1.00	10	03/08/2013	SV	1303008
200.8	**Lead**	**3.79**		ug/L	1.00	10	03/08/2013	SV	1303008
200.8	**Nickel**	**12.2**		ug/L	5.00	10	03/08/2013	SV	1303008
200.8	**Selenium**	**10.7**		ug/L	5.00	10	03/08/2013	SV	1303008
200.8	Silver	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303008
200.8	Thallium	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303008
200.8	**Vanadium**	**20.5**	J	ug/L	20.0	10	03/08/2013	SV	1303008

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: 13BH-DT-BENCH-SPS-C4 **Date / Time Sampled:** 02/27/13 14:35 **Workorder:** C130301

EPA Tag No.: No Tag Prefix-B **Matrix:** Surface Water **Lab Number:** C130301-34 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	Aluminum	< 500	U	ug/L	200	10	03/08/2013	SV	1303008
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	03/08/2013	SV	1303008
200.7	**Calcium**	**194000**		ug/L	1000	10	03/08/2013	SV	1303008
200.7	**Copper**	**49.8**		ug/L	20.0	10	03/08/2013	SV	1303008
200.7	Iron	< 2500	U	ug/L	1000	10	03/08/2013	SV	1303008
200.7	**Magnesium**	**100000**		ug/L	1000	10	03/08/2013	SV	1303008
200.7	Manganese	< 50.0	U	ug/L	20.0	10	03/08/2013	SV	1303008
200.7	**Potassium**	**128000**		ug/L	2500	10	03/08/2013	SV	1303008
200.7	**Sodium**	**379000**		ug/L	2500	10	03/08/2013	SV	1303008
200.7	Zinc	< 200	U	ug/L	100	10	03/08/2013	SV	1303008
200.8	Antimony	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303008
200.8	**Arsenic**	**104**		ug/L	5.00	10	03/08/2013	SV	1303008
200.8	Barium	< 100	U	ug/L	50.0	10	03/08/2013	SV	1303008
200.8	**Cadmium**	**2.38**		ug/L	1.00	10	03/08/2013	SV	1303008
200.8	**Chromium**	**20.4**		ug/L	10.0	10	03/08/2013	SV	1303008
200.8	Cobalt	< 2.00	U	ug/L	1.00	10	03/08/2013	SV	1303008
200.8	Lead	< 2.00	U	ug/L	1.00	10	03/08/2013	SV	1303008
200.8	**Nickel**	**22.8**		ug/L	5.00	10	03/08/2013	SV	1303008
200.8	**Selenium**	**34.9**		ug/L	5.00	10	03/08/2013	SV	1303008
200.8	Silver	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303008
200.8	Thallium	< 10.0	U	ug/L	5.00	10	03/08/2013	SV	1303008
200.8	Vanadium	< 30.0	U	ug/L	20.0	10	03/08/2013	SV	1303008

"J" Qualifier indicates an estimated value

Classical Chemistry by EPA/ASTM/APHA Methods

Station ID: 13BH-BENCH-OXD **Date / Time Sampled:** 02/25/13 16:00 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-C **Matrix:** Surface Water **Lab Number:** C130301-03 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
EPA 300.0	Chloride	< 20.0	U	mg/L	10.0	10	03/19/2013	NP	1303036
EPA 300.0	**Fluoride**	**1.9**	J	mg/L	1.0	10	03/19/2013	NP	1303036
EPA 300.0	**Sulfate as SO4**	**841**		mg/L	20.0	10	03/19/2013	NP	1303036
EPA 310.1	Total Alkalinity	< 5.00		mg CaCO3 / L	5.00	1	03/07/2013	SV	1303009

Classical Chemistry by EPA/ASTM/APHA Methods

Station ID: 13BH-DT-BENCH-PH45-CHIT **Date / Time Sampled:** 02/26/13 12:00 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-C **Matrix:** Surface Water **Lab Number:** C130301-06 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
EPA 300.0	**Chloride**	**19.4**	J	mg/L	10.0	10	03/19/2013	NP	1303036
EPA 300.0	**Fluoride**	**2.4**		mg/L	1.0	10	03/19/2013	NP	1303036
EPA 300.0	**Sulfate as SO4**	**829**		mg/L	20.0	10	03/19/2013	NP	1303036
EPA 310.1	Total Alkalinity	< 5.00		mg CaCO3 / L	5.00	1	03/07/2013	SV	1303009

Classical Chemistry by EPA/ASTM/APHA Methods

Station ID: 13BH-DT-BENCH-PH45-LIME **Date / Time Sampled:** 02/25/13 18:30 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-C **Matrix:** Surface Water **Lab Number:** C130301-09 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
EPA 300.0	Chloride	< 20.0	U	mg/L	10.0	10	03/19/2013	NP	1303036
EPA 300.0	**Fluoride**	**2.0**		mg/L	1.0	10	03/19/2013	NP	1303036
EPA 300.0	**Sulfate as SO4**	**803**		mg/L	20.0	10	03/19/2013	NP	1303036
EPA 310.1	Total Alkalinity	< 5.00		mg CaCO3 / L	5.00	1	03/07/2013	SV	1303009

Classical Chemistry by EPA/ASTM/APHA Methods

Station ID: 13BH-DT-BENCH-PH45-LIME-T **Date / Time Sampled:** 02/26/13 10:40 **Workorder:** C130301
EPA Tag No.: SS No Tag Prefix-D **Matrix:** Surface Water **Lab Number:** C130301-10 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
EPA 160.2	**Total Suspended Solids**	**248**		mg/L	10	1	03/04/2013	NP	1303032

Classical Chemistry by EPA/ASTM/APHA Methods

Station ID: 13BH-DT-BENCH-PH45-NAOH **Date / Time Sampled:** 02/25/13 16:45 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-C **Matrix:** Surface Water **Lab Number:** C130301-13 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
EPA 300.0	Chloride	< 20.0	U	mg/L	10.0	10	03/19/2013	NP	1303036
EPA 300.0	**Fluoride**	**1.8**	J	mg/L	1.0	10	03/19/2013	NP	1303036
EPA 300.0	**Sulfate as SO4**	**799**		mg/L	20.0	10	03/19/2013	NP	1303036
EPA 310.1	Total Alkalinity	< 5.00		mg CaCO3 / L	5.00	1	03/07/2013	SV	1303009

Classical Chemistry by EPA/ASTM/APHA Methods

Station ID: 13BH-DT-BENCH-PH45-NAOH- **Date / Time Sampled:** 02/26/13 10:25 **Workorder:** C130301
EPA Tag No.: TSSNo Tag Prefix-D **Matrix:** Surface Water **Lab Number:** C130301-14 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
EPA 160.2	**Total Suspended Solids**	**156**		mg/L	10	1	03/04/2013	NP	1303032

Classical Chemistry by EPA/ASTM/APHA Methods

Station ID: 13BH-DT-BENCH-PH95-LIME **Date / Time Sampled:** 02/27/13 10:30 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-C **Matrix:** Surface Water **Lab Number:** C130301-17 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
EPA 300.0	Chloride	< 20.0	U	mg/L	10.0	10	03/19/2013	NP	1303036
EPA 300.0	**Fluoride**	**1.5**	J	mg/L	1.0	10	03/19/2013	NP	1303036
EPA 300.0	**Sulfate as SO4**	**817**		mg/L	20.0	10	03/19/2013	NP	1303036
EPA 310.1	**Total Alkalinity**	**14.1**		mg CaCO3 / L	5.00	1	03/07/2013	SV	1303009

Classical Chemistry by EPA/ASTM/APHA Methods

Station ID: 13BH-DT-BENCH-PH95-NAOH **Date / Time Sampled:** 02/26/13 16:00 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-C **Matrix:** Surface Water **Lab Number:** C130301-20 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
EPA 300.0	Chloride	< 20.0	U	mg/L	10.0	10	03/19/2013	NP	1303036
EPA 300.0	**Fluoride**	**1.7**	J	mg/L	1.0	10	03/19/2013	NP	1303036
EPA 300.0	**Sulfate as SO4**	**829**		mg/L	20.0	10	03/19/2013	NP	1303036
EPA 310.1	**Total Alkalinity**	**18.3**		mg CaCO3 / L	5.00	1	03/07/2013	SV	1303009

Classical Chemistry by EPA/ASTM/APHA Methods

Station ID: 13BH-DT-BENCH-RAW **Date / Time Sampled:** 02/25/13 14:00 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-C **Matrix:** Surface Water **Lab Number:** C130301-23 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
EPA 300.0	Chloride	< 20.0	U	mg/L	10.0	10	03/19/2013	NP	1303036
EPA 300.0	**Fluoride**	**1.9**	J	mg/L	1.0	10	03/19/2013	NP	1303036
EPA 300.0	**Sulfate as SO4**	**835**		mg/L	20.0	10	03/19/2013	NP	1303036
EPA 310.1	Total Alkalinity	< 5.00		mg CaCO3 / L	5.00	1	03/07/2013	SV	1303009

Classical Chemistry by EPA/ASTM/APHA Methods

Station ID: 13BH-DT-BENCH-SPS-C1 **Date / Time Sampled:** 02/27/13 14:05 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-C **Matrix:** Surface Water **Lab Number:** C130301-26 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
EPA 300.0	**Chloride**	**89.8**		mg/L	10.0	10	03/19/2013	NP	1303036
EPA 300.0	**Fluoride**	**1.3**	J	mg/L	1.0	10	03/19/2013	NP	1303036
EPA 300.0	**Sulfate as SO4**	**808**		mg/L	20.0	10	03/19/2013	NP	1303036
EPA 310.1	**Total Alkalinity**	**214**		mg CaCO3 / L	5.00	1	03/07/2013	SV	1303009

Classical Chemistry by EPA/ASTM/APHA Methods

Station ID: 13BH-DT-BENCH-SPS-C2 **Date / Time Sampled:** 02/27/13 14:15 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-C **Matrix:** Surface Water **Lab Number:** C130301-29 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
EPA 300.0	**Chloride**	**90.2**		mg/L	10.0	10	03/19/2013	NP	1303036
EPA 300.0	**Fluoride**	**1.2**	J	mg/L	1.0	10	03/19/2013	NP	1303036
EPA 300.0	**Sulfate as SO4**	**793**		mg/L	20.0	10	03/19/2013	NP	1303036
EPA 310.1	**Total Alkalinity**	**196**		mg CaCO3 / L	5.00	1	03/07/2013	SV	1303009

Classical Chemistry by EPA/ASTM/APHA Methods

Station ID: 13BH-DT-BENCH-SPS-C3 **Date / Time Sampled:** 02/27/13 14:25 **Workorder:** C130301
EPA Tag No.: No Tag Prefix-C **Matrix:** Surface Water **Lab Number:** C130301-32 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
EPA 300.0	**Chloride**	**70.3**		mg/L	10.0	10	03/19/2013	NP	1303036
EPA 300.0	Fluoride	< 2.0	U	mg/L	1.0	10	03/19/2013	NP	1303036
EPA 300.0	**Sulfate as SO4**	**801**		mg/L	20.0	10	03/19/2013	NP	1303036
EPA 310.1	**Total Alkalinity**	**235**		mg CaCO3 / L	5.00	1	03/07/2013	SV	1303009

Classical Chemistry by EPA/ASTM/APHA Methods

Station ID: 13BH-DT-BENCH-SPS-C4
Date / Time Sampled: 02/27/13 14:35
Workorder: C130301
EPA Tag No.: No Tag Prefix-C
Matrix: Surface Water
Lab Number: C130301-35 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
EPA 300.0	**Chloride**	**519**		mg/L	10.0	10	03/20/2013	NP	1303036
EPA 300.0	**Fluoride**	**2.3**		mg/L	1.0	10	03/20/2013	NP	1303036
EPA 300.0	**Sulfate as SO4**	**777**		mg/L	20.0	10	03/20/2013	NP	1303036
EPA 310.1	**Total Alkalinity**	**574**		mg CaCO3 / L	5.00	1	03/07/2013	SV	1303009

"J" Qualifier indicates an estimated value

Metals (Dissolved) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

ICPMS-PE DRC-II

Batch 1303011 - No Lab Prep Reqd *Water* **ICPMS-PE DRC-II**

Method Blank (1303011-BLK1) Dilution Factor: 1 Prepared: 03/07/13 Analyzed: 03/08/13

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Vanadium	< 2.00	3.00	ug/L						
Chromium	< 1.00	2.00	"						
Cobalt	< 0.100	0.200	"						
Nickel	< 0.500	1.00	"						
Arsenic	< 0.500	2.00	"						
Selenium	0.620	1.00	"						
Silver	< 0.500	1.00	"						
Cadmium	< 0.100	0.200	"						
Antimony	< 0.500	1.00	"						
Barium	< 5.00	10.0	"						
Thallium	< 0.500	1.00	"						
Lead	< 0.100	0.200	"						

Method Blank Spike (1303011-BS1) Dilution Factor: 1 Prepared: 03/07/13 Analyzed: 03/08/13

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Vanadium	94.5	3.00	ug/L	100		95	85-115		
Chromium	96.2	2.00	"	100		96	85-115		
Cobalt	93.8	0.200	"	100		94	85-115		
Nickel	102	1.00	"	100		102	85-115		
Arsenic	93.9	2.00	"	100		94	85-115		
Selenium	510	1.00	"	500		102	85-115		
Silver	90.4	1.00	"	100		90	85-115		
Cadmium	98.9	0.200	"	100		99	85-115		
Antimony	97.0	1.00	"	100		97	85-115		
Barium	95.9	10.0	"	100		96	85-115		
Thallium	97.0	1.00	"	100		97	85-115		
Lead	97.3	0.200	"	100		97	85-115		

Duplicate (1303011-DUP1) Dilution Factor: 5 **Source: C130301-01** Prepared: 03/07/13 Analyzed: 03/08/13

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Vanadium	< 10.0	15.0	ug/L		< 10.0				20
Chromium	< 5.00	10.0	"		< 5.00				20
Cobalt	27.6	1.00	"		27.7			0.02	20
Nickel	26.8	5.00	"		26.4			1	20
Arsenic	4.88	10.0	"		4.81			1	20
Selenium	7.14	5.00	"		5.14			33	20
Silver	< 2.50	5.00	"		< 2.50				20
Cadmium	139	1.00	"		138			1	20
Antimony	< 2.50	5.00	"		< 2.50				20
Barium	< 25.0	50.0	"		< 25.0				20
Thallium	< 2.50	5.00	"		< 2.50				20

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

Metals (Dissolved) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1303011 - No Lab Prep Reqd			*Water*						**ICPMS-PE DRC-II**
Duplicate (1303011-DUP1)		Dilution Factor: 5	**Source: C130301-01**			Prepared: 03/07/13 Analyzed: 03/08/13			
Lead	78.3	1.00	ug/L		82.6			5	20
Matrix Spike (1303011-MS1)		Dilution Factor: 5	**Source: C130301-01**			Prepared: 03/07/13 Analyzed: 03/08/13			
Vanadium	87.1	15.0	ug/L	100	< 10.0	87	75-125		
Chromium	94.6	10.0	"	100	< 5.00	95	75-125		
Cobalt	117	1.00	"	100	27.7	90	75-125		
Nickel	121	5.00	"	100	26.4	94	75-125		
Arsenic	102	10.0	"	100	4.81	97	75-125		
Selenium	500	5.00	"	500	5.14	99	75-125		
Silver	87.4	5.00	"	100	< 2.50	87	75-125		
Cadmium	229	1.00	"	100	138	91	75-125		
Antimony	94.8	5.00	"	100	< 2.50	95	75-125		
Barium	103	50.0	"	100	< 25.0	103	75-125		
Thallium	95.7	5.00	"	100	< 2.50	96	75-125		
Lead	171	1.00	"	100	82.6	89	75-125		
Matrix Spike Dup (1303011-MSD1)		Dilution Factor: 5	**Source: C130301-01**			Prepared: 03/07/13 Analyzed: 03/08/13			
Vanadium	87.1	15.0	ug/L	100	< 10.0	87	75-125	0.002	20
Chromium	94.4	10.0	"	100	< 5.00	94	75-125	0.1	20
Cobalt	120	1.00	"	100	27.7	93	75-125	3	20
Nickel	122	5.00	"	100	26.4	96	75-125	1	20
Arsenic	104	10.0	"	100	4.81	99	75-125	2	20
Selenium	525	5.00	"	500	5.14	104	75-125	5	20
Silver	85.4	5.00	"	100	< 2.50	85	75-125	2	20
Cadmium	233	1.00	"	100	138	95	75-125	2	20
Antimony	93.6	5.00	"	100	< 2.50	94	75-125	1	20
Barium	106	50.0	"	100	< 25.0	106	75-125	3	20
Thallium	95.6	5.00	"	100	< 2.50	96	75-125	0.1	20
Lead	175	1.00	"	100	82.6	92	75-125	2	20

Metals (Dissolved) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Batch 1303023 - 1303011 *Water* **ICPMS-PE DRC-II**

Serial Dilution (1303023-SRD1) Dilution Factor: 2 **Source: C130301-01** Prepared: 03/07/13 Analyzed: 03/08/13

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Vanadium	< 50.0	75.0	ug/L		< 10.00				10
Chromium	< 25.0	50.0	"		< 5.00				10
Cobalt	27.2	5.00	"		27.7			2	10
Nickel	26.1	25.0	"		26.4			1	10
Arsenic	< 12.5	50.0	"		4.81				10
Selenium	< 12.5	25.0	"		5.14				10
Silver	< 12.5	25.0	"		< 2.50				10
Cadmium	136	5.00	"		138			1	10
Antimony	< 12.5	25.0	"		< 2.50				10
Barium	< 125	250	"		< 25.00				10
Thallium	< 12.5	25.0	"		< 2.50				10
Lead	79.0	5.00	"		82.6			4	10

ICPOE - PE Optima

Batch 1303010 - No Lab Prep Reqd *Water* **ICPOE - PE Optima**

Method Blank (1303010-BLK1) Dilution Factor: 1 Prepared: 03/07/13 Analyzed: 03/08/13

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Aluminum	< 20.0	50.0	ug/L						
Beryllium	< 2.00	5.00	"						
Calcium	< 100	250	"						
Copper	< 2.00	2.00	"						
Iron	< 100	250	"						
Potassium	< 250	1000	"						
Magnesium	< 100	250	"						
Manganese	< 2.00	5.00	"						
Sodium	< 250	1000	"						
Zinc	< 10.0	20.0	"						

Metals (Dissolved) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1303010 - No Lab Prep Reqd			*Water*						ICPOE - PE Optima
Method Blank Spike (1303010-BS1)		Dilution Factor: 1				Prepared: 03/07/13	Analyzed: 03/08/13		
Aluminum	10440	50.0	ug/L	10100		103	85-115		
Beryllium	103.8	5.00	"	100		104	85-115		
Calcium	10560	250	"	10100		105	85-115		
Copper	96.59	2.00	"	100		97	85-115		
Iron	10930	250	"	10100		108	85-115		
Potassium	10420	1000	"	10100		103	85-115		
Magnesium	10550	250	"	10100		104	85-115		
Manganese	101.0	5.00	"	100		101	85-115		
Sodium	10660	1000	"	10100		106	85-115		
Zinc	106.0	20.0	"	100		106	85-115		
Duplicate (1303010-DUP1)		Dilution Factor: 5	**Source: C130301-01**			Prepared: 03/07/13	Analyzed: 03/08/13		
Aluminum	6480	250	ug/L		6246			4	20
Beryllium	< 10.0	25.0	"		< 10.0				20
Calcium	96650	1250	"		95850			0.8	20
Copper	414.9	10.0	"		420.8			1	20
Iron	78010	1250	"		79190			2	20
Potassium	2163	5000	"		2109			3	20
Magnesium	21100	1250	"		20920			0.9	20
Manganese	90780	25.0	"		91170			0.4	20
Sodium	8201	5000	"		8307			1	20
Zinc	40420	100	"		40720			0.7	20
Matrix Spike (1303010-MS1)		Dilution Factor: 5	**Source: C130301-01**			Prepared: 03/07/13	Analyzed: 03/08/13		
Aluminum	16730	250	ug/L	10100	6246	104	75-125		
Beryllium	112.2	25.0	"	100	< 10.0	112	75-125		
Calcium	104600	1250	"	10100	95850	87	75-125		
Copper	512.3	10.0	"	100	420.8	91	75-125		
Iron	87840	1250	"	10100	79190	86	75-125		
Potassium	12400	5000	"	10100	2109	102	75-125		
Magnesium	31170	1250	"	10100	20920	102	75-125		
Manganese	88880	25.0	"	100	91170	NR	75-125		
Sodium	19060	5000	"	10100	8307	106	75-125		
Zinc	39860	100	"	100	40720	NR	75-125		

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

Metals (Dissolved) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Batch 1303010 - No Lab Prep Reqd *Water* **ICPOE - PE Optima**

Matrix Spike Dup (1303010-MSD1) Dilution Factor: 5 **Source: C130301-01** Prepared: 03/07/13 Analyzed: 03/08/13

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Aluminum	16740	250	ug/L	10100	6246	104	75-125	0.06	20
Beryllium	110.0	25.0	"	100	< 10.0	110	75-125	2	20
Calcium	105700	1250	"	10100	95850	97	75-125	1	20
Copper	512.9	10.0	"	100	420.8	92	75-125	0.1	20
Iron	86280	1250	"	10100	79190	70	75-125	2	20
Potassium	12240	5000	"	10100	2109	100	75-125	1	20
Magnesium	31190	1250	"	10100	20920	102	75-125	0.07	20
Manganese	89930	25.0	"	100	91170	NR	75-125	1	20
Sodium	18660	5000	"	10100	8307	103	75-125	2	20
Zinc	39810	100	"	100	40720	NR	75-125	0.1	20

Batch 1303021 - 1303010 *Water* **ICPOE - PE Optima**

Serial Dilution (1303021-SRD1) Dilution Factor: 2 **Source: C130301-01** Prepared: 03/07/13 Analyzed: 03/08/13

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Aluminum	6320	1250	ug/L		6246			1	10
Beryllium	< 50.0	125	"		< 10.00				10
Calcium	94700	6250	"		95850			1	10
Copper	377.5	50.0	"		420.8			11	10
Iron	75930	6250	"		79190			4	10
Potassium	< 6250	25000	"		2109				10
Magnesium	20680	6250	"		20920			1	10
Manganese	93340	125	"		91170			2	10
Sodium	8151	25000	"		8307			2	10
Zinc	39050	500	"		40720			4	10

NOTE: %R = % Recovery, %R limits do not apply when sample levels exceed 4x the spike level.
RPD = Relative Percent Difference, %D = % Difference, DL = Detection Limit for QC sample .

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

ICPMS-PE DRC-II

Batch 1303008 - 200.2 - TR Metals *Water* **ICPMS-PE DRC-II**

Method Blank (1303008-BLK2) Dilution Factor: 5 Prepared: 03/06/13 Analyzed: 03/08/13

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Vanadium	< 10.0	15.0	ug/L						
Chromium	< 5.00	10.0	"						
Cobalt	< 0.500	1.00	"						
Nickel	< 2.50	5.00	"						
Arsenic	< 2.50	10.0	"						
Selenium	< 2.50	5.00	"						
Silver	< 2.50	5.00	"						
Cadmium	< 0.500	1.00	"						
Antimony	< 2.50	5.00	"						
Barium	< 25.0	50.0	"						
Thallium	< 2.50	5.00	"						
Lead	< 0.500	1.00	"						

Duplicate (1303008-DUP2) Dilution Factor: 5 **Source: C130301-22** Prepared: 03/06/13 Analyzed: 03/08/13

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Vanadium	< 10.0	15.0	ug/L		< 10.0				20
Chromium	< 5.00	10.0	"		< 5.00				20
Cobalt	26.35	1.00	"		25.50			3	20
Nickel	21.60	5.00	"		19.65			9	20
Arsenic	12.49	10.0	"		14.31			14	20
Selenium	5.187	5.00	"		8.165			45	20
Silver	< 2.50	5.00	"		< 2.50				20
Cadmium	139.9	1.00	"		134.0			4	20
Antimony	< 2.50	5.00	"		< 2.50				20
Barium	< 25.0	50.0	"		< 25.0				20
Thallium	9.886	5.00	"		34.63			111	20
Lead	81.08	1.00	"		80.28			1	20

Matrix Spike (1303008-MS2) Dilution Factor: 5 **Source: C130301-22** Prepared: 03/06/13 Analyzed: 03/08/13

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Vanadium	236.5	15.0	ug/L	300	< 10.0	79	75-125		
Chromium	350.1	10.0	"	400	< 5.00	88	75-125		
Cobalt	186.4	1.00	"	200	25.50	80	75-125		
Nickel	458.6	5.00	"	500	19.65	88	75-125		
Arsenic	718.5	10.0	"	800	14.31	88	75-125		
Selenium	1938	5.00	"	2000	8.165	97	75-125		
Silver	66.67	5.00	"	75.0	< 2.50	89	75-125		
Cadmium	312.1	1.00	"	200	134.0	89	75-125		
Antimony	725.3	5.00	"	800	< 2.50	91	75-125		
Barium	177.7	50.0	"	200	< 25.0	89	75-125		
Thallium	1609	5.00	"	2000	34.63	79	75-125		

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1303008 - 200.2 - TR Metals			*Water*						**ICPMS-PE DRC-II**
Matrix Spike (1303008-MS2)		Dilution Factor: 5	**Source: C130301-22**			Prepared: 03/06/13 Analyzed: 03/08/13			
Lead	903.3	1.00	ug/L	1000	80.28	82	75-125		
Matrix Spike Dup (1303008-MSD2)		Dilution Factor: 5	**Source: C130301-22**			Prepared: 03/06/13 Analyzed: 03/08/13			
Vanadium	254.5	15.0	ug/L	300	< 10.0	85	75-125	7	20
Chromium	340.7	10.0	"	400	< 5.00	85	75-125	3	20
Cobalt	194.6	1.00	"	200	25.50	85	75-125	4	20
Nickel	455.0	5.00	"	500	19.65	87	75-125	0.8	20
Arsenic	735.6	10.0	"	800	14.31	90	75-125	2	20
Selenium	1909	5.00	"	2000	8.165	95	75-125	2	20
Silver	69.64	5.00	"	75.0	< 2.50	93	75-125	4	20
Cadmium	320.8	1.00	"	200	134.0	93	75-125	3	20
Antimony	763.1	5.00	"	800	< 2.50	95	75-125	5	20
Barium	192.1	50.0	"	200	< 25.0	96	75-125	8	20
Thallium	1711	5.00	"	2000	34.63	84	75-125	6	20
Lead	949.3	1.00	"	1000	80.28	87	75-125	5	20
Post Spike (1303008-PS2)		Dilution Factor: 5	**Source: C130301-22**			Prepared: 03/06/13 Analyzed: 03/08/13			
Vanadium	82.34		ug/L	100	-10.15	92	80-120		
Chromium	89.13		"	100	4.221	85	80-120		
Cobalt	108.3		"	100	25.50	83	80-120		
Nickel	102.8		"	100	19.65	83	80-120		
Arsenic	112.2		"	100	14.31	98	80-120		
Selenium	500.7		"	500	8.165	99	80-120		
Silver	85.73		"	100	0.3110	85	80-120		
Cadmium	229.6		"	100	134.0	96	80-120		
Antimony	96.43		"	100	0.8426	96	80-120		
Barium	98.18		"	100	3.691	94	80-120		
Thallium	102.1		"	100	34.63	67	80-120		
Lead	169.8		"	100	80.28	90	80-120		

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1303008 - 200.2 - TR Metals			*Water*						ICPMS-PE DRC-II
Reference (1303008-SRM2)		Dilution Factor: 2				Prepared: 03/06/13	Analyzed: 03/08/13		
Vanadium	897.5	60.0	ug/L	1000		90	80-120		
Chromium	910.0	40.0	"	1000		91	80-120		
Cobalt	923.0	4.00	"	1000		92	80-120		
Nickel	935.9	20.0	"	1000		94	80-120		
Arsenic	1940	40.0	"	2000		97	80-120		
Selenium	992.0	20.0	"	1000		99	80-120		
Silver	236.0	20.0	"	250		94	80-120		
Cadmium	954.4	4.00	"	1000		95	80-120		
Antimony	1864	20.0	"	2000		93	80-120		
Barium	939.1	200	"	1000		94	80-120		
Thallium	4415	20.0	"	5000		88	80-120		
Lead	1798	4.00	"	2000		90	80-120		
Batch 1303024 - 1303008			*Water*						ICPMS-PE DRC-II
Serial Dilution (1303024-SRD1)		Dilution Factor: 2	**Source: C130301-22**			Prepared: 03/06/13	Analyzed: 03/08/13		
Vanadium	< 50.0	75.0	ug/L		< 10.00				10
Chromium	< 25.0	50.0	"		< 5.00				10
Cobalt	26.49	5.00	"		25.50			4	10
Nickel	21.18	25.0	"		19.65			8	10
Arsenic	24.28	50.0	"		14.31			52	10
Selenium	18.05	25.0	"		8.165			75	10
Silver	< 12.5	25.0	"		< 2.50				10
Cadmium	136.7	5.00	"		134.0			2	10
Antimony	< 12.5	25.0	"		< 2.50				10
Barium	< 125	250	"		< 25.00				10
Thallium	38.98	25.0	"		34.63			12	10
Lead	81.31	5.00	"		80.28			1	10

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
ICPOE - PE Optima									
Batch 1303008 - 200.2 - TR Metals			***Water***					**ICPOE - PE Optima**	
Method Blank (1303008-BLK1)		Dilution Factor: 1				Prepared: 03/06/13 Analyzed: 03/08/13			
Aluminum	< 20.0	50.0	ug/L						
Beryllium	< 2.00	5.00	"						
Calcium	< 100	250	"						
Copper	< 2.00	2.00	"						
Iron	< 100	250	"						
Potassium	< 250	1000	"						
Magnesium	< 100	250	"						
Manganese	< 2.00	5.00	"						
Sodium	< 250	1000	"						
Zinc	< 10.0	20.0	"						
Duplicate (1303008-DUP1)		Dilution Factor: 5	**Source: C130301-22**			Prepared: 03/06/13 Analyzed: 03/08/13			
Aluminum	6490	250	ug/L		6492			0.03	20
Beryllium	< 10.0	25.0	"		< 10.0				20
Calcium	94650	1250	"		94570			0.09	20
Copper	425.8	10.0	"		426.2			0.08	20
Iron	81650	1250	"		82440			1	20
Potassium	< 1250	5000	"		< 1250				20
Magnesium	20500	1250	"		20450			0.2	20
Manganese	90630	25.0	"		89670			1	20
Sodium	5806	5000	"		5775			0.5	20
Zinc	39770	100	"		39120			2	20
Matrix Spike (1303008-MS1)		Dilution Factor: 5	**Source: C130301-22**			Prepared: 03/06/13 Analyzed: 03/08/13			
Aluminum	8190	250	ug/L	2000	6492	85	75-125		
Beryllium	196.4	25.0	"	200	< 10.0	98	75-125		
Calcium	93780	1250	"	1000	94570	NR	75-125		
Copper	702.2	10.0	"	300	426.2	92	75-125		
Iron	83860	1250	"	3000	82440	47	75-125		
Potassium	9975	5000	"	10000	< 1250	100	75-125		
Magnesium	22100	1250	"	2000	20450	82	75-125		
Manganese	88890	25.0	"	200	89670	NR	75-125		
Sodium	8657	5000	"	3000	5775	96	75-125		
Zinc	38940	100	"	200	39120	NR	75-125		

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1303008 - 200.2 - TR Metals			*Water*						**ICPOE - PE Optima**
Matrix Spike Dup (1303008-MSD1)		Dilution Factor: 5	**Source: C130301-22**			Prepared: 03/06/13 Analyzed: 03/08/13			
Aluminum	8352	250	ug/L	2000	6492	93	75-125	2	20
Beryllium	204.3	25.0	"	200	< 10.0	102	75-125	4	20
Calcium	94990	1250	"	1000	94570	42	75-125	1	20
Copper	725.3	10.0	"	300	426.2	100	75-125	3	20
Iron	85110	1250	"	3000	82440	89	75-125	1	20
Potassium	10300	5000	"	10000	< 1250	103	75-125	3	20
Magnesium	22530	1250	"	2000	20450	104	75-125	2	20
Manganese	89860	25.0	"	200	89670	93	75-125	1	20
Sodium	8944	5000	"	3000	5775	106	75-125	3	20
Zinc	39310	100	"	200	39120	98	75-125	1	20
Post Spike (1303008-PS1)		Dilution Factor: 5	**Source: C130301-22**			Prepared: 03/06/13 Analyzed: 03/08/13			
Aluminum	16800		ug/L	10100	6492	102	80-120		
Beryllium	108.8		"	100	6.134	103	80-120		
Calcium	102600		"	10100	94570	79	80-120		
Copper	518.0		"	100	426.2	92	80-120		
Iron	90730		"	10100	82440	82	80-120		
Potassium	11020		"	10100	745.3	102	80-120		
Magnesium	30540		"	10100	20450	100	80-120		
Manganese	87680		"	100	89670	NR	80-120		
Sodium	16700		"	10100	5775	108	80-120		
Zinc	38080		"	100	39120	NR	80-120		
Reference (1303008-SRM1)		Dilution Factor: 1				Prepared: 03/06/13 Analyzed: 03/08/13			
Aluminum	887.1	50.0	ug/L	1000		89	80-120		
Beryllium	969.4	5.00	"	1000		97	80-120		
Calcium	884.2	250	"	1000		88	80-120		
Copper	968.3	2.00	"	1000		97	80-120		
Iron	912.5	250	"	1000		91	80-120		
Potassium	4427	1000	"	5000		89	80-120		
Magnesium	928.0	250	"	1000		93	80-120		
Manganese	995.1	5.00	"	1000		100	80-120		
Sodium	951.3	1000	"	1000		95	80-120		
Zinc	982.3	20.0	"	1000		98	80-120		

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1303022 - 1303008			*Water*						ICPOE - PE Optima
Serial Dilution (1303022-SRD1)		Dilution Factor: 2		**Source: C130301-22**		Prepared: 03/06/13 Analyzed: 03/08/13			
Aluminum	6325	1250	ug/L		6492			3	10
Beryllium	< 50.0	125	"		< 10.00				10
Calcium	92280	6250	"		94570			2	10
Copper	1469	50.0	"		426.2			110	10
Iron	80430	6250	"		82440			2	10
Potassium	< 6250	25000	"		< 1,250.00				10
Magnesium	19770	6250	"		20450			3	10
Manganese	92470	125	"		89670			3	10
Sodium	6864	25000	"		5775			17	10
Zinc	38650	500	"		39120			1	10

NOTE: %R = % Recovery, %R limits do not apply when sample levels exceed 4x the spike level.
RPD = Relative Percent Difference, %D = % Difference, DL = Detection Limit for QC sample .

Classical Chemistry by EPA/ASTM/APHA Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
ESAT Dionex IC									
Batch 1303036 - No Prep Req			***Water***						**ESAT Dionex IC**
Method Blank (1303036-BLK1)		Dilution Factor: 1				Prepared & Analyzed: 03/19/13			
Fluoride	< 0.1	0.2	mg/L						
Chloride	< 1.0	2.0	"						
Sulfate as SO4	< 2.0	5.0	"						
Method Blank Spike (1303036-BS1)		Dilution Factor: 1				Prepared & Analyzed: 03/19/13			
Fluoride	5.0	0.2	mg/L	5.00		101	90-110		
Chloride	23.7	2.0	"	25.0		95	90-110		
Sulfate as SO4	23.1	5.0	"	25.0		92	90-110		
Duplicate (1303036-DUP1)		Dilution Factor: 1	**Source: C130301-03**			Prepared & Analyzed: 03/19/13			
Fluoride	2.0	2.0	mg/L		1.9			6	20
Chloride	< 10.0	20.0	"		< 10.0				20
Sulfate as SO4	851	50.0	"		841			1	20
Matrix Spike (1303036-MS1)		Dilution Factor: 1	**Source: C130301-03**			Prepared & Analyzed: 03/19/13			
Fluoride	48.5	2.0	mg/L	50.0	1.9	93	80-120		
Chloride	241	20.0	"	250	< 10.0	96	80-120		
Sulfate as SO4	1090	50.0	"	250	841	98	80-120		
Matrix Spike Dup (1303036-MSD1)		Dilution Factor: 1	**Source: C130301-03**			Prepared & Analyzed: 03/19/13			
Fluoride	49.3	2.0	mg/L	50.0	1.9	95	80-120	2	20
Chloride	240	20.0	"	250	< 10.0	96	80-120	0.5	20
Sulfate as SO4	1070	50.0	"	250	841	93	80-120	1	20
Mettler AT									
Batch 1303009 - No Prep Req			***Water***						**Mettler AT**
Method Blank (1303009-BLK1)		Dilution Factor: 1				Prepared: 03/06/13 Analyzed: 03/07/13			
Total Alkalinity	< 5.00	5.00	mg CaCO3 / L						

Classical Chemistry by EPA/ASTM/APHA Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1303009 - No Prep Req			***Water***						**Mettler AT**
Duplicate (1303009-DUP1)		Dilution Factor: 1		**Source: C130301-03**		Prepared: 03/06/13 Analyzed: 03/07/13			
Total Alkalinity	< 5.00	5.00	mg CaCO3 / L		< 5.00				20
Reference (1303009-SRM1)		Dilution Factor: 1				Prepared: 03/06/13 Analyzed: 03/07/13			
Total Alkalinity	109	5.00	mg CaCO3 / L	115		95	90-110		
None - Gravimetric									
Batch 1303032 - No Prep Req			***Water***						**None - Gravimetric**
Method Blank (1303032-BLK1)		Dilution Factor: 1				Prepared & Analyzed: 03/04/13			
Total Suspended Solids	< 10	10	mg/L						
Duplicate (1303032-DUP1)		Dilution Factor: 1		**Source: C130301-10**		Prepared & Analyzed: 03/04/13			
Total Suspended Solids	240	10	mg/L		248			3	20
Reference (1303032-SRM1)		Dilution Factor: 1				Prepared & Analyzed: 03/04/13			
Total Suspended Solids	118	10	mg/L	144		82	75-125		

NOTE: %R = % Recovery, %R limits do not apply when sample levels exceed 4x the spike level.
RPD = Relative Percent Difference, %D = % Difference, DL = Detection Limit for QC sample .

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

TechLaw Inc., ESAT Region 8

INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: EPA 310.1 Analysis Name: WC - Alkalinity

Instrument: **Mettler AT** Work Order: Nu C130301

Analytical Sequence: **Total** Concentration Units: mg CaCO3 / L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	**Initial Calibration Blank (1 & 2)**	**Continuing Calibration Blanks**				**Method Blank (Batch ID)**		**PQL**
		1	**2**	**3**	**4**	1303009-BLK1	NA	
Total Alkalinity		0.80	1.88			3.43	NA	5.00
		5	**6**	**7**	**8**			

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

TechLaw Inc., ESAT Region 8

INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.7 Analysis Name: ICPOE Diss. Metals

Instrument: **ICPOE - PE Optima** Work Order: Nu C130301

Analytical Sequence: 1303021 **Dissolved** Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	**Initial Calibration Blank (1 & 2)**	**Continuing Calibration Blanks**								**Method Blank (Batch ID)**		**PQL**
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**			
Aluminum	2.27	1.74	3.08	1.58						1303010-BLK1 2.71	NA NA	50.00
Beryllium	0.29	-0.01	0.33	0.25						1303010-BLK1 0.38	NA NA	5.00
Calcium	-1.28	-2.24	-2.74	-3.95						1303010-BLK1 -3.29	NA NA	250.00
Copper	-0.96	0.27	-0.68	-0.64						1303010-BLK1 -1.42	NA NA	2.00
Iron	-11.44	7.88	-7.63	-8.37						1303010-BLK1 -10.46	NA NA	250.00
Potassium	15.96	17.38	24.88	26.92						1303010-BLK1 15.87	NA NA	1,000.00
Magnesium	-1.66	-0.74	-0.92	0.01						1303010-BLK1 -1.17	NA NA	250.00
Manganese	-0.02	-0.06	0.09	-0.03						1303010-BLK1 -0.10	NA NA	5.00

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

TechLaw Inc., ESAT Region 8

INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.7

Analysis Name: ICPOE Diss. Metals

Instrument: **ICPOE - PE Optima**

Work Order: Nu C130301

Analytical Sequence: 1303021 **Dissolved**

Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
		1	**2**	**3**	**4**	1303010-BLK1	NA	
Sodium	2.58	0.62	13.52	16.59		2.12	NA	1,000.00
		5	**6**	**7**	**8**			
		1	**2**	**3**	**4**	1303010-BLK1	NA	
Zinc	1.71	0.68	1.61	0.88		1.07	NA	20.00
		5	**6**	**7**	**8**			

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

TechLaw Inc., ESAT Region 8

INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.7

Analysis Name: ICPOE Tot. Rec. Metals

Instrument: **ICPOE - PE Optima**

Work Order: Nu C130301

Analytical Sequence: 1303022 **Total Recoverable**

Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
Aluminum	2.27	1	2	3	4	1303008-BLK1	NA	50.00
		1.74	3.08	1.58	1.93	3.97	NA	
		5	6	7	8			
		3.93						
Beryllium	0.29	1	2	3	4	1303008-BLK1	NA	5.00
		-0.01	0.33	0.25	-0.18	0.22	NA	
		5	6	7	8			
		-0.05						
Calcium	-1.28	1	2	3	4	1303008-BLK1	NA	250.00
		-2.24	-2.74	-3.95	-3.13	3.28	NA	
		5	6	7	8			
		-3.81						
Copper	-0.96	1	2	3	4	1303008-BLK1	NA	2.00
		0.27	-0.68	-0.64	0.67	0.08	NA	
		5	6	7	8			
		0.53						
Iron	-11.44	1	2	3	4	1303008-BLK1	NA	250.00
		7.88	-7.63	-8.37	-0.66	-8.21	NA	
		5	6	7	8			
		-0.10						
Potassium	15.96	1	2	3	4	1303008-BLK1	NA	1,000.00
		17.38	24.88	26.92	31.57	142.79	NA	
		5	6	7	8			
		22.43						
Magnesium	-1.66	1	2	3	4	1303008-BLK1	NA	250.00
		-0.74	-0.92	0.01	-1.37	-1.89	NA	
		5	6	7	8			
		-0.44						
Manganese	-0.02	1	2	3	4	1303008-BLK1	NA	5.00
		-0.06	0.09	-0.03	0.14	0.19	NA	
		5	6	7	8			
		0.05						

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

TechLaw Inc., ESAT Region 8

INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.7

Analysis Name: ICPOE Tot. Rec. Metals

Instrument: **ICPOE - PE Optima**

Work Order: Nu C130301

Analytical Sequence: 1303022 **Total Recoverable**

Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
Sodium	2.58	**1**	**2**	**3**	**4**	1303008-BLK1	NA	1,000.00
		0.62	13.52	16.59	8.79	43.43	NA	
		5	**6**	**7**	**8**			
		6.01						
Zinc	1.71	**1**	**2**	**3**	**4**	1303008-BLK1	NA	20.00
		0.68	1.61	0.88	0.70	6.25	NA	
		5	**6**	**7**	**8**			
		0.86						

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

TechLaw Inc., ESAT Region 8

INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.8

Analysis Name: ICPMS Diss. Metals

Instrument: **ICPMS-PE DRC-II**

Work Order: Nu C130301

Analytical Sequence: 1303023 **Dissolved**

Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
Vanadium	0.00	**1**	**2**	**3**	**4**	1303011-BLK1	NA	3.00
		-0.02	0.00	-0.04		0.00	NA	
		5	**6**	**7**	**8**			
Chromium	-0.02	**1**	**2**	**3**	**4**	1303011-BLK1	NA	2.00
		-0.09	0.01	-0.13		0.01	NA	
		5	**6**	**7**	**8**			
Cobalt	0.00	**1**	**2**	**3**	**4**	1303011-BLK1	NA	0.20
		0.00	0.00	0.00		0.00	NA	
		5	**6**	**7**	**8**			
Nickel	0.00	**1**	**2**	**3**	**4**	1303011-BLK1	NA	1.00
		0.00	0.00	-0.01		0.01	NA	
		5	**6**	**7**	**8**			
Arsenic	0.05	**1**	**2**	**3**	**4**	1303011-BLK1	NA	2.00
		0.06	0.23	0.46		0.22	NA	
		5	**6**	**7**	**8**			
Selenium	0.31	**1**	**2**	**3**	**4**	1303011-BLK1	NA	1.00
		0.17	0.25	0.61		0.62	NA	
		5	**6**	**7**	**8**			
Silver	0.03	**1**	**2**	**3**	**4**	1303011-BLK1	NA	1.00
		0.02	0.03	0.04		0.02	NA	
		5	**6**	**7**	**8**			
Cadmium	0.00	**1**	**2**	**3**	**4**	1303011-BLK1	NA	0.20
		0.01	0.00	0.02		0.01	NA	
		5	**6**	**7**	**8**			

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

TechLaw Inc., ESAT Region 8

INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.8 Analysis Name: ICPMS Diss. Metals

Instrument: **ICPMS-PE DRC-II** Work Order: Nu C130301

Analytical Sequence: 1303023 **Dissolved** Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	**Initial Calibration Blank (1 & 2)**	**Continuing Calibration Blanks**				**Method Blank (Batch ID)**		**PQL**
Antimony	0.08	**1**	**2**	**3**	**4**	1303011-BLK1	NA	1.00
		0.15	0.15	0.11		0.39	NA	
		5	**6**	**7**	**8**			
Barium	0.02	**1**	**2**	**3**	**4**	1303011-BLK1	NA	10.00
		0.00	0.02	0.00		-0.02	NA	
		5	**6**	**7**	**8**			
Thallium	0.01	**1**	**2**	**3**	**4**	1303011-BLK1	NA	1.00
		0.01	0.01	0.01		0.06	NA	
		5	**6**	**7**	**8**			
Lead	0.01	**1**	**2**	**3**	**4**	1303011-BLK1	NA	0.20
		0.00	0.00	0.00		0.03	NA	
		5	**6**	**7**	**8**			

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INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.8 Analysis Name: ICPMS Tot. Rec. Metals

Instrument: **ICPMS-PE DRC-II** Work Order: Nu C130301

Analytical Sequence: 1303024 **Total Recoverable** Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	**Initial Calibration Blank (1 & 2)**	**Continuing Calibration Blanks**				**Method Blank (Batch ID)**		**PQL**
Vanadium	0.00	**1**	**2**	**3**	**4**	NA	1303008-BLK2	3.00
		-0.02	0.00	-0.04	-0.08	NA	-1.59	
		5	**6**	**7**	**8**			
		-0.10						
Chromium	-0.02	**1**	**2**	**3**	**4**	NA	1303008-BLK2	2.00
		-0.09	0.01	-0.13	-0.04	NA	0.48	
		5	**6**	**7**	**8**			
		-0.03						
Cobalt	0.00	**1**	**2**	**3**	**4**	NA	1303008-BLK2	0.20
		0.00	0.00	0.00	0.00	NA	0.00	
		5	**6**	**7**	**8**			
		0.00						
Nickel	0.00	**1**	**2**	**3**	**4**	NA	1303008-BLK2	1.00
		0.00	0.00	-0.01	0.00	NA	-0.01	
		5	**6**	**7**	**8**			
		0.00						
Arsenic	0.05	**1**	**2**	**3**	**4**	NA	1303008-BLK2	2.00
		0.06	0.23	0.46	0.42	NA	0.29	
		5	**6**	**7**	**8**			
		0.75						
Selenium	0.31	**1**	**2**	**3**	**4**	NA	1303008-BLK2	1.00
		0.17	0.25	0.61	0.70	NA	0.38	
		5	**6**	**7**	**8**			
		0.48						
Silver	0.03	**1**	**2**	**3**	**4**	NA	1303008-BLK2	1.00
		0.02	0.03	0.04	0.03	NA	0.06	
		5	**6**	**7**	**8**			
		0.03						
Cadmium	0.00	**1**	**2**	**3**	**4**	NA	1303008-BLK2	0.20
		0.01	0.00	0.02	0.01	NA	0.05	
		5	**6**	**7**	**8**			
		0.01						

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

TechLaw Inc., ESAT Region 8

INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.8

Analysis Name: ICPMS Tot. Rec. Metals

Instrument: **ICPMS-PE DRC-II**

Work Order: Nu C130301

Analytical Sequence: 1303024 **Total Recoverable**

Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	**Initial Calibration Blank (1 & 2)**	**Continuing Calibration Blanks**				**Method Blank (Batch ID)**		**PQL**
Antimony	0.08	**1**	**2**	**3**	**4**	NA	1303008-BLK2	1.00
		0.15	0.15	0.11	0.14	NA	0.06	
		5	**6**	**7**	**8**			
		0.13						
Barium	0.02	**1**	**2**	**3**	**4**	NA	1303008-BLK2	10.00
		0.00	0.02	0.00	0.01	NA	0.15	
		5	**6**	**7**	**8**			
		0.00						
Thallium	0.01	**1**	**2**	**3**	**4**	NA	1303008-BLK2	1.00
		0.01	0.01	0.01	0.23	NA	0.00	
		5	**6**	**7**	**8**			
		0.06						
Lead	0.01	**1**	**2**	**3**	**4**	NA	1303008-BLK2	0.20
		0.00	0.00	0.00	0.00	NA	0.02	
		5	**6**	**7**	**8**			
		0.00						

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

TechLaw Inc., ESAT Region 8

INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: EPA 300.0

Analysis Name: WC - Anions by Ion Chromatography

Instrument: **ESAT Dionex IC**

Work Order: Nu C130301

Analytical Sequence: 1303044 **Dissolved**

Concentration Units: mg/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	**Initial Calibration Blank (1 & 2)**	**Continuing Calibration Blanks**				**Method Blank (Batch ID)**		**PQL**
		1	**2**	**3**	**4**	1303036-BLK1	NA	
Fluoride	0.00	0.00	0.00	0.00	0.00	0.00	NA	0.20
		5	**6**	**7**	**8**			
		1	**2**	**3**	**4**	1303036-BLK1	NA	
Chloride	0.00	0.00	0.00	0.00	0.00	0.00	NA	2.00
		5	**6**	**7**	**8**			
		1	**2**	**3**	**4**	1303036-BLK1	NA	
Sulfate as SO4	0.00	0.00	0.00	0.00	0.00	0.00	NA	5.00
		5	**6**	**7**	**8**			

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

Mettler AT Method: EPA 310.1 Analysis Name: WC - Alkalinity

Sequence: 1303012 Work Order: C130301 Units: mg CaCO3 / L

Total Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Total Alkalinity					1			2			3	
				100	93.0	93.0	100	94.1	94.1			
					4			5			6	
					7			8			9	

Metals - ICV & CCV %R Criteria = 90 - 110%, Classical Chemistry %R Criteria - ICV = 90 - 110%R, CCV = 80 - 120%R.

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Diss. Metals

Sequence: 1303021 Work Order: C130301 Units: ug/L

Dissolved Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
					1			2			3	
Aluminum	1000	957.7	95.8	12500	12630	101.0	12500	12820	102.6	12500	12620	101.0
					4			5			6	
					7			8			9	
					1			2			3	
Beryllium	1000	996.3	99.6	500	517.1	103.4	500	520.5	104.1	500	518.3	103.7
					4			5			6	
					7			8			9	
					1			2			3	
Calcium	1000	948.3	94.8	12500	13030	104.2	12500	12940	103.5	12500	12960	103.7
					4			5			6	
					7			8			9	
					1			2			3	
Copper	1000	1006	100.6	1000	1012	101.2	1000	1020	102.0	1000	1009	100.9
					4			5			6	
					7			8			9	
					1			2			3	
Iron	1000	994.4	99.4	12500	13500	108.0	12500	13280	106.2	12500	13450	107.6
					4			5			6	
					7			8			9	
					1			2			3	
Magnesium	1000	1002	100.2	12500	12870	103.0	12500	12920	103.4	12500	12830	102.6
					4			5			6	
					7			8			9	

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Diss. Metals

Sequence: 1303021 Work Order: C130301 Units: ug/L

Dissolved Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
					1			2			3	
Manganese	1000	1034	103.4	1000	1041	104.1	1000	1036	103.6	1000	1037	103.7
					4			5			6	
					7			8			9	
					1			2			3	
Potassium	5000	4674	93.5	25000	24830	99.3	25000	25420	101.7	25000	24940	99.8
					4			5			6	
					7			8			9	
					1			2			3	
Sodium	1000	964.2	96.4	12500	12730	101.8	12500	12900	103.2	12500	12860	102.9
					4			5			6	
					7			8			9	
					1			2			3	
Zinc	1000	1026	102.6	2500	2609	104.4	2500	2628	105.1	2500	2621	104.8
					4			5			6	
					7			8			9	

Metals - ICV & CCV %R Criteria = 90 - 110%, Classical Chemistry %R Criteria - ICV = 90 - 110%R, CCV = 80 - 120%R.

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Tot. Rec. Metals

Sequence: 1303022 Work Order: C130301 Units: ug/L

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Aluminum	1000	957.7	95.8		1			2			3	
				12500	12630	101.0	12500	12820	102.6	12500	12620	101.0
					4			5			6	
				12500	12790	102.3	12500	12640	101.1			
					7			8			9	
Beryllium	1000	996.3	99.6		1			2			3	
				500	517.1	103.4	500	520.5	104.1	500	518.3	103.7
					4			5			6	
				500	513.1	102.6	500	521.7	104.3			
					7			8			9	
Calcium	1000	948.3	94.8		1			2			3	
				12500	13030	104.2	12500	12940	103.5	12500	12960	103.7
					4			5			6	
				12500	12940	103.5	12500	13140	105.1			
					7			8			9	
Copper	1000	1006	100.6		1			2			3	
				1000	1012	101.2	1000	1020	102.0	1000	1009	100.9
					4			5			6	
				1000	1015	101.5	1000	1005	100.5			
					7			8			9	
Iron	1000	994.4	99.4		1			2			3	
				12500	13500	108.0	12500	13280	106.2	12500	13450	107.6
					4			5			6	
				12500	13170	105.4	12500	13490	107.9			
					7			8			9	
Magnesium	1000	1002	100.2		1			2			3	
				12500	12870	103.0	12500	12920	103.4	12500	12830	102.6
					4			5			6	
				12500	12850	102.8	12500	12840	102.7			
					7			8			9	

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Tot. Rec. Metals

Sequence: 1303022 Work Order: C130301 Units: ug/L

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Manganese					1			2			3	
	1000	1034	103.4	1000	1041	104.1	1000	1036	103.6	1000	1037	103.7
					4			5			6	
				1000	1037	103.7	1000	1039	103.9			
					7			8			9	
Potassium					1			2			3	
	5000	4674	93.5	25000	24830	99.3	25000	25420	101.7	25000	24940	99.8
					4			5			6	
				25000	25410	101.6	25000	24970	99.9			
					7			8			9	
Sodium					1			2			3	
	1000	964.2	96.4	12500	12730	101.8	12500	12900	103.2	12500	12860	102.9
					4			5			6	
				12500	12720	101.8	12500	12670	101.4			
					7			8			9	
Zinc					1			2			3	
	1000	1026	102.6	2500	2609	104.4	2500	2628	105.1	2500	2621	104.8
					4			5			6	
				2500	2591	103.6	2500	2629	105.2			
					7			8			9	

Metals - ICV & CCV %R Criteria = 90 - 110%, Classical Chemistry %R Criteria - ICV = 90 - 110%R, CCV = 80 - 120%R.

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPMS-PE DRC-II Method: 200.8 Analysis Name: ICPMS Diss. Metals

Sequence: 1303023 Work Order: C130301 Units: ug/L

Dissolved Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Antimony	50.0	47.7	95.4		1			2			3	
				50.0	45.7	91.4	50.0	47.4	94.8	50.0	48.4	96.8
					4			5			6	
					7			8			9	
Arsenic	50.0	51.6	103.2		1			2			3	
				50.0	48.8	97.6	50.0	50.7	101.4	50.0	49.8	99.6
					4			5			6	
					7			8			9	
Barium	50.0	48.3	96.6		1			2			3	
				50.0	48.5	97.0	50.0	48.3	96.6	50.0	48.7	97.4
					4			5			6	
					7			8			9	
Cadmium	50.0	48.2	96.4		1			2			3	
				50.0	47.7	95.4	50.0	49.7	99.4	50.0	50.3	100.6
					4			5			6	
					7			8			9	
Chromium	50.0	48.0	96.0		1			2			3	
				50.0	48.6	97.2	50.0	50.8	101.6	50.0	48.5	97.0
					4			5			6	
					7			8			9	
Cobalt	50.0	47.1	94.2		1			2			3	
				50.0	47.9	95.8	50.0	51.2	102.4	50.0	45.6	91.2
					4			5			6	
					7			8			9	

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPMS-PE DRC-II Method: 200.8 Analysis Name: ICPMS Diss. Metals

Sequence: 1303023 Work Order: C130301 Units: ug/L

Dissolved Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Lead					1			2			3	
	50.0	51.0	102.0	50.0	49.2	98.4	50.0	48.3	96.6	50.0	46.0	92.0
					4			5			6	
					7			8			9	
Nickel					1			2			3	
	50.0	48.9	97.8	50.0	48.3	96.6	50.0	53.9	107.8	50.0	47.9	95.8
					4			5			6	
					7			8			9	
Selenium					1			2			3	
	250	269	107.6	50.0	51.7	103.4	50.0	54.3	108.6	50.0	51.5	103.0
					4			5			6	
					7			8			9	
Silver					1			2			3	
	50.0	50.2	100.4	50.0	50.9	101.8	50.0	51.0	102.0	50.0	49.9	99.8
					4			5			6	
					7			8			9	
Thallium					1			2			3	
	50.0	50.9	101.8	50.0	49.0	98.0	50.0	47.7	95.4	50.0	45.8	91.6
					4			5			6	
					7			8			9	
Vanadium					1			2			3	
	50.0	47.9	95.8	50.0	48.1	96.2	50.0	51.1	102.2	50.0	47.7	95.4
					4			5			6	
					7			8			9	

Metals - ICV & CCV %R Criteria = 90 - 110%, Classical Chemistry %R Criteria - ICV = 90 - 110%R, CCV = 80 - 120%R.

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPMS-PE DRC-II Method: 200.8 Analysis Name: ICPMS Tot. Rec. Metals

Sequence: 1303024 Work Order: C130301 Units: ug/L

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Antimony	50.0	47.68	95.4		1			2			3	
				50.0	45.69	91.4	50.0	47.45	94.9	50.0	48.42	96.8
					4			5			6	
				50.0	47.48	95.0	50.0	48.08	96.2			
					7			8			9	
Arsenic	50.0	51.57	103.1		1			2			3	
				50.0	48.78	97.6	50.0	50.70	101.4	50.0	49.82	99.6
					4			5			6	
				50.0	49.28	98.6	50.0	51.63	103.3			
					7			8			9	
Barium	50.0	48.31	96.6		1			2			3	
				50.0	48.53	97.1	50.0	48.31	96.6	50.0	48.67	97.3
					4			5			6	
				50.0	50.35	100.7	50.0	48.69	97.4			
					7			8			9	
Cadmium	50.0	48.16	96.3		1			2			3	
				50.0	47.68	95.4	50.0	49.67	99.3	50.0	50.26	100.5
					4			5			6	
				50.0	48.50	97.0	50.0	49.61	99.2			
					7			8			9	
Chromium	50.0	47.98	96.0		1			2			3	
				50.0	48.63	97.3	50.0	50.85	101.7	50.0	48.50	97.0
					4			5			6	
				50.0	46.76	93.5	50.0	49.05	98.1			
					7			8			9	
Cobalt	50.0	47.07	94.1		1			2			3	
				50.0	47.95	95.9	50.0	51.17	102.3	50.0	45.64	91.3
					4			5			6	
				50.0	46.05	92.1	50.0	47.76	95.5			
					7			8			9	

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPMS-PE DRC-II Method: 200.8 Analysis Name: ICPMS Tot. Rec. Metals

Sequence: 1303024 Work Order: C130301 Units: ug/L

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Lead					1			2			3	
	50.0	50.98	102.0	50.0	49.23	98.5	50.0	48.34	96.7	50.0	46.00	92.0
					4			5			6	
				50.0	47.38	94.8	50.0	46.00	92.0			
					7			8			9	
Nickel					1			2			3	
	50.0	48.87	97.7	50.0	48.33	96.7	50.0	53.89	107.8	50.0	47.94	95.9
					4			5			6	
				50.0	47.91	95.8	50.0	49.05	98.1			
					7			8			9	
Selenium					1			2			3	
	250	268.7	107.5	50.0	51.65	103.3	50.0	54.30	108.6	50.0	51.47	102.9
					4			5			6	
				50.0	52.57	105.1	50.0	55.13	110.3			
					7			8			9	
Silver					1			2			3	
	50.0	50.19	100.4	50.0	50.91	101.8	50.0	50.96	101.9	50.0	49.89	99.8
					4			5			6	
				50.0	49.10	98.2	50.0	48.68	97.4			
					7			8			9	
Thallium					1			2			3	
	50.0	50.91	101.8	50.0	48.96	97.9	50.0	47.72	95.4	50.0	45.80	91.6
					4			5			6	
				50.0	47.63	95.3	50.0	46.13	92.3			
					7			8			9	
Vanadium					1			2			3	
	50.0	47.92	95.8	50.0	48.10	96.2	50.0	51.14	102.3	50.0	47.73	95.5
					4			5			6	
				50.0	45.74	91.5	50.0	47.95	95.9			
					7			8			9	

Metals - ICV & CCV %R Criteria = 90 - 110%, Classical Chemistry %R Criteria - ICV = 90 - 110%R, CCV = 80 - 120%R.

Project Name: **Barker-Hughesville_Pilot Study_MAR 2013_D353** **Certificate of Analysis**

TDF #: **DG-353**

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ESAT Dionex IC Method: EPA 300.0 Analysis Name: WC - Anions by Ion Chromatography 2010

Sequence: 1303044 Work Order: C130301 Units: mg/L

Dissolved Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Chloride	15.0	15.1	100.7		1			2			3	
				40.0	39.6	99.0	40.0	39.3	98.3	40.0	39.2	98.0
					4			5			6	
				40.0	39.2	98.0						
					7			8			9	
Fluoride	10.0	10.6	106.0		1			2			3	
				4.00	4.1	102.5	4.00	4.1	102.5	4.00	4.0	100.0
					4			5			6	
				4.00	4.1	102.5						
					7			8			9	
Sulfate as SO4	75.0	77.3	103.1		1			2			3	
				100	99.9	99.9	100	98.9	98.9	100	98.2	98.2
					4			5			6	
				100	98.6	98.6						
					7			8			9	

Metals - ICV & CCV %R Criteria = 90 - 110%, Classical Chemistry %R Criteria - ICV = 90 - 110%R, CCV = 80 - 120%R.

TechLaw, Inc. - ESAT Region 8

ICP Interference Check Sample

ICPMS-PE DRC-II

Sequence: 1303023 Analysis: ICPMS Diss. Metals

Analyte	Check Sample	Result*	Units	True	%R	PQL
Antimony	IFA1	0.1	ug/L			1.00
	IFB1	0.1	ug/L			1.00
Arsenic	IFA1	-0.1	ug/L			2.00
	IFB1	19.2	ug/L	20	96	2.00
Barium	IFA1	0.2	ug/L			10.0
	IFB1	0.1	ug/L			10.0
Cadmium	IFA1	0.1	ug/L			0.200
	IFB1	19.2	ug/L	20	96	0.200
Chromium	IFA1	0.8	ug/L			2.00
	IFB1	20.4	ug/L	20	102	2.00
Cobalt	IFA1	-0.1	ug/L			0.200
	IFB1	19.4	ug/L	20	97	0.200
Lead	IFA1	0.1	ug/L			0.200
	IFB1	0.1	ug/L			0.200
Nickel	IFA1	0.3	ug/L			1.00
	IFB1	20.4	ug/L	20	102	1.00
Selenium	IFA1	0.0	ug/L			1.00
	IFB1	0.0	ug/L			1.00
Silver	IFA1	0.0	ug/L			1.00
	IFB1	20.1	ug/L	20	101	1.00
Thallium	IFA1	0.0	ug/L			1.00
	IFB1	0.0	ug/L			1.00
Vanadium	IFA1	-0.2	ug/L			3.00
	IFB1	-0.4	ug/L			3.00

*Criteria = 80-120%R of True Value or +/- PQL

See raw data for complete analyte list and results.

TechLaw, Inc. - ESAT Region 8

ICP Interference Check Sample

ICPMS-PE DRC-II

Sequence: 1303024 Analysis: ICPMS Tot. Rec. Metals

Analyte	Check Sample	Result*	Units	True	%R	PQL
Antimony	IFA1	0.1	ug/L			1.00
	IFB1	0.1	ug/L			1.00
Arsenic	IFA1	-0.1	ug/L			2.00
	IFB1	19.2	ug/L	20	96	2.00
Barium	IFA1	0.2	ug/L			10.0
	IFB1	0.1	ug/L			10.0
Cadmium	IFA1	0.1	ug/L			0.200
	IFB1	19.2	ug/L	20	96	0.200
Chromium	IFA1	0.8	ug/L			2.00
	IFB1	20.4	ug/L	20	102	2.00
Cobalt	IFA1	-0.1	ug/L			0.200
	IFB1	19.4	ug/L	20	97	0.200
Lead	IFA1	0.1	ug/L			0.200
	IFB1	0.1	ug/L			0.200
Nickel	IFA1	0.3	ug/L			1.00
	IFB1	20.4	ug/L	20	102	1.00
Selenium	IFA1	0.0	ug/L			1.00
	IFB1	0.0	ug/L			1.00
Silver	IFA1	0.0	ug/L			1.00
	IFB1	20.1	ug/L	20	101	1.00
Thallium	IFA1	0.0	ug/L			1.00
	IFB1	0.0	ug/L			1.00
Vanadium	IFA1	-0.2	ug/L			3.00
	IFB1	-0.4	ug/L			3.00

*Criteria = 80-120%R of True Value or +/- PQL

See raw data for complete analyte list and results.

TechLaw, Inc. - ESAT Region 8

ICP Interference Check Sample

ICPOE - PE Optima

Analyte	Check Sample	Result*	Units	True	%R	PQL
Sequence: 1303021	Analysis: ICPOE Diss. Metals					
Aluminum	IFA1	56,624.2	ug/L	60,000	94	50.0
	IFB1	58,041.9	ug/L	60,000	97	50.0
Beryllium	IFA1	-1.0	ug/L			5.00
	IFB1	93.5	ug/L	100	93	5.00
Calcium	IFA1	285,565.6	ug/L	300,000	95	250
	IFB1	292,382.7	ug/L	300,000	97	250
Copper	IFA1	-1.7	ug/L			2.00
	IFB1	302.9	ug/L	300	101	2.00
Iron	IFA1	232,104.9	ug/L	250,000	93	250
	IFB1	235,670.9	ug/L	250,000	94	250
Magnesium	IFA1	135,557.2	ug/L	150,000	90	250
	IFB1	139,360.1	ug/L	150,000	93	250
Manganese	IFA1	-0.2	ug/L			5.00
	IFB1	194.7	ug/L	200	97	5.00
Potassium	IFA1	-98.9	ug/L			1000
	IFB1	20,419.5	ug/L	20,000	102	1000
Sodium	IFA1	48,317.3	ug/L	50,000	97	1000
	IFB1	49,412.0	ug/L	50,000	99	1000
Zinc	IFA1	3.8	ug/L			20.0
	IFB1	286.2	ug/L	300	95	20.0

*Criteria = 80-120%R of True Value or +/- PQL

See raw data for complete analyte list and results.

TechLaw, Inc. - ESAT Region 8

ICP Interference Check Sample

ICPOE - PE Optima

Sequence: 1303022 Analysis: ICPOE Tot. Rec. Metals

Analyte	Check Sample	Result*	Units	True	%R	PQL
Aluminum	IFA1	56,624.2	ug/L	60,000	94	50.0
	IFB1	58,041.9	ug/L	60,000	97	50.0
Beryllium	IFA1	-1.0	ug/L			5.00
	IFB1	93.5	ug/L	100	93	5.00
Calcium	IFA1	285,565.6	ug/L	300,000	95	250
	IFB1	292,382.7	ug/L	300,000	97	250
Copper	IFA1	-1.7	ug/L			2.00
	IFB1	302.9	ug/L	300	101	2.00
Iron	IFA1	232,104.9	ug/L	250,000	93	250
	IFB1	235,670.9	ug/L	250,000	94	250
Magnesium	IFA1	135,557.2	ug/L	150,000	90	250
	IFB1	139,360.1	ug/L	150,000	93	250
Manganese	IFA1	-0.2	ug/L			5.00
	IFB1	194.7	ug/L	200	97	5.00
Potassium	IFA1	-98.9	ug/L			1000
	IFB1	20,419.5	ug/L	20,000	102	1000
Sodium	IFA1	48,317.3	ug/L	50,000	97	1000
	IFB1	49,412.0	ug/L	50,000	99	1000
Zinc	IFA1	3.8	ug/L			20.0
	IFB1	286.2	ug/L	300	95	20.0

*Criteria = 80-120%R of True Value or +/- PQL
See raw data for complete analyte list and results.

TechLaw, Inc. - ESAT Region 8

Detection Limit (PQL) Standard

ICPMS-PE DRC-II

Metals (Dissolved) by EPA 200/7000 Series Methods

Sequence: 1303023

Analyte	True	Found	%R	Units
Antimony	1.00	0.969	97	ug/L
Arsenic	2.00	2.08	104	ug/L
Barium	0.500	0.565	113	ug/L
Cadmium	0.200	0.194	97	ug/L
Chromium	1.00	0.937	94	ug/L
Cobalt	0.200	0.174	87	ug/L
Lead	0.200	0.197	99	ug/L
Nickel	1.00	0.989	99	ug/L
Selenium	1.00	0.977	98	ug/L
Silver	0.500	0.476	95	ug/L
Thallium	0.200	0.189	95	ug/L
Vanadium	2.00	1.99	100	ug/L

Recovery Control Limits: 70-130% except Pb, Tl, Sb, & Hg at 50-150%. No limits for Al, Ca, Fe, K, Mg & Na.

TechLaw, Inc. - ESAT Region 8

Detection Limit (PQL) Standard

ICPOE - PE Optima

Metals (Dissolved) by EPA 200/7000 Series Methods

Sequence: 1303021

Analyte	True	Found	%R	Units
Aluminum	100	100.8	101	ug/L
Beryllium	5.00	5.119	102	ug/L
Calcium	250	247.3	99	ug/L
Copper	10.0	8.615	86	ug/L
Iron	100	71.03	71	ug/L
Magnesium	1000	1020	102	ug/L
Manganese	10.0	10.40	104	ug/L
Potassium	1000	983.5	98	ug/L
Sodium	1000	1044	104	ug/L
Zinc	50.0	55.85	112	ug/L

Recovery Control Limits: 70-130% except Pb, Tl, Sb, & Hg at 50-150%. No limits for Al, Ca, Fe, K, Mg & Na.

TechLaw, Inc. - ESAT Region 8

Detection Limit (PQL) Standard

ICPMS-PE DRC-II

Metals (Total Recov) by EPA 200/7000 Series Methods

Sequence: 1303024

Analyte	True	Found	%R	Units
Antimony	1.00	0.9692	97	ug/L
Arsenic	2.00	2.083	104	ug/L
Barium	0.500	0.5653	113	ug/L
Cadmium	0.200	0.1941	97	ug/L
Chromium	1.00	0.9366	94	ug/L
Cobalt	0.200	0.1744	87	ug/L
Lead	0.200	0.1974	99	ug/L
Nickel	1.00	0.9895	99	ug/L
Selenium	1.00	0.9772	98	ug/L
Silver	0.500	0.4759	95	ug/L
Thallium	0.200	0.1893	95	ug/L
Vanadium	2.00	1.991	100	ug/L

Recovery Control Limits: 70-130% except Pb, Tl, Sb, & Hg at 50-150%. No limits for Al, Ca, Fe, K, Mg & Na.

TechLaw, Inc. - ESAT Region 8

Detection Limit (PQL) Standard

ICPOE - PE Optima

Metals (Total Recov) by EPA 200/7000 Series Methods

Sequence: 1303022

Analyte	True	Found	%R	Units
Aluminum	100	100.8	101	ug/L
Beryllium	5.00	5.119	102	ug/L
Calcium	250	247.3	99	ug/L
Copper	10.0	8.615	86	ug/L
Iron	100	71.03	71	ug/L
Magnesium	1000	1020	102	ug/L
Manganese	10.0	10.40	104	ug/L
Potassium	1000	983.5	98	ug/L
Sodium	1000	1044	104	ug/L
Zinc	50.0	55.85	112	ug/L

Recovery Control Limits: 70-130% except Pb, Tl, Sb, & Hg at 50-150%. No limits for Al, Ca, Fe, K, Mg & Na.

TechLaw Inc., ESAT Region 8

INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: EPA 310.1 **Total** **Sequence ID#:** 1303012

Instrument ID #: Mettler AT Water **LSR #:** DG-353

Analysis ID	Sample Name	Analysis Date	Analysis Time
1303009-SRM1	Reference	03/07/13	13:50
1303009-BLK1	Blank	03/07/13	13:50
C130301-03	13BH-BENCH-OXD	03/07/13	13:50
1303009-DUP1	Duplicate	03/07/13	13:50
C130301-06	13BH-DT-BENCH-PH45-CHIT	03/07/13	13:50
C130301-09	13BH-DT-BENCH-PH45-LIMI	03/07/13	13:50
C130301-13	13BH-DT-BENCH-PH45-NAO	03/07/13	13:50
C130301-17	13BH-DT-BENCH-PH95-LIMI	03/07/13	13:50
C130301-20	13BH-DT-BENCH-PH95-NAO	03/07/13	13:50
C130301-23	13BH-DT-BENCH-RAW	03/07/13	13:50
C130301-26	13BH-DT-BENCH-SPS-C1	03/07/13	13:50
C130301-29	13BH-DT-BENCH-SPS-C2	03/07/13	13:50
1303012-CCV1	Calibration Check	03/07/13	13:50
1303012-CCB1	Calibration Blank	03/07/13	13:50
C130301-32	13BH-DT-BENCH-SPS-C3	03/07/13	13:50
C130301-35	13BH-DT-BENCH-SPS-C4	03/07/13	13:50
1303012-CCV2	Calibration Check	03/07/13	13:50
1303012-CCB2	Calibration Blank	03/07/13	13:50

TechLaw Inc., ESAT Region 8

INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: 200.7 **Dissolved** **Sequence ID#:** 1303021

Instrument ID #: ICPOE - PE Optima Water **LSR #:** DG-353

Analysis ID	Sample Name	Analysis Date	Analysis Time
1303021-ICV1	Initial Cal Check	03/08/13	10:42
1303021-ICB1	Initial Cal Blank	03/08/13	10:45
1303021-CRL1	Instrument RL Check	03/08/13	10:49
1303021-IFA1	Interference Check A	03/08/13	10:51
1303021-IFB1	Interference Check B	03/08/13	10:55
1303021-CCV1	Calibration Check	03/08/13	10:59
1303021-CCB1	Calibration Blank	03/08/13	11:02
1303010-BLK1	Blank	03/08/13	11:05
1303010-BS1	Blank Spike	03/08/13	11:08
C130301-01	13BH-BENCH-OXD	03/08/13	11:11
1303010-DUP1	Duplicate	03/08/13	11:14
1303021-SRD1	Serial Dilution	03/08/13	11:17
1303010-MS1	Matrix Spike	03/08/13	11:20
1303010-MSD1	Matrix Spike Dup	03/08/13	11:23
C130301-04	13BH-DT-BENCH-PH45-CHIT	03/08/13	11:27
C130301-07	13BH-DT-BENCH-PH45-LIMI	03/08/13	11:30
1303021-CCV2	Calibration Check	03/08/13	11:36
1303021-CCB2	Calibration Blank	03/08/13	11:39
C130301-11	13BH-DT-BENCH-PH45-NAO	03/08/13	11:42
C130301-15	13BH-DT-BENCH-PH95-LIMI	03/08/13	11:45
C130301-18	13BH-DT-BENCH-PH95-NAO	03/08/13	11:48
C130301-21	13BH-DT-BENCH-RAW	03/08/13	11:51
C130301-24	13BH-DT-BENCH-SPS-C1	03/08/13	11:54
C130301-27	13BH-DT-BENCH-SPS-C2	03/08/13	11:57
C130301-30	13BH-DT-BENCH-SPS-C3	03/08/13	12:01
C130301-33	13BH-DT-BENCH-SPS-C4	03/08/13	12:04
1303021-CCV3	Calibration Check	03/08/13	12:13
1303021-CCB3	Calibration Blank	03/08/13	12:16

TechLaw Inc., ESAT Region 8

INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: 200.7 **Total Recoverable** **Sequence ID#:** 1303022

Instrument ID #: ICPOE - PE Optima Water **LSR #:** DG-353

Analysis ID	Sample Name	Analysis Date	Analysis Time
1303022-ICV1	Initial Cal Check	03/08/13	10:42
1303022-ICB1	Initial Cal Blank	03/08/13	10:45
1303022-CRL1	Instrument RL Check	03/08/13	10:49
1303022-IFA1	Interference Check A	03/08/13	10:51
1303022-IFB1	Interference Check B	03/08/13	10:55
1303022-CCV1	Calibration Check	03/08/13	10:59
1303022-CCB1	Calibration Blank	03/08/13	11:02
1303022-CCV2	Calibration Check	03/08/13	11:36
1303022-CCB2	Calibration Blank	03/08/13	11:39
1303022-CCV3	Calibration Check	03/08/13	12:13
1303022-CCB3	Calibration Blank	03/08/13	12:16
1303008-BLK1	Blank	03/08/13	12:19
1303008-SRM1	Reference	03/08/13	12:22
C130301-22	13BH-DT-BENCH-RAW	03/08/13	12:25
1303008-DUP1	Duplicate	03/08/13	12:28
1303022-SRD1	Serial Dilution	03/08/13	12:31
1303008-MS1	Matrix Spike	03/08/13	12:34
1303008-MSD1	Matrix Spike Dup	03/08/13	12:37
1303008-PS1	Post Spike	03/08/13	12:40
C130301-02	13BH-BENCH-OXD	03/08/13	12:44
1303022-CCV4	Calibration Check	03/08/13	12:50
1303022-CCB4	Calibration Blank	03/08/13	12:53
C130301-05	13BH-DT-BENCH-PH45-CHIT	03/08/13	12:56
C130301-08	13BH-DT-BENCH-PH45-LIMI	03/08/13	12:59
C130301-12	13BH-DT-BENCH-PH45-NAO	03/08/13	13:02
C130301-16	13BH-DT-BENCH-PH95-LIMI	03/08/13	13:05
C130301-19	13BH-DT-BENCH-PH95-NAO	03/08/13	13:08
C130301-25	13BH-DT-BENCH-SPS-C1	03/08/13	13:11
C130301-28	13BH-DT-BENCH-SPS-C2	03/08/13	13:15
C130301-31	13BH-DT-BENCH-SPS-C3	03/08/13	13:18
C130301-34	13BH-DT-BENCH-SPS-C4	03/08/13	13:21
1303022-CCV5	Calibration Check	03/08/13	13:27
1303022-CCB5	Calibration Blank	03/08/13	13:30

TechLaw Inc., ESAT Region 8

INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: 200.8 **Dissolved** **Sequence ID#:** 1303023

Instrument ID #: ICPMS-PE DRC-II Water **LSR #:** DG-353

Analysis ID	Sample Name	Analysis Date	Analysis Time
1303023-ICV1	Initial Cal Check	03/08/13	11:40
1303023-ICB1	Initial Cal Blank	03/08/13	11:43
1303023-CRL1	Instrument RL Check	03/08/13	11:47
1303023-IFA1	Interference Check A	03/08/13	11:50
1303023-IFB1	Interference Check B	03/08/13	11:53
1303023-CCV1	Calibration Check	03/08/13	11:56
1303023-CCB1	Calibration Blank	03/08/13	12:00
1303011-BLK1	Blank	03/08/13	12:03
C130301-01	13BH-BENCH-OXD	03/08/13	12:06
1303011-DUP1	Duplicate	03/08/13	12:09
1303023-SRD1	Serial Dilution	03/08/13	12:12
1303011-BS1	Blank Spike	03/08/13	12:15
1303011-MS1	Matrix Spike	03/08/13	12:18
1303011-MSD1	Matrix Spike Dup	03/08/13	12:21
C130301-04	13BH-DT-BENCH-PH45-CHIT	03/08/13	12:24
C130301-07	13BH-DT-BENCH-PH45-LIMI	03/08/13	12:27
1303023-CCV2	Calibration Check	03/08/13	12:33
1303023-CCB2	Calibration Blank	03/08/13	12:37
C130301-11	13BH-DT-BENCH-PH45-NAO	03/08/13	12:40
C130301-15	13BH-DT-BENCH-PH95-LIMI	03/08/13	12:43
C130301-18	13BH-DT-BENCH-PH95-NAO	03/08/13	12:46
C130301-21	13BH-DT-BENCH-RAW	03/08/13	12:49
C130301-24	13BH-DT-BENCH-SPS-C1	03/08/13	12:52
C130301-27	13BH-DT-BENCH-SPS-C2	03/08/13	12:55
C130301-30	13BH-DT-BENCH-SPS-C3	03/08/13	12:58
C130301-33	13BH-DT-BENCH-SPS-C4	03/08/13	13:01
1303023-CCV3	Calibration Check	03/08/13	13:11
1303023-CCB3	Calibration Blank	03/08/13	13:14

TechLaw Inc., ESAT Region 8

INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: 200.8 **Total Recoverable** **Sequence ID#:** 1303024

Instrument ID #: ICPMS-PE DRC-II Water **LSR #:** DG-353

Analysis ID	Sample Name	Analysis Date	Analysis Time
1303024-ICV1	Initial Cal Check	03/08/13	11:40
1303024-ICB1	Initial Cal Blank	03/08/13	11:43
1303024-CRL1	Instrument RL Check	03/08/13	11:47
1303024-IFA1	Interference Check A	03/08/13	11:50
1303024-IFB1	Interference Check B	03/08/13	11:53
1303024-CCV1	Calibration Check	03/08/13	11:56
1303024-CCB1	Calibration Blank	03/08/13	12:00
1303024-CCV2	Calibration Check	03/08/13	12:33
1303024-CCB2	Calibration Blank	03/08/13	12:37
1303024-CCV3	Calibration Check	03/08/13	13:11
1303024-CCB3	Calibration Blank	03/08/13	13:14
1303008-BLK2	Blank	03/08/13	13:17
C130301-22	13BH-DT-BENCH-RAW	03/08/13	13:20
1303008-DUP2	Duplicate	03/08/13	13:23
1303024-SRD1	Serial Dilution	03/08/13	13:26
1303008-SRM2	Reference	03/08/13	13:29
1303008-MS2	Matrix Spike	03/08/13	13:32
1303008-MSD2	Matrix Spike Dup	03/08/13	13:35
1303008-PS2	Post Spike	03/08/13	13:38
C130301-02	13BH-BENCH-OXD	03/08/13	13:42
1303024-CCV4	Calibration Check	03/08/13	13:48
1303024-CCB4	Calibration Blank	03/08/13	13:51
C130301-05	13BH-DT-BENCH-PH45-CHIT	03/08/13	13:54
C130301-08	13BH-DT-BENCH-PH45-LIMI	03/08/13	13:57
C130301-12	13BH-DT-BENCH-PH45-NAO	03/08/13	14:00
C130301-16	13BH-DT-BENCH-PH95-LIMI	03/08/13	14:03
C130301-19	13BH-DT-BENCH-PH95-NAO	03/08/13	14:06
C130301-25	13BH-DT-BENCH-SPS-C1	03/08/13	14:10
C130301-28	13BH-DT-BENCH-SPS-C2	03/08/13	14:13
C130301-31	13BH-DT-BENCH-SPS-C3	03/08/13	14:16
C130301-34	13BH-DT-BENCH-SPS-C4	03/08/13	14:19
1303024-CCV5	Calibration Check	03/08/13	14:25
1303024-CCB5	Calibration Blank	03/08/13	14:28

TechLaw Inc., ESAT Region 8

INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: EPA 300.0 **Dissolved** **Sequence ID#:** 1303044

Instrument ID #: ESAT Dionex IC Water **LSR #:** DG-353

Analysis ID	Sample Name	Analysis Date	Analysis Time
1303036-BS1	Blank Spike	03/19/13	13:03
1303044-ICV1	Initial Cal Check	03/19/13	13:19
1303044-ICB1	Initial Cal Blank	03/19/13	13:52
1303036-BLK1	Blank	03/19/13	14:08
C130301-03	13BH-BENCH-OXD	03/19/13	14:24
1303036-DUP1	Duplicate	03/19/13	14:40
1303036-MS1	Matrix Spike	03/19/13	14:56
1303036-MSD1	Matrix Spike Dup	03/19/13	15:12
C130301-06	13BH-DT-BENCH-PH45-CHIT	03/19/13	15:29
C130301-09	13BH-DT-BENCH-PH45-LIMI	03/19/13	15:45
C130301-13	13BH-DT-BENCH-PH45-NAO	03/19/13	16:01
1303044-CCV1	Calibration Check	03/19/13	16:17
1303044-CCB1	Calibration Blank	03/19/13	16:33
C130301-17	13BH-DT-BENCH-PH95-LIMI	03/19/13	16:49
C130301-20	13BH-DT-BENCH-PH95-NAO	03/19/13	17:05
C130301-23	13BH-DT-BENCH-RAW	03/19/13	17:21
C130301-26	13BH-DT-BENCH-SPS-C1	03/19/13	17:37
C130301-29	13BH-DT-BENCH-SPS-C2	03/19/13	17:53
C130301-32	13BH-DT-BENCH-SPS-C3	03/19/13	18:09
1303044-CCV2	Calibration Check	03/19/13	18:41
1303044-CCB2	Calibration Blank	03/19/13	18:58
1303044-CCV3	Calibration Check	03/20/13	07:42
1303044-CCB3	Calibration Blank	03/20/13	07:58
C130301-35	13BH-DT-BENCH-SPS-C4	03/20/13	08:15
1303044-CCV4	Calibration Check	03/20/13	08:31
1303044-CCB4	Calibration Blank	03/20/13	08:47

C130301

ESAT Technical Direction Form

Contract No. EPW06033
EPA Region 8

Site ID: 085N
TDF ID: DG-353

Date Issued: 2/21/2013
Date Updated:

Date Closed:
Closed By:

Name: Barker Hughesville Pilot Study

Details: The Contractor shall analyze approximately 20 water samples collected from the Barker Hughesville Superfund site as indicated in the Analytical Information Section. The samples are expected to arrive at the R8 ESAT Lab during the week ending 3/1/13. The samples will be collected by CDM Smith and sampling dates may change based upon site conditions and other factors. The samples are part of a pilot study which may include minimum sample volumes. As a result, reduced volume digestions and minimum QC processing (MS/MSD/Dup, etc) may be necessary based upon the volume of sample collected.

TO49/Subtask 49b: Inorganic Chemistry

The site RPM is Roger Hoogerheide.

Analytical Information:

MATRIX

☑ Water ☐ Soils ☐ Vegetation ☐ Biota

WET CHEM

☑ TSS ☐ TDS ☐ DOC ☑ Alk ☑ Chloride ☑ Sulfate ☑ Fluoride ☐ Nitrate ☐ Nitrite
Other

METALS

☐ Dissolved ☑ Total Recoverable ☐ Total ☐ Hardness (Calc)
200.7: ☐ Ag ☑ Al ☐ As ☐ Ba ☑ Be ☐ B ☑ Ca ☐ Cd ☐ Co ☐ Cr ☑ Cu ☑ Fe ☑ K ☑ Mg
☑ Mn ☐ Mo ☑ Na ☐ Ni ☐ Pb ☐ Sb ☐ Se ☐ Sr ☐ Ti ☐ Tl ☐ V ☑ Zn ☐ SiO2
200.8: ☑ Ag ☐ Al ☑ As ☑ Ba ~~☑ Be~~ ☑ Cd ☑ Co ☑ Cr ~~☑ Cu~~ ~~☑ Mn~~ ☐ M ☑ Ni ☑ Pb ☑ Sb
☑ Se ☐ Th ☑ Tl ☐ U ☑ V ~~☑ Zn~~

SJ
03/21/13

7470/7471/7473: ☐ Hg

FIBERS

☐ PLM ☐ TEM

Deliverables:

ID	*Description*	*Due Date*	*Submission Date*
1	Provide final deliverable package to Task Monitor no later than 30 days after delivery of samples.		

CHAIN OF CUSTODY RECORD

CDM Danny T Bench Test

NOTES: Limited sample volumes because of bench testing Barker Hughesville site

SAMPLE NUMBER	DATE	TIME	MATRIX	Preservative	Type & No. of Containers	Total Metals (TAL), 200.7 or 200.8	Dissolved Metals (TAL), 200.7 or 200.8	Alkalinity, Anions (sulfate, chloride, fluoride)	Total Suspended Solids	Other Instructions and Notes
13BH-DT-BENCH-RAW	2/25/13	14:00	aqueous	HNO3, cool	3 poly	x	x	x		
13BH-DT-BENCH-OXD	2/25/13	16:00	aqueous	HNO3, cool	3 poly	x	x	x		
13BH-DT-BENCH-PH45-NAOH	2/25/13	16:45	aqueous	HNO3, cool	3 poly	x	x	x		
13BH-DT-BENCH-PH45-LIME	2/25/13	18:30	aqueous	HNO3, cool	3 poly	x	x	x		
13BH-DT-BENCH-PH45-CHIT	2/26/13	12:00	aqueous	HNO3, cool	3 poly	x	x	x		
13BH-DT-BENCH-PH95-NAOH	2/26/13	16:00	aqueous	HNO3, cool	3 poly	x	x	x		
13BH-DT-BENCH-PH95-LIME	2/27/13	10:30	aqueous	HNO3, cool	3 poly	x	x	x		
13BH-DT-BENCH-PH45-NAOH-TSS	2/26/13	10:25	aqueous	cool	1 poly				x	
13BH-DT-BENCH-PH45-LIME-TSS	2/26/13	10:40	aqueous	cool	1 poly				x	
13BH-DT-BENCH-SPS-C1	2/27/13	14:05	aqueous	HNO3, cool	3 poly	x	x	x		
13BH-DT-BENCH-SPS-C2	2/27/13	14:15	aqueous	HNO3, cool	3 poly	x	x	x		
13BH-DT-BENCH-SPS-C3	2/27/13	14:25	aqueous	HNO3, cool	3 poly	x	x	x		
13BH-DT-BENCH-CHI-C4	2/27/13	14:35	aqueous	HNO3, cool	3 poly	x	x	x		

2/28/13

Relinquished by: (Signature)

Date/Time 1500 2/28/2013

Received for Laboratory by: (Signature)

Received by: (Signature)

Date/Time ~~2/28/1730~~

Airbill No.(s) NA

~~3/1/~~ 2/28/1013 @ 1730

ESAT

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ANALYTICAL SUMMARY REPORT

March 07, 2013

CDM Federal Programs
555 17th St Ste 1100
Denver, CO 80202

Workorder No.: H13030003 Quote ID: H823 - Baker-Hughsville Superfund Site

Project Name: Danny T Bench Test Barker Hughesville Site

Energy Laboratories Inc Helena MT received the following 11 samples for CDM Federal Programs on 3/1/2013 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H13030003-001	13BH-DT-Bench-Raw	02/25/13 14:00	03/01/13	Aqueous	Acidity, Total as CaCO3
H13030003-002	13BH-DT-Bench-Oxd	02/25/13 16:00	03/01/13	Aqueous	Same As Above
H13030003-003	13BH-DT-Bench-Ph45-Naoh	02/25/13 16:45	03/01/13	Aqueous	Same As Above
H13030003-004	13BH-DT-Bench-Ph45-Lime	02/25/13 18:30	03/01/13	Aqueous	Same As Above
H13030003-005	13BH-DT-Bench-Ph45-Chit	02/26/13 12:00	03/01/13	Aqueous	Same As Above
H13030003-006	13BH-DT-Bench-Ph95-Naoh	02/26/13 16:00	03/01/13	Aqueous	Same As Above
H13030003-007	13BH-DT-Bench-Ph95-Lime	02/27/13 10:30	03/01/13	Aqueous	Same As Above
H13030003-008	13BH-DT-Bench-Sps-C1	02/27/13 14:05	03/01/13	Aqueous	Same As Above
H13030003-009	13BH-DT-Bench-Sps-C2	02/27/13 14:15	03/01/13	Aqueous	Same As Above
H13030003-010	13BH-DT-Bench-Sps-C3	02/27/13 14:25	03/01/13	Aqueous	Same As Above
H13030003-011	13BH-DT-Bench-Chi-C4	02/27/13 14:35	03/01/13	Aqueous	Same As Above

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By:

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	03/07/13
Project:	Danny T Bench Test Barker Hughesville Site	**Collection Date:**	02/25/13 14:00
Lab ID:	H13030003-001	**DateReceived:**	03/01/13
Client Sample ID	13BH-DT-Bench-Raw	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
INORGANICS							
Acidity, Total as CaCO3	380	mg/L	D	4.0		A2310 B	03/04/13 10:00 / cmm

Report Definitions:	RL - Analyte reporting limit.	MCL - Maximum contaminant level.
	QCL - Quality control limit.	ND - Not detected at the reporting limit.
	D - RL increased due to sample matrix.	

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	03/07/13
Project:	Danny T Bench Test Barker Hughesville Site	**Collection Date:**	02/25/13 16:00
Lab ID:	H13030003-002	**DateReceived:**	03/01/13
Client Sample ID	13BH-DT-Bench-Oxd	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
INORGANICS							
Acidity, Total as CaCO3	340	mg/L	D	4.0		A2310 B	03/04/13 10:00 / cmm

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	03/07/13
Project:	Danny T Bench Test Barker Hughesville Site	**Collection Date:**	02/25/13 16:45
Lab ID:	H13030003-003	**DateReceived:**	03/01/13
Client Sample ID	13BH-DT-Bench-Ph45-Naoh	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
INORGANICS							
Acidity, Total as CaCO3	260	mg/L	D	4.0		A2310 B	03/04/13 10:00 / cmm

Report Definitions:	RL - Analyte reporting limit.	MCL - Maximum contaminant level.
	QCL - Quality control limit.	ND - Not detected at the reporting limit.
	D - RL increased due to sample matrix.	

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	03/07/13
Project:	Danny T Bench Test Barker Hughesville Site	**Collection Date:**	02/25/13 18:30
Lab ID:	H13030003-004	**DateReceived:**	03/01/13
Client Sample ID	13BH-DT-Bench-Ph45-Lime	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
INORGANICS							
Acidity, Total as CaCO3	110	mg/L	D	4.0		A2310 B	03/04/13 10:00 / cmm

Report Definitions:	RL - Analyte reporting limit.	MCL - Maximum contaminant level.
	QCL - Quality control limit.	ND - Not detected at the reporting limit.
	D - RL increased due to sample matrix.	

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	03/07/13
Project:	Danny T Bench Test Barker Hughesville Site	**Collection Date:**	02/26/13 12:00
Lab ID:	H13030003-005	**DateReceived:**	03/01/13
Client Sample ID	13BH-DT-Bench-Ph45-Chit	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
INORGANICS							
Acidity, Total as CaCO3	240	mg/L	D	4.0		A2310 B	03/04/13 10:00 / cmm

Report Definitions:	RL - Analyte reporting limit.	MCL - Maximum contaminant level.
	QCL - Quality control limit.	ND - Not detected at the reporting limit.
	D - RL increased due to sample matrix.	

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	03/07/13
Project:	Danny T Bench Test Barker Hughesville Site	**Collection Date:**	02/26/13 16:00
Lab ID:	H13030003-006	**DateReceived:**	03/01/13
Client Sample ID	13BH-DT-Bench-Ph95-Naoh	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
INORGANICS							
Acidity, Total as CaCO3	8.0	mg/L	D	4.0		A2310 B	03/04/13 10:00 / cmm

Report Definitions:

RL - Analyte reporting limit.

QCL - Quality control limit.

D - RL increased due to sample matrix.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	03/07/13
Project:	Danny T Bench Test Barker Hughesville Site	**Collection Date:**	02/27/13 10:30
Lab ID:	H13030003-007	**DateReceived:**	03/01/13
Client Sample ID	13BH-DT-Bench-Ph95-Lime	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
INORGANICS							
Acidity, Total as CaCO3	ND	mg/L	D	4.0		A2310 B	03/04/13 10:00 / cmm

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Danny T Bench Test Barker Hughesville Site
Lab ID: H13030003-008
Client Sample ID 13BH-DT-Bench-Sps-C1

Report Date: 03/07/13
Collection Date: 02/27/13 14:05
DateReceived: 03/01/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
INORGANICS							
Acidity, Total as $CaCO_3$	ND	mg/L	D	4.0		A2310 B	03/04/13 10:00 / cmm

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	03/07/13
Project:	Danny T Bench Test Barker Hughesville Site	**Collection Date:**	02/27/13 14:15
Lab ID:	H13030003-009	**DateReceived:**	03/01/13
Client Sample ID	13BH-DT-Bench-Sps-C2	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
INORGANICS							
Acidity, Total as CaCO3	ND	mg/L	D	4.0		A2310 B	03/04/13 10:00 / cmm

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	03/07/13
Project:	Danny T Bench Test Barker Hughesville Site	**Collection Date:**	02/27/13 14:25
Lab ID:	H13030003-010	**DateReceived:**	03/01/13
Client Sample ID	13BH-DT-Bench-Sps-C3	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
INORGANICS							
Acidity, Total as CaCO3	ND	mg/L	D	4.0		A2310 B	03/04/13 10:00 / cmm

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	03/07/13
Project:	Danny T Bench Test Barker Hughesville Site	**Collection Date:**	02/27/13 14:35
Lab ID:	H13030003-011	**DateReceived:**	03/01/13
Client Sample ID	13BH-DT-Bench-Chi-C4	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
INORGANICS							
Acidity, Total as CaCO3	ND	mg/L	D	4.0		A2310 B	03/04/13 10:00 / cmm

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 03/07/13

Project: Danny T Bench Test Barker Hughesville Site **Work Order:** H13030003

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2310 B							Analytical Run: MISC WC_130304A			
Sample ID: CCV		Continuing Calibration Verification Standard							03/04/13 10:00	
Acidity, Total as CaCO3		7.0	mg/L	4.0	101	90	110			
Method: A2310 B							Batch: H13030003-001A			
Sample ID: H13030003-001ADUP		Sample Duplicate				Run: MISC WC_130304A			03/04/13 10:00	
Acidity, Total as CaCO3		420	mg/L	4.0				10	20	
Sample ID: H13030003-011ADUP		Sample Duplicate				Run: MISC WC_130304A			03/04/13 10:00	
Acidity, Total as CaCO3		ND	mg/L	4.0					20	
Sample ID: LCS1303040000		Laboratory Control Sample				Run: MISC WC_130304A			03/04/13 10:00	
Acidity, Total as CaCO3		770	mg/L	4.0	99	90	110			
Sample ID: MBLK1303040000		Method Blank				Run: MISC WC_130304A			03/04/13 10:00	
Acidity, Total as CaCO3		4	mg/L	3						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

Standard Reporting Procedures

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Workorder Receipt Checklist

CDM Federal Programs

H13030003

Login completed by: Tracy L. Lorash
Reviewed by: BL2000\jweidemoyer
Reviewed Date: 3/4/2013

Date Received: 3/1/2013
Received by: elm
Carrier name: FedEx Express

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received?	Yes ☐	No ☑	Not Applicable ☐
Container/Temp Blank temperature:	2.4°C On Ice		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Contact and Corrective Action Comments:

None

CHAIN OF CUSTODY RECORD

CDM Danny T Bench Test

Barker Hughesville Site

NOTES: Limited sample volumes because of bench testing.

Analysis

Other Instructions and Notes

H13030003

SAMPLE NUMBER	DATE	TIME	MATRIX	Preservative	Type & No. of Containers	Acidity
13BH-DT-BENCH-RAW	2/25/13	14:00	aqueous	cool	1 poly	x
13BH-DT-BENCH-OXD	2/25/13	16:00	aqueous	cool	1 poly	x
13BH-DT-BENCH-PH45-NAOH	2/25/13	16:45	aqueous	cool	1 poly	x
13BH-DT-BENCH-PH45-LIME	2/25/13	18:30	aqueous	cool	1 poly	x
13BH-DT-BENCH-PH45-CHIT	2/26/13	12:00	aqueous	cool	1 poly	x
13BH-DT-BENCH-PH95-NAOH	2/26/13	16:00	aqueous	cool	1 poly	x
13BH-DT-BENCH-PH95-LIME	2/27/13	10:30	aqueous	cool	1 poly	x
13BH-DT-BENCH-SPS-C1	2/27/13	14:05	aqueous	cool	1 poly	x
13BH-DT-BENCH-SPS-C2	2/27/13	14:15	aqueous	cool	1 poly	x
13BH-DT-BENCH-SPS-C3	2/27/13	14:25	aqueous	cool	1 poly	x
13BH-DT-BENCH-CHI-C4	2/27/13	14:35	aqueous	cool	1 poly	x

ak 2/28/13

Relinquished by: (Signature)	Date/Time 1500 2/28/2013	Received for Laboratory by: (Signature) Esther Klemitt 3-1-13 945	FedEx Exp.	2.4 on ice
Received by: (Signature)	Date/Time	Airbill No.(s)		

ANALYTICAL SUMMARY REPORT

April 25, 2013

CDM Smith Helena
50 W 14th St Ste 200
Helena, MT 59601

Workorder No.: H13040227 Quote ID: H823 - Baker-Hughsville Superfund Site

Project Name: Barker-Hughsville

Energy Laboratories Inc Helena MT received the following 4 samples for CDM Smith Helena on 4/16/2013 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H13040227-001	13H-DT-Bench-BCR-C1	04/15/13 11:35	04/16/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Biochemical Oxygen Demand, 5 Day Conductivity Fluoride Anions by Ion Chromatography Preparation for TSS Solids, Total Suspended Sulfide, Iodine Titrimetric
H13040227-002	13H-DT-Bench-BCR-C2	04/15/13 11:40	04/16/13	Aqueous	Same As Above
H13040227-003	13H-DT-Bench-BCR-C3	04/15/13 11:45	04/16/13	Aqueous	Same As Above
H13040227-004	13H-DT-Bench-BCR-C4	04/15/13 11:50	04/16/13	Aqueous	Same As Above

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By:

CLIENT: CDM Smith Helena
Project: Barker-Hughsville
Sample Delivery Group: H13040227

Report Date: 04/25/13

CASE NARRATIVE

Tests associated with analyst identified as ELI-B were subcontracted to Energy Laboratories, 1120 S. 27th St., Billings, MT, EPA Number MT00005.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Smith Helena	**Report Date:**	04/25/13
Project:	Barker-Hughsville	**Collection Date:**	04/15/13 11:35
Lab ID:	H13040227-001	**DateReceived:**	04/16/13
Client Sample ID	13H-DT-Bench-BCR-C1	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Suspended TSS @ 105 C	1020	mg/L		10		A2540 D	04/16/13 15:51 / cmm
INORGANICS							
Acidity, Total as CaCO3	1200	mg/L	D	4.0		A2310 B	04/19/13 09:00 / cmm
Alkalinity, Total as CaCO3	3100	mg/L		1		A2320 B	04/16/13 18:51 / cmm
Bicarbonate as HCO3	3800	mg/L		1		A2320 B	04/16/13 18:51 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	04/16/13 18:51 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	04/16/13 18:51 / cmm
Chloride	410	mg/L	D	10		E300.0	04/17/13 12:22 / cmm
Sulfate	1000	mg/L	D	5		E300.0	04/17/13 12:22 / cmm
Fluoride	0.3	mg/L	D	0.2	4	A4500-F C	04/18/13 10:11 / cmm
Sulfide	13	mg/L		1		A4500-S F	04/17/13 14:20 / eli-b22
AGGREGATE ORGANICS							
Oxygen Demand, Biochemical (BOD)	>1788	mg/L		2000		A5210 B	04/16/13 15:30 / cmm
Minimum DO for BOD is less than 1.0 mg/L.							
METALS, DISSOLVED							
Aluminum	0.24	mg/L		0.03		E200.8	04/19/13 15:05 / dck
Arsenic	0.010	mg/L		0.001		E200.8	04/18/13 14:51 / dck
Barium	1.69	mg/L		0.05		E200.8	04/18/13 14:51 / dck
Beryllium	ND	mg/L		0.001		E200.8	04/18/13 14:51 / dck
Cadmium	ND	mg/L		0.001		E200.8	04/18/13 14:51 / dck
Calcium	1120	mg/L		1		E200.7	04/17/13 16:43 / sld
Chromium	ND	mg/L		0.005		E200.8	04/19/13 15:05 / dck
Cobalt	0.016	mg/L		0.005		E200.8	04/18/13 14:51 / dck
Copper	0.022	mg/L		0.005		E200.8	04/18/13 14:51 / dck
Iron	13.7	mg/L		0.03		E200.7	04/17/13 16:43 / sld
Lead	0.003	mg/L		0.001		E200.8	04/18/13 14:51 / dck
Magnesium	157	mg/L		1		E200.7	04/17/13 16:43 / sld
Manganese	9.90	mg/L		0.001		E200.8	04/19/13 15:05 / dck
Nickel	0.071	mg/L		0.005		E200.8	04/18/13 14:51 / dck
Potassium	1090	mg/L		1		E200.7	04/17/13 16:43 / sld
Silver	ND	mg/L		0.001		E200.8	04/18/13 14:51 / dck
Sodium	162	mg/L		1		E200.7	04/17/13 16:43 / sld
Thallium	ND	mg/L		0.0005		E200.8	04/18/13 14:51 / dck
Zinc	0.47	mg/L		0.01		E200.8	04/18/13 14:51 / dck

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Smith Helena
Project: Barker-Hughsville
Lab ID: H13040227-002
Client Sample ID 13H-DT-Bench-BCR-C2

Report Date: 04/25/13
Collection Date: 04/15/13 11:40
DateReceived: 04/16/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Suspended TSS @ 105 C	550	mg/L		10		A2540 D	04/16/13 15:51 / cmm
INORGANICS							
Acidity, Total as CaCO3	950	mg/L	D	4.0		A2310 B	04/19/13 09:00 / cmm
Alkalinity, Total as CaCO3	2700	mg/L		1		A2320 B	04/16/13 19:08 / cmm
Bicarbonate as HCO3	3300	mg/L		1		A2320 B	04/16/13 19:08 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	04/16/13 19:08 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	04/16/13 19:08 / cmm
Chloride	260	mg/L	D	10		E300.0	04/17/13 12:35 / cmm
Sulfate	950	mg/L	D	5		E300.0	04/17/13 12:35 / cmm
Fluoride	0.3	mg/L	D	0.2	4	A4500-F C	04/18/13 10:12 / cmm
Sulfide	3	mg/L		1		A4500-S F	04/17/13 14:20 / eli-b22
AGGREGATE ORGANICS							
Oxygen Demand, Biochemical (BOD)	>1782	mg/L		2000		A5210 B	04/16/13 15:31 / cmm
Minimum DO for BOD is less than 1.0 mg/L.							
METALS, DISSOLVED							
Aluminum	0.22	mg/L		0.03		E200.8	04/19/13 15:25 / dck
Arsenic	0.009	mg/L		0.001		E200.8	04/18/13 14:56 / dck
Barium	1.74	mg/L		0.05		E200.8	04/18/13 14:56 / dck
Beryllium	ND	mg/L		0.001		E200.8	04/18/13 14:56 / dck
Cadmium	ND	mg/L		0.001		E200.8	04/18/13 14:56 / dck
Calcium	1020	mg/L		1		E200.7	04/17/13 16:47 / sld
Chromium	ND	mg/L		0.005		E200.8	04/19/13 15:25 / dck
Cobalt	0.018	mg/L		0.005		E200.8	04/18/13 14:56 / dck
Copper	0.016	mg/L		0.005		E200.8	04/18/13 14:56 / dck
Iron	12.6	mg/L		0.03		E200.7	04/17/13 16:47 / sld
Lead	0.002	mg/L		0.001		E200.8	04/18/13 14:56 / dck
Magnesium	158	mg/L		1		E200.7	04/17/13 16:47 / sld
Manganese	19.2	mg/L		0.001		E200.8	04/19/13 15:25 / dck
Nickel	0.067	mg/L		0.005		E200.8	04/18/13 14:56 / dck
Potassium	981	mg/L		1		E200.7	04/17/13 16:47 / sld
Silver	ND	mg/L		0.001		E200.8	04/18/13 14:56 / dck
Sodium	65	mg/L		1		E200.7	04/17/13 16:47 / sld
Thallium	ND	mg/L		0.0005		E200.8	04/18/13 14:56 / dck
Zinc	0.45	mg/L		0.01		E200.8	04/18/13 14:56 / dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Smith Helena	**Report Date:**	04/25/13
Project:	Barker-Hughsville	**Collection Date:**	04/15/13 11:45
Lab ID:	H13040227-003	**DateReceived:**	04/16/13
Client Sample ID	13H-DT-Bench-BCR-C3	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Suspended TSS @ 105 C	1830	mg/L		10		A2540 D	04/16/13 15:51 / cmm
INORGANICS							
Acidity, Total as CaCO3	550	mg/L	D	4.0		A2310 B	04/19/13 09:00 / cmm
Alkalinity, Total as CaCO3	3100	mg/L		1		A2320 B	04/16/13 19:25 / cmm
Bicarbonate as HCO3	3700	mg/L		1		A2320 B	04/16/13 19:25 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	04/16/13 19:25 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	04/16/13 19:25 / cmm
Chloride	340	mg/L	D	10		E300.0	04/17/13 12:47 / cmm
Sulfate	1000	mg/L	D	5		E300.0	04/17/13 12:47 / cmm
Fluoride	0.2	mg/L	D	0.2	4	A4500-F C	04/18/13 10:13 / cmm
Sulfide	11	mg/L		1		A4500-S F	04/17/13 14:20 / eli-b22
AGGREGATE ORGANICS							
Oxygen Demand, Biochemical (BOD)	>1785	mg/L		2000		A5210 B	04/16/13 15:33 / cmm
Minimum DO for BOD is less than 1.0 mg/L.							
METALS, DISSOLVED							
Aluminum	0.24	mg/L		0.03		E200.8	04/19/13 15:29 / dck
Arsenic	0.009	mg/L		0.001		E200.8	04/18/13 15:01 / dck
Barium	1.60	mg/L		0.05		E200.8	04/18/13 15:01 / dck
Beryllium	ND	mg/L		0.001		E200.8	04/18/13 15:01 / dck
Cadmium	ND	mg/L		0.001		E200.8	04/18/13 15:01 / dck
Calcium	1180	mg/L		1		E200.7	04/17/13 16:51 / sld
Chromium	ND	mg/L		0.005		E200.8	04/19/13 15:29 / dck
Cobalt	0.019	mg/L		0.005		E200.8	04/18/13 15:01 / dck
Copper	0.015	mg/L		0.005		E200.8	04/18/13 15:01 / dck
Iron	14.4	mg/L		0.03		E200.7	04/17/13 16:51 / sld
Lead	0.003	mg/L		0.001		E200.8	04/18/13 15:01 / dck
Magnesium	169	mg/L		1		E200.7	04/17/13 16:51 / sld
Manganese	16.5	mg/L		0.001		E200.8	04/19/13 15:29 / dck
Nickel	0.074	mg/L		0.005		E200.8	04/18/13 15:01 / dck
Potassium	1020	mg/L		1		E200.7	04/17/13 16:51 / sld
Silver	ND	mg/L		0.001		E200.8	04/18/13 15:01 / dck
Sodium	64	mg/L		1		E200.7	04/17/13 16:51 / sld
Thallium	ND	mg/L		0.0005		E200.8	04/18/13 15:01 / dck
Zinc	0.45	mg/L		0.01		E200.8	04/18/13 15:01 / dck

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Smith Helena	**Report Date:**	04/25/13
Project:	Barker-Hughsville	**Collection Date:**	04/15/13 11:50
Lab ID:	H13040227-004	**DateReceived:**	04/16/13
Client Sample ID	13H-DT-Bench-BCR-C4	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Suspended TSS @ 105 C	1400	mg/L		10		A2540 D	04/16/13 15:52 / cmm
INORGANICS							
Acidity, Total as CaCO3	640	mg/L	D	4.0		A2310 B	04/19/13 09:00 / cmm
Alkalinity, Total as CaCO3	3500	mg/L		1		A2320 B	04/16/13 19:41 / cmm
Bicarbonate as HCO3	4300	mg/L		1		A2320 B	04/16/13 19:41 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	04/16/13 19:41 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	04/16/13 19:41 / cmm
Chloride	450	mg/L	D	10		E300.0	04/17/13 13:00 / cmm
Sulfate	960	mg/L	D	5		E300.0	04/17/13 13:00 / cmm
Fluoride	ND	mg/L		0.1	4	A4500-F C	04/18/13 10:15 / cmm
Sulfide	8	mg/L		1		A4500-S F	04/17/13 14:20 / eli-b22
AGGREGATE ORGANICS							
Oxygen Demand, Biochemical (BOD)	>1791	mg/L		2000		A5210 B	04/16/13 15:34 / cmm
Minimum DO for BOD is less than 1.0 mg/L.							
METALS, DISSOLVED							
Aluminum	0.20	mg/L		0.03		E200.8	04/19/13 15:34 / dck
Arsenic	0.067	mg/L		0.001		E200.8	04/18/13 15:05 / dck
Barium	1.75	mg/L		0.05		E200.8	04/18/13 15:05 / dck
Beryllium	ND	mg/L		0.001		E200.8	04/18/13 15:05 / dck
Cadmium	ND	mg/L		0.001		E200.8	04/18/13 15:05 / dck
Calcium	1100	mg/L		1		E200.7	04/17/13 16:55 / sld
Chromium	0.005	mg/L		0.005		E200.8	04/19/13 15:34 / dck
Cobalt	0.016	mg/L		0.005		E200.8	04/18/13 15:05 / dck
Copper	0.023	mg/L		0.005		E200.8	04/18/13 15:05 / dck
Iron	13.6	mg/L		0.03		E200.7	04/17/13 16:55 / sld
Lead	0.003	mg/L		0.001		E200.8	04/18/13 15:05 / dck
Magnesium	205	mg/L		1		E200.7	04/17/13 16:55 / sld
Manganese	4.94	mg/L		0.001		E200.8	04/19/13 15:34 / dck
Nickel	0.078	mg/L		0.005		E200.8	04/18/13 15:05 / dck
Potassium	977	mg/L		1		E200.7	04/17/13 16:55 / sld
Silver	ND	mg/L		0.001		E200.8	04/18/13 15:05 / dck
Sodium	271	mg/L		1		E200.7	04/17/13 16:55 / sld
Thallium	ND	mg/L		0.0005		E200.8	04/18/13 15:05 / dck
Zinc	0.46	mg/L		0.01		E200.8	04/18/13 15:05 / dck

Report Definitions:

RL - Analyte reporting limit.

QCL - Quality control limit.

D - RL increased due to sample matrix.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Smith Helena **Report Date:** 04/25/13

Project: Barker-Hughsville **Work Order:** H13040227

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2310 B									Batch: H13040227-001B	
Sample ID: H13040227-004BDUP		Sample Duplicate				Run: MISC WC_130419B			04/19/13 09:00	
Acidity, Total as CaCO3		640	mg/L	4.0				0.8	20	
Sample ID: LCS1304190000		Laboratory Control Sample				Run: MISC WC_130419B			04/19/13 09:00	
Acidity, Total as CaCO3		660	mg/L	4.0	100	90	110			
Sample ID: MBLK1304190000		Method Blank				Run: MISC WC_130419B			04/19/13 09:00	
Acidity, Total as CaCO3		ND	mg/L	3						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Smith Helena
Project: Barker-Hughsville

Report Date: 04/25/13
Work Order: H13040227

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2320 B										Batch: R87671
Sample ID: MBLK		Method Blank				Run: MAN-TECH_130416A				04/16/13 17:26
Alkalinity, Total as CaCO3		ND	mg/L	2						
Sample ID: LCS-03252013		Laboratory Control Sample				Run: MAN-TECH_130416A				04/16/13 17:33
Alkalinity, Total as CaCO3		620	mg/L	4.0	104	90	110			
Sample ID: H13040142-002ADUP	3	Sample Duplicate				Run: MAN-TECH_130416A				04/16/13 17:49
Alkalinity, Total as CaCO3		260	mg/L	4.0				0.7	10	
Bicarbonate as HCO3		300	mg/L	4.0				0.0	10	
Carbonate as CO3		7.0	mg/L	4.0				15	10	R
Sample ID: H13040142-005AMS		Sample Matrix Spike				Run: MAN-TECH_130416A				04/16/13 18:03
Alkalinity, Total as CaCO3		740	mg/L	4.0	104	80	120			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

R - RPD exceeds advisory limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Smith Helena
Project: Barker-Hughsville
Report Date: 04/25/13
Work Order: H13040227

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2540 D									Batch: 20057	
Sample ID: MB-20057	Method Blank					Run: ACCU-124 (14410200)_13041			04/16/13 15:50	
Solids, Total Suspended TSS @ 105 C		ND	mg/L	1						
Sample ID: LCS-20057	Laboratory Control Sample					Run: ACCU-124 (14410200)_13041			04/16/13 15:50	
Solids, Total Suspended TSS @ 105 C		2110	mg/L	10	105	70	130			
Sample ID: H13040226-001BDUP	Sample Duplicate					Run: ACCU-124 (14410200)_13041			04/16/13 15:50	
Solids, Total Suspended TSS @ 105 C		20.0	mg/L	10				0.0	5	
Sample ID: H13040231-002BDUP	Sample Duplicate					Run: ACCU-124 (14410200)_13041			04/16/13 15:53	
Solids, Total Suspended TSS @ 105 C		10.0	mg/L	10				0.0	5	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Smith Helena
Project: Barker-Hughsville

Report Date: 04/25/13
Work Order: H13040227

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-F C										Analytical Run: PH_130418A
Sample ID: ICV1_130418A		Initial Calibration Verification Standard								04/18/13 10:03
Fluoride		0.7	mg/L	0.1	96	90	110			
Method: A4500-F C										Batch: 130418A-F-ISE-W
Sample ID: MBLK1_130418A		Method Blank				Run: PH_130418A				04/18/13 10:01
Fluoride		0.01	mg/L	0.005						
Sample ID: LFB1_130418A		Laboratory Fortified Blank				Run: PH_130418A				04/18/13 10:02
Fluoride		0.5	mg/L	0.1	93	90	110			
Sample ID: H13040210-012AMS		Sample Matrix Spike				Run: PH_130418A				04/18/13 10:05
Fluoride		4.9	mg/L	0.5	95	85	115			
Sample ID: H13040210-012AMSD		Sample Matrix Spike Duplicate				Run: PH_130418A				04/18/13 10:07
Fluoride		4.8	mg/L	0.5	93	85	115	1.0	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Smith Helena **Report Date:** 04/25/13
Project: Barker-Hughsville **Work Order:** H13040227

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-S F									Batch: B_R203110	
Sample ID: MB-R203110		Method Blank				Run: SUB-B203110			04/17/13 14:20	
Sulfide		ND	mg/L	0.5						
Sample ID: LCS-R203110		Laboratory Control Sample				Run: SUB-B203110			04/17/13 14:20	
Sulfide		21.4	mg/L	1.0	99	70	130			
Sample ID: B13041274-001AMS		Sample Matrix Spike				Run: SUB-B203110			04/17/13 14:20	
Sulfide		22.5	mg/L	1.0	97	80	120			
Sample ID: B13041274-001AMSD		Sample Matrix Spike Duplicate				Run: SUB-B203110			04/17/13 14:20	
Sulfide		22.6	mg/L	1.0	97	80	120	0.4	20	
Sample ID: B13041274-005AMS		Sample Matrix Spike				Run: SUB-B203110			04/17/13 14:20	
Sulfide		22.6	mg/L	1.0	98	80	120			
Sample ID: B13041274-005AMSD		Sample Matrix Spike Duplicate				Run: SUB-B203110			04/17/13 14:20	
Sulfide		22.6	mg/L	1.0	98	80	120	0.4	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Smith Helena
Project: Barker-Hughsville

Report Date: 04/25/13
Work Order: H13040227

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A5210 B										Batch: 130416_1_BOD5-W
Sample ID: Dil-H201_130416		Dilution Water Blank				Run: MISC WC_130416A				04/16/13 15:18
Oxygen Demand, Biochemical (BOD)		ND	mg/L	2.0		0	0.2			
Sample ID: GGA1_130416		Laboratory Control Sample				Run: MISC WC_130416A				04/16/13 15:24
Oxygen Demand, Biochemical (BOD)		210	mg/L	53	105	85	115			
Sample ID: H13040229-002ADUP		Sample Duplicate				Run: MISC WC_130416A				04/16/13 15:37
Oxygen Demand, Biochemical (BOD)		730	mg/L	160		90	110	5.3	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Smith Helena
Project: Barker-Hughsville
Report Date: 04/25/13
Work Order: H13040227

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7										Analytical Run: ICP2-HE_130416D
Sample ID: ICV	5	Initial Calibration Verification Standard								04/17/13 12:05
Calcium		40.5	mg/L	1.0	101	95	105			
Iron		3.99	mg/L	0.030	100	95	105			
Magnesium		40.0	mg/L	1.0	100	95	105			
Potassium		39.4	mg/L	1.0	98	95	105			
Sodium		39.7	mg/L	1.0	99	95	105			
Sample ID: CCV-1	5	Continuing Calibration Verification Standard								04/17/13 12:09
Calcium		25.2	mg/L	1.0	101	95	105			
Iron		2.49	mg/L	0.030	100	95	105			
Magnesium		24.9	mg/L	1.0	100	95	105			
Potassium		23.8	mg/L	1.0	95	95	105			
Sodium		23.8	mg/L	1.0	95	95	105			
Sample ID: ICSA	5	Interference Check Sample A								04/17/13 12:21
Calcium		470	mg/L	1.0	94	80	120			
Iron		184	mg/L	0.030	92	80	120			
Magnesium		505	mg/L	1.0	101	80	120			
Potassium		-0.0398	mg/L	1.0		0	0			
Sodium		0.00721	mg/L	1.0		0	0			
Sample ID: ICSAB	5	Interference Check Sample AB								04/17/13 12:25
Calcium		475	mg/L	1.0	95	80	120			
Iron		188	mg/L	0.030	94	80	120			
Magnesium		517	mg/L	1.0	103	80	120			
Potassium		21.9	mg/L	1.0	110	80	120			
Sodium		22.0	mg/L	1.0	110	80	120			
Sample ID: CCV	5	Continuing Calibration Verification Standard								04/17/13 16:28
Calcium		23.8	mg/L	1.0	95	90	110			
Iron		2.36	mg/L	0.030	94	90	110			
Magnesium		24.4	mg/L	1.0	98	90	110			
Potassium		24.2	mg/L	1.0	97	90	110			
Sodium		24.2	mg/L	1.0	97	90	110			
Method: E200.7										Batch: R87703
Sample ID: ICB	5	Method Blank				Run: ICP2-HE_130416D				04/17/13 12:33
Calcium		0.04	mg/L	0.02						
Iron		ND	mg/L	0.003						
Magnesium		0.008	mg/L	0.007						
Potassium		ND	mg/L	0.02						
Sodium		ND	mg/L	0.02						
Sample ID: LFB	5	Laboratory Fortified Blank				Run: ICP2-HE_130416D				04/17/13 12:36
Calcium		49.6	mg/L	1.0	99	85	115			
Iron		4.90	mg/L	0.030	98	85	115			
Magnesium		49.9	mg/L	1.0	100	85	115			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Smith Helena
Project: Barker-Hughsville

Report Date: 04/25/13
Work Order: H13040227

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7										Batch: R87703
Sample ID: LFB	5	Laboratory Fortified Blank				Run: ICP2-HE_130416D			04/17/13 12:36	
Potassium		48.0	mg/L	1.0	96	85	115			
Sodium		48.3	mg/L	1.0	97	85	115			
Sample ID: H13040224-001BMS2	5	Sample Matrix Spike				Run: ICP2-HE_130416D			04/17/13 16:06	
Calcium		67.3	mg/L	1.0	92	70	130			
Iron		4.72	mg/L	0.030	92	70	130			
Magnesium		62.3	mg/L	1.0	95	70	130			
Potassium		51.2	mg/L	1.0	94	70	130			
Sodium		665	mg/L	1.0		70	130			A
Sample ID: H13040224-001BMSD	5	Sample Matrix Spike Duplicate				Run: ICP2-HE_130416D			04/17/13 16:09	
Calcium		68.0	mg/L	1.0	94	70	130	1.0	20	
Iron		4.79	mg/L	0.030	93	70	130	1.4	20	
Magnesium		62.9	mg/L	1.0	96	70	130	0.8	20	
Potassium		53.1	mg/L	1.0	98	70	130	3.7	20	
Sodium		686	mg/L	1.0		70	130	3.1	20	A

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Smith Helena
Project: Barker-Hughsville

Report Date: 04/25/13
Work Order: H13040227

Method: **E200.8** Analytical Run: ICPMS204-B_130416A

Sample ID: ICV STD 11 Initial Calibration Verification Standard 04/16/13 10:32

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Arsenic		0.0516	mg/L	0.0050	103	90	110			
Barium		0.0512	mg/L	0.10	102	90	110			
Beryllium		0.0260	mg/L	0.0010	104	90	110			
Cadmium		0.0266	mg/L	0.0010	106	90	110			
Cobalt		0.0515	mg/L	0.010	103	90	110			
Copper		0.0527	mg/L	0.010	105	90	110			
Lead		0.0511	mg/L	0.010	102	90	110			
Nickel		0.0521	mg/L	0.010	104	90	110			
Silver		0.0250	mg/L	0.0050	100	90	110			
Thallium		0.0531	mg/L	0.10	106	90	110			
Zinc		0.0522	mg/L	0.010	104	90	110			

Sample ID: ICSA 11 Interference Check Sample A 04/16/13 10:37

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Arsenic		0.000443	mg/L	0.0050						
Barium		0.000199	mg/L	0.10						
Beryllium		1.00E-06	mg/L	0.0010						
Cadmium		0.00131	mg/L	0.0010						
Cobalt		0.000325	mg/L	0.010						
Copper		0.000846	mg/L	0.010						
Lead		0.000230	mg/L	0.010						
Nickel		0.000745	mg/L	0.010						
Silver		0.000228	mg/L	0.0050						
Thallium		9.20E-05	mg/L	0.10						
Zinc		0.00166	mg/L	0.010						

Sample ID: ICSAB 11 Interference Check Sample AB 04/16/13 10:42

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Arsenic		0.0104	mg/L	0.0050	104	70	130			
Barium		0.000130	mg/L	0.10		0	0			
Beryllium		-4.00E-06	mg/L	0.0010		0	0			
Cadmium		0.0110	mg/L	0.0010	110	70	130			
Cobalt		0.0205	mg/L	0.010	102	70	130			
Copper		0.0201	mg/L	0.010	100	70	130			
Lead		0.000188	mg/L	0.010		0	0			
Nickel		0.0211	mg/L	0.010	105	70	130			
Silver		0.0193	mg/L	0.0050	96	70	130			
Thallium		3.90E-05	mg/L	0.10		0	0			
Zinc		0.0111	mg/L	0.010	111	70	130			

Sample ID: ICSA 11 Interference Check Sample A 04/16/13 23:17

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Arsenic		0.000614	mg/L	0.0050						
Barium		0.000303	mg/L	0.10						
Beryllium		5.00E-06	mg/L	0.0010						
Cadmium		0.00114	mg/L	0.0010						
Cobalt		0.000325	mg/L	0.010						
Copper		0.000818	mg/L	0.010						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Smith Helena

Project: Barker-Hughsville

Report Date: 04/25/13

Work Order: H13040227

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130416A
Sample ID: ICSA	11	Interference Check Sample A								04/16/13 23:17
Lead		0.000227	mg/L	0.010						
Nickel		0.000771	mg/L	0.010						
Silver		0.000158	mg/L	0.0050						
Thallium		0.000116	mg/L	0.10						
Zinc		0.00132	mg/L	0.010						
Sample ID: ICSAB	11	Interference Check Sample AB								04/16/13 23:21
Arsenic		0.0111	mg/L	0.0050	111	70	130			
Barium		0.000201	mg/L	0.10		0	0			
Beryllium		-1.10E-05	mg/L	0.0010		0	0			
Cadmium		0.0110	mg/L	0.0010	109	70	130			
Cobalt		0.0213	mg/L	0.010	107	70	130			
Copper		0.0208	mg/L	0.010	104	70	130			
Lead		0.000187	mg/L	0.010		0	0			
Nickel		0.0215	mg/L	0.010	108	70	130			
Silver		0.0199	mg/L	0.0050	100	70	130			
Thallium		7.00E-05	mg/L	0.10		0	0			
Zinc		0.0120	mg/L	0.010	120	70	130			
Sample ID: ICSA	11	Interference Check Sample A								04/17/13 14:23
Arsenic		0.000493	mg/L	0.0050						
Barium		0.000253	mg/L	0.10						
Beryllium		-1.00E-06	mg/L	0.0010						
Cadmium		0.00104	mg/L	0.0010						
Cobalt		0.000385	mg/L	0.010						
Copper		0.000865	mg/L	0.010						
Lead		0.000217	mg/L	0.010						
Nickel		0.000789	mg/L	0.010						
Silver		0.000188	mg/L	0.0050						
Thallium		0.000144	mg/L	0.10						
Zinc		0.00148	mg/L	0.010						
Sample ID: ICSAB	11	Interference Check Sample AB								04/17/13 14:28
Arsenic		0.0112	mg/L	0.0050	112	70	130			
Barium		0.000180	mg/L	0.10		0	0			
Beryllium		-9.00E-06	mg/L	0.0010		0	0			
Cadmium		0.0106	mg/L	0.0010	106	70	130			
Cobalt		0.0226	mg/L	0.010	113	70	130			
Copper		0.0211	mg/L	0.010	105	70	130			
Lead		0.000188	mg/L	0.010		0	0			
Nickel		0.0221	mg/L	0.010	110	70	130			
Silver		0.0196	mg/L	0.0050	98	70	130			
Thallium		0.000100	mg/L	0.10		0	0			
Zinc		0.0112	mg/L	0.010	112	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Smith Helena
Project: Barker-Hughsville

Report Date: 04/25/13
Work Order: H13040227

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130416A
Sample ID: ICSA	11	Interference Check Sample A								04/18/13 05:39
Arsenic		0.000382	mg/L	0.0050						
Barium		0.000294	mg/L	0.10						
Beryllium		-5.00E-06	mg/L	0.0010						
Cadmium		0.000848	mg/L	0.0010						
Cobalt		0.000330	mg/L	0.010						
Copper		0.000806	mg/L	0.010						
Lead		0.000203	mg/L	0.010						
Nickel		0.000746	mg/L	0.010						
Silver		0.000218	mg/L	0.0050						
Thallium		0.000234	mg/L	0.10						
Zinc		0.00143	mg/L	0.010						
Sample ID: ICSAB	11	Interference Check Sample AB								04/18/13 05:44
Arsenic		0.0109	mg/L	0.0050	109	70	130			
Barium		0.000217	mg/L	0.10		0	0			
Beryllium		-4.00E-06	mg/L	0.0010		0	0			
Cadmium		0.0104	mg/L	0.0010	104	70	130			
Cobalt		0.0220	mg/L	0.010	110	70	130			
Copper		0.0204	mg/L	0.010	102	70	130			
Lead		0.000175	mg/L	0.010		0	0			
Nickel		0.0212	mg/L	0.010	106	70	130			
Silver		0.0190	mg/L	0.0050	95	70	130			
Thallium		0.000130	mg/L	0.10		0	0			
Zinc		0.0104	mg/L	0.010	104	70	130			
Sample ID: ICV STD	11	Initial Calibration Verification Standard								04/18/13 12:19
Arsenic		0.0543	mg/L	0.0050	109	90	110			
Barium		0.0533	mg/L	0.10	107	90	110			
Beryllium		0.0249	mg/L	0.0010	100	90	110			
Cadmium		0.0259	mg/L	0.0010	103	90	110			
Cobalt		0.0542	mg/L	0.010	108	90	110			
Copper		0.0541	mg/L	0.010	108	90	110			
Lead		0.0522	mg/L	0.010	104	90	110			
Nickel		0.0538	mg/L	0.010	108	90	110			
Silver		0.0249	mg/L	0.0050	100	90	110			
Thallium		0.0546	mg/L	0.10	109	90	110			
Zinc		0.0542	mg/L	0.010	108	90	110			
Sample ID: ICSA	11	Interference Check Sample A								04/18/13 12:24
Arsenic		0.000403	mg/L	0.0050						
Barium		0.000319	mg/L	0.10						
Beryllium		-5.00E-06	mg/L	0.0010						
Cadmium		0.000839	mg/L	0.0010						
Cobalt		0.000322	mg/L	0.010						
Copper		0.000768	mg/L	0.010						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Smith Helena
Project: Barker-Hughsville

Report Date: 04/25/13
Work Order: H13040227

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130416A
Sample ID: ICSA	11	Interference Check Sample A								04/18/13 12:24
Lead		0.000210	mg/L	0.010						
Nickel		0.000665	mg/L	0.010						
Silver		0.000230	mg/L	0.0050						
Thallium		0.000270	mg/L	0.10						
Zinc		0.00134	mg/L	0.010						
Sample ID: ICSAB	11	Interference Check Sample AB								04/18/13 12:29
Arsenic		0.0113	mg/L	0.0050	113	70	130			
Barium		0.000253	mg/L	0.10		0	0			
Beryllium		-2.00E-06	mg/L	0.0010		0	0			
Cadmium		0.0106	mg/L	0.0010	106	70	130			
Cobalt		0.0218	mg/L	0.010	109	70	130			
Copper		0.0208	mg/L	0.010	104	70	130			
Lead		0.000174	mg/L	0.010		0	0			
Nickel		0.0218	mg/L	0.010	109	70	130			
Silver		0.0187	mg/L	0.0050	94	70	130			
Thallium		0.000185	mg/L	0.10		0	0			
Zinc		0.0112	mg/L	0.010	112	70	130			
Method: E200.8										Batch: R87679
Sample ID: LFB-20022	10	Laboratory Fortified Blank				Run: ICPMS204-B_130416A				04/16/13 11:46
Arsenic		51.1	mg/kg	1.0	102	85	115			
Barium		50.4	mg/kg	1.0	100	85	115			
Beryllium		50.2	mg/kg	1.0	100	85	115			
Cadmium		52.6	mg/kg	0.10	105	85	115			
Cobalt		51.1	mg/kg	1.0	102	85	115			
Copper		53.8	mg/kg	1.0	104	85	115			
Lead		51.2	mg/kg	1.0	102	85	115			
Nickel		52.7	mg/kg	1.0	105	85	115			
Thallium		52.2	mg/kg	1.0	104	85	115			
Zinc		53.2	mg/kg	1.0	102	85	115			
Sample ID: LFB-20023	10	Laboratory Fortified Blank				Run: ICPMS204-B_130416A				04/16/13 18:50
Arsenic		52.0	mg/kg	1.0	104	85	115			
Barium		51.3	mg/kg	1.0	102	85	115			
Beryllium		50.9	mg/kg	1.0	102	85	115			
Cadmium		53.3	mg/kg	0.10	107	85	115			
Cobalt		54.7	mg/kg	1.0	109	85	115			
Copper		54.0	mg/kg	1.0	107	85	115			
Lead		52.8	mg/kg	1.0	105	85	115			
Nickel		54.1	mg/kg	1.0	108	85	115			
Thallium		52.7	mg/kg	1.0	105	85	115			
Zinc		53.8	mg/kg	1.0	104	85	115			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Smith Helena
Project: Barker-Hughsville

Report Date: 04/25/13
Work Order: H13040227

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Batch: R87679
Sample ID: LFB-20033	10	Laboratory Fortified Blank				Run: ICPMS204-B_130416A				04/17/13 00:28
Arsenic		51.8	mg/kg	1.0	103	85	115			
Barium		50.1	mg/kg	1.0	99	85	115			
Beryllium		50.4	mg/kg	1.0	101	85	115			
Cadmium		53.3	mg/kg	0.10	107	85	115			
Cobalt		54.2	mg/kg	1.0	108	85	115			
Copper		55.0	mg/kg	1.0	108	85	115			
Lead		52.7	mg/kg	1.0	105	85	115			
Nickel		54.6	mg/kg	1.0	109	85	115			
Thallium		52.5	mg/kg	1.0	105	85	115			
Zinc		54.2	mg/kg	1.0	104	85	115			
Sample ID: LFB-20050	10	Laboratory Fortified Blank				Run: ICPMS204-B_130416A				04/17/13 12:37
Arsenic		52.6	mg/kg	1.0	105	85	115			
Barium		50.8	mg/kg	1.0	101	85	115			
Beryllium		50.2	mg/kg	1.0	100	85	115			
Cadmium		54.2	mg/kg	0.10	108	85	115			
Cobalt		55.1	mg/kg	1.0	110	85	115			
Copper		56.0	mg/kg	1.0	110	85	115			
Lead		53.2	mg/kg	1.0	106	85	115			
Nickel		55.8	mg/kg	1.0	112	85	115			
Thallium		52.7	mg/kg	1.0	105	85	115			
Zinc		54.5	mg/kg	1.0	105	85	115			
Sample ID: LFB-20051	9	Laboratory Fortified Blank				Run: ICPMS204-B_130416A				04/17/13 21:13
Arsenic		52.8	mg/kg	1.0	105	85	115			
Barium		49.7	mg/kg	1.0	99	85	115			
Beryllium		49.9	mg/kg	1.0	100	85	115			
Cadmium		52.7	mg/kg	0.10	105	85	115			
Copper		54.5	mg/kg	1.0	108	85	115			
Lead		51.7	mg/kg	1.0	103	85	115			
Nickel		53.5	mg/kg	1.0	107	85	115			
Thallium		51.6	mg/kg	1.0	103	85	115			
Zinc		55.0	mg/kg	1.0	107	85	115			
Sample ID: LFB-20052	10	Laboratory Fortified Blank				Run: ICPMS204-B_130416A				04/18/13 04:41
Arsenic		52.8	mg/kg	1.0	106	85	115			
Barium		51.3	mg/kg	1.0	102	85	115			
Beryllium		49.4	mg/kg	1.0	99	85	115			
Cadmium		52.8	mg/kg	0.10	106	85	115			
Cobalt		51.8	mg/kg	1.0	104	85	115			
Copper		54.6	mg/kg	1.0	108	85	115			
Lead		52.5	mg/kg	1.0	105	85	115			
Nickel		54.6	mg/kg	1.0	109	85	115			
Thallium		52.1	mg/kg	1.0	104	85	115			
Zinc		52.6	mg/kg	1.0	103	85	115			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Smith Helena
Project: Barker-Hughsville

Report Date: 04/25/13
Work Order: H13040227

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Batch: R87679
Sample ID: LFB-20052	10	Laboratory Fortified Blank				Run: ICPMS204-B_130416A				04/18/13 04:41
Sample ID: ICB	11	Method Blank				Run: ICPMS204-B_130416A				04/18/13 12:55
Arsenic		ND	mg/L	7E-05						
Barium		ND	mg/L	5E-05						
Beryllium		ND	mg/L	2E-05						
Cadmium		ND	mg/L	7E-06						
Cobalt		ND	mg/L	2E-05						
Copper		ND	mg/L	3E-05						
Lead		ND	mg/L	6E-06						
Nickel		ND	mg/L	6E-05						
Silver		ND	mg/L	4E-05						
Thallium		ND	mg/L	1E-05						
Zinc		ND	mg/L	0.0003						
Sample ID: LFB	11	Laboratory Fortified Blank				Run: ICPMS204-B_130416A				04/18/13 13:00
Arsenic		0.0520	mg/L	0.0050	104	85	115			
Barium		0.0501	mg/L	0.10	100	85	115			
Beryllium		0.0463	mg/L	0.0010	93	85	115			
Cadmium		0.0490	mg/L	0.0010	98	85	115			
Cobalt		0.0525	mg/L	0.010	105	85	115			
Copper		0.0513	mg/L	0.010	103	85	115			
Lead		0.0499	mg/L	0.010	100	85	115			
Nickel		0.0518	mg/L	0.010	104	85	115			
Silver		0.0199	mg/L	0.0050	99	85	115			
Thallium		0.0512	mg/L	0.10	102	85	115			
Zinc		0.0523	mg/L	0.010	105	85	115			
Sample ID: H13040220-001AMS	11	Sample Matrix Spike				Run: ICPMS204-B_130416A				04/18/13 14:04
Arsenic		0.0904	mg/L	0.0010	103	70	130			
Barium		0.0779	mg/L	0.050	102	70	130			
Beryllium		0.0516	mg/L	0.0010	89	70	130			
Cadmium		0.104	mg/L	0.0010	20	70	130			S
Cobalt		0.481	mg/L	0.0050		70	130			A
Copper		4.12	mg/L	0.0050		70	130			A
Lead		0.0621	mg/L	0.0010	103	70	130			
Nickel		0.269	mg/L	0.0050		70	130			A
Silver		0.0182	mg/L	0.0010	90	70	130			
Thallium		0.0523	mg/L	0.00050	104	70	130			
Zinc		86.4	mg/L	0.010		70	130			A
Sample ID: H13040220-001AMSD	11	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130416A				04/18/13 14:08
Arsenic		0.0896	mg/L	0.0010	102	70	130	1.0	20	
Barium		0.0768	mg/L	0.050	100	70	130	1.5	20	
Beryllium		0.0508	mg/L	0.0010	88	70	130	1.4	20	
Cadmium		0.104	mg/L	0.0010	19	70	130	0.5	20	S

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Smith Helena
Project: Barker-Hughsville
Report Date: 04/25/13
Work Order: H13040227

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Batch: R87679
Sample ID: H13040220-001AMSD	11	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130416A				04/18/13 14:08
Cobalt		0.483	mg/L	0.0050		70	130	0.4	20	A
Copper		4.15	mg/L	0.0050		70	130	0.7	20	A
Lead		0.0619	mg/L	0.0010	102	70	130	0.4	20	
Nickel		0.267	mg/L	0.0050		70	130	0.7	20	A
Silver		0.0184	mg/L	0.0010	91	70	130	0.9	20	
Thallium		0.0524	mg/L	0.00050	104	70	130	0.3	20	
Zinc		86.6	mg/L	0.010		70	130	0.2	20	A
Method: E200.8										Analytical Run: ICPMS204-B_130419A
Sample ID: ICSA	3	Interference Check Sample A								04/19/13 11:26
Aluminum		35.7	mg/L	0.10	89	70	130			
Chromium		0.00112	mg/L	0.010						
Manganese		0.000337	mg/L	0.010						
Sample ID: ICSAB	3	Interference Check Sample AB								04/19/13 11:31
Aluminum		36.7	mg/L	0.10	92	70	130			
Chromium		0.0210	mg/L	0.010	105	70	130			
Manganese		0.0204	mg/L	0.010	102	70	130			
Sample ID: ICV STD	3	Initial Calibration Verification Standard								04/19/13 12:00
Aluminum		0.282	mg/L	0.10	94	90	110			
Chromium		0.0591	mg/L	0.010	99	90	110			
Manganese		0.303	mg/L	0.010	101	90	110			
Method: E200.8										Batch: R87794
Sample ID: ICB	3	Method Blank				Run: ICPMS204-B_130419A				04/19/13 14:37
Aluminum		ND	mg/L	0.0001						
Chromium		ND	mg/L	4E-05						
Manganese		ND	mg/L	8E-05						
Sample ID: LFB	3	Laboratory Fortified Blank				Run: ICPMS204-B_130419A				04/19/13 14:41
Aluminum		0.0463	mg/L	0.10	93	85	115			
Chromium		0.0481	mg/L	0.010	96	85	115			
Manganese		0.0481	mg/L	0.010	96	85	115			
Sample ID: H13040227-001CMS	3	Sample Matrix Spike				Run: ICPMS204-B_130419A				04/19/13 15:10
Aluminum		0.466	mg/L	0.030	89	70	130			
Chromium		0.241	mg/L	0.0050	94	70	130			
Manganese		10.6	mg/L	0.0010		70	130			A
Sample ID: H13040227-001CMSD	3	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130419A				04/19/13 15:15
Aluminum		0.472	mg/L	0.030	91	70	130	1.3	20	
Chromium		0.245	mg/L	0.0050	96	70	130	1.5	20	
Manganese		10.5	mg/L	0.0010		70	130	0.6	20	A

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Smith Helena
Project: Barker-Hughsville

Report Date: 04/25/13
Work Order: H13040227

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E300.0										Analytical Run: IC102-H_130417A
Sample ID: ICV041713-12	2	Initial Calibration Verification Standard								04/17/13 10:03
Chloride		100	mg/L	1.0	102	90	110			
Sulfate		400	mg/L	1.0	101	90	110			
Sample ID: CCV041713-15	2	Continuing Calibration Verification Standard								04/17/13 10:41
Chloride		100	mg/L	1.0	102	90	110			
Sulfate		410	mg/L	1.0	102	90	110			
Method: E300.0										Batch: R87693
Sample ID: ICB041713-13	2	Method Blank				Run: IC102-H_130417A				04/17/13 10:16
Chloride		ND	mg/L	0.008						
Sulfate		ND	mg/L	0.08						
Sample ID: LFB041713-14	2	Laboratory Fortified Blank				Run: IC102-H_130417A				04/17/13 10:29
Chloride		49	mg/L	1.0	98	90	110			
Sulfate		200	mg/L	1.0	98	90	110			
Sample ID: H13040224-003AMS	2	Sample Matrix Spike				Run: IC102-H_130417A				04/17/13 11:44
Chloride		77	mg/L	1.0	110	90	110			
Sulfate		660	mg/L	1.0	111	90	110			S
Sample ID: H13040224-003AMSD	2	Sample Matrix Spike Duplicate				Run: IC102-H_130417A				04/17/13 11:57
Chloride		77	mg/L	1.0	110	90	110	0.0	20	
Sulfate		660	mg/L	1.0	110	90	110	0.5	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

Standard Reporting Procedures

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Workorder Receipt Checklist

CDM Smith Helena H13040227

Login completed by:	Tracy L. Lorash	Date Received:	4/16/2013
Reviewed by:	BL2000\jweidemoyer	Received by:	reh
Reviewed Date:	4/19/2013	Carrier name:	UPS ARS NDA

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☐	No ☑	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received?	Yes ☑	No ☐	Not Applicable ☐
Container/Temp Blank temperature:	2.7℃ On Ice		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☑	Not Applicable ☐

Contact and Corrective Action Comments:

Sample ID on COC has 13H-DT-Bench as part of it - ID on bottles does not. Logged in with ID from COC.
All dissolved metals samples received at a pH of 3.
No sulfide samples were pH tested due to very strong odor. Tl 4/18/13.

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

Page 1 of 1

PLEASE PRINT (Provide as much information as possible.)

Company Name: CDM SMITH

Project Name, PWS, Permit, Etc.: BARKER HUGHESVILE

Sample Origin State: CO

EPA/State Compliance: Yes ☒ No ☐

Report Mail Address (Required):
50 West 14th street Suite 200
Helena, MT 59601

☐ No Hard Copy Email:

Contact Name: ANGELA FRANSEN

Phone/Fax: 406-441-1435

Cell: 406-439-3776

Sampler: (Please Print) Nick Anton ~~720-264-1147~~

Invoice Contact & Phone: AS ABOVE

Purchase Order: 3385-325-006-AL

Quote/Bottle Order: H823

Invoice Address (Required): AS ABOVE

☐ No Hard Copy Email:

Special Report/Formats:
☐ DW
☐ POTW/WWTP
☐ State:
☐ Other:
☒ EDD/EDT (Electronic Data)
Format:
☐ LEVEL IV
☐ NELAC

→ Contact ELI prior to **RUSH** sample submittal for charges and scheduling – See Instruction Page

Comments: Limited sample Volume For BOD + ACIDITY, ALKALINITY, ANIONS BOTTLES.

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	Number of Containers Sample Type: A W S V B O DW Air Water Soils/Solids Vegetation Bioassay Other DW - Drinking Water	ALKALINITY, ACIDITY, ANIONS	BOD	SULFIDE	DISS Metals							SEE ATTACHED	Standard Turnaround (TAT)	RUSH
1 13H-DT-BENCH-BCR-C1	4/15/13	1135	WATER		✓	✓	✓	✓									
2 13H-DT-BENCH-BCR-C2	4/15/13	1140	"		✓	✓	✓	✓									
3 13H-DT-BENCH-BCR-C3	4/15/13	1145	"		✓	✓	✓	✓									
4 13H-DT-BENCH-BCR-C4	4/15/13	1150	"		✓	✓	✓	✓									
5																	
6																	
7																	
8																	
9																	
10																	

LABORATORY USE ONLY

Shipped by: UPS ARS-ND

Cooler ID(s): Y

Receipt Temp 2.7 °C TB

On Ice: [✓ Y] N

Custody Seal
On Bottle Y [✓ N]
On Cooler [✓ Y] N
Intact [✓ Y] N
Signature Match [✓ Y] N

H13040227

Custody Record MUST be Signed

Relinquished by (print): Nick Anton Date/Time: 4/15/13 /1400 Signature:

Relinquished by (print): Date/Time: Signature:

Received by (print): Date/Time: Signature:

Received by (print): Date/Time: Signature:

Sample Disposal: Return to Client: ________ Lab Disposal: X

Received by Laboratory: Date/Time: 4/16/13 10:35 Signature: Rebecca Hilliard

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.

Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links

Appendix B.2

Pilot-Scale Laboratory Data Packages

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ANALYTICAL SUMMARY REPORT

July 25, 2013

CDM Federal Programs
555 17th St Ste 1100
Denver, CO 80202

Workorder No.: H13070211 Quote ID: H823 - Baker-Hughsville Superfund Site

Project Name: Barker Hughsville Pilot

Energy Laboratories Inc Helena MT received the following 9 samples for CDM Federal Programs on 7/12/2013 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H13070211-001	13BH-DT-PILOT-INFL-071113	07/11/13 16:20	07/12/13	Aqueous	Metals by ICP/ICPMS, Dissolved Metals by ICP/ICPMS, Total Acidity, Total as CaCO3 Alkalinity Fluoride Anions by Ion Chromatography Metals Digestion by EPA 200.2 Phosphorus, Orthophosphate as P Solids, Total Dissolved
H13070211-002	13BH-DT-PILOT-INFD-071113	07/11/13 16:30	07/12/13	Aqueous	Same As Above
H13070211-003	13BH-DT-PILOT-BCR1-071113	07/11/13 16:50	07/12/13	Aqueous	Metals by ICP/ICPMS, Dissolved Metals by ICP/ICPMS, Total Acidity, Total as CaCO3 Alkalinity Fluoride Anions by Ion Chromatography Metals Digestion by EPA 200.2 Phosphorus, Orthophosphate as P Solids, Total Dissolved Sulfide, Iodine Titrimetric
H13070211-004	13BH-DT-PILOT-BCR2-071113	07/11/13 17:05	07/12/13	Aqueous	Same As Above
H13070211-005	13BH-DT-PILOT-BCR3-071113	07/11/13 17:20	07/12/13	Aqueous	Same As Above
H13070211-006	13BH-DT-PILOT-BCR4-071113	07/11/13 17:35	07/12/13	Aqueous	Same As Above
H13070211-007	13BH-DT-PILOT-SAPS-071113	07/11/13 17:55	07/12/13	Aqueous	Metals by ICP/ICPMS, Dissolved Metals by ICP/ICPMS, Total Acidity, Total as CaCO3 Alkalinity Fluoride Anions by Ion Chromatography Metals Digestion by EPA 200.2 Phosphorus, Orthophosphate as P Solids, Total Dissolved
H13070211-008	13BH-DT-PILOT-CHIT-071113	07/11/13 18:10	07/12/13	Aqueous	Metals by ICP/ICPMS, Dissolved Metals by ICP/ICPMS, Total Acidity, Total as CaCO3 Alkalinity Fluoride Anions by Ion Chromatography Metals Digestion by EPA 200.2 Phosphorus, Orthophosphate as P Solids, Total Dissolved Sulfide, Iodine Titrimetric

ANALYTICAL SUMMARY REPORT

H13070211-009	13BH-DT-PILOT-MGOH-071113	07/11/13 18:30	07/12/13	Aqueous	Metals by ICP/ICPMS, Dissolved Metals by ICP/ICPMS, Total Acidity, Total as CaCO3 Alkalinity Fluoride Anions by Ion Chromatography Metals Digestion by EPA 200.2 Phosphorus, Orthophosphate as P Solids, Total Dissolved

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By:

CLIENT: CDM Federal Programs
Project: Barker Hughsville Pilot
Sample Delivery Group: H13070211

Report Date: 07/25/13

CASE NARRATIVE

Tests associated with analyst identified as ELI-B were subcontracted to Energy Laboratories, 1120 S. 27th St., Billings, MT, EPA Number MT00005.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	07/29/13
Project:	Barker Hughsville Pilot	**Collection Date:**	07/11/13 16:20
Lab ID:	H13070211-001	**Date Received:**	07/12/13
Client Sample ID:	13BH-DT-PILOT-INFL-071113	**Matrix:**	AQUEOUS

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
PHYSICAL PROPERTIES								
Solids, Total Dissolved TDS @ 180 C	1840	mg/L		10		1	A2540 C	07/12/13 14:12/glj
INORGANICS								
Acidity, Total as CaCO3	660	mg/L	D	4.0		1	A2310 B	07/15/13 10:00/cmm
Alkalinity, Total as CaCO3	ND	mg/L		1		1	A2320 B	07/15/13 14:31/jaw
Bicarbonate as HCO3	ND	mg/L		1		1	A2320 B	07/15/13 14:31/jaw
Carbonate as CO3	ND	mg/L		1		1	A2320 B	07/15/13 14:31/jaw
Hydroxide as OH	ND	mg/L		1		1	A2320 B	07/15/13 14:31/jaw
Chloride	2	mg/L		1		5	E300.0	07/16/13 15:02/cmm
Sulfate	1600	mg/L		1		5	E300.0	07/16/13 15:02/cmm
Fluoride	0.5	mg/L	D	0.2	4	2	A4500-F C	07/16/13 10:04/cmm
NUTRIENTS								
Phosphorus, Orthophosphate as P	ND	mg/L	D	0.1		100	E365.1	07/12/13 14:24/reh
METALS, DISSOLVED								
Aluminum	15.6	mg/L		0.03		200	E200.8	07/18/13 05:17/dck
Arsenic	0.311	mg/L		0.001		10	E200.8	07/16/13 19:01/dck
Barium	ND	mg/L		0.05		10	E200.8	07/16/13 19:01/dck
Beryllium	0.008	mg/L		0.001		10	E200.8	07/16/13 19:01/dck
Cadmium	0.316	mg/L		0.001		10	E200.8	07/16/13 19:01/dck
Calcium	108	mg/L		1		5	E200.7	07/15/13 11:34/sld
Chromium	0.006	mg/L		0.005		10	E200.8	07/16/13 19:01/dck
Cobalt	0.058	mg/L		0.005		10	E200.8	07/16/13 19:01/dck
Copper	2.16	mg/L		0.005		10	E200.8	07/16/13 19:01/dck
Iron	180	mg/L		0.03		5	E200.7	07/15/13 11:34/sld
Lead	0.252	mg/L		0.001		10	E200.8	07/16/13 19:01/dck
Magnesium	24	mg/L		1		5	E200.7	07/15/13 11:34/sld
Manganese	124	mg/L	D	0.02		200	E200.8	07/18/13 05:17/dck
Nickel	0.039	mg/L		0.005		10	E200.8	07/16/13 19:01/dck
Potassium	1	mg/L		1		5	E200.7	07/15/13 11:34/sld
Silver	ND	mg/L		0.001		10	E200.8	07/16/13 19:01/dck
Sodium	6	mg/L		1		5	E200.7	07/15/13 11:34/sld
Thallium	0.0023	mg/L		0.0005		10	E200.8	07/16/13 19:01/dck
Zinc	69.1	mg/L	D	0.07		200	E200.8	07/18/13 05:17/dck
METALS, TOTAL								
Aluminum	18.9	mg/L	D	0.7		200	E200.8	07/18/13 05:21/dck
Arsenic	0.324	mg/L		0.001		1	E200.8	07/16/13 19:05/dck

Report Definitions:	RL - Analyte reporting limit.	MCL - Maximum contaminant level.
	QCL - Quality control limit.	ND - Not detected at the reporting limit.
	D - RL increased due to sample matrix.	

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070211-001
Client Sample ID: 13BH-DT-PILOT-INFL-071113

Report Date: 07/29/13
Collection Date: 07/11/13 16:20
Date Received: 07/12/13
Matrix: AQUEOUS

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
METALS, TOTAL								
Barium	ND	mg/L		0.05		1	E200.8	07/16/13 19:05/dck
Beryllium	0.008	mg/L		0.001		1	E200.8	07/16/13 19:05/dck
Cadmium	0.293	mg/L		0.001		1	E200.8	07/16/13 19:05/dck
Calcium	107	mg/L		1		1	E200.7	07/16/13 12:53/sld
Chromium	0.006	mg/L		0.005		1	E200.8	07/16/13 19:05/dck
Cobalt	0.056	mg/L		0.005		1	E200.8	07/16/13 19:05/dck
Copper	2.04	mg/L		0.005		1	E200.8	07/16/13 19:05/dck
Iron	179	mg/L		0.03		1	E200.7	07/16/13 12:53/sld
Lead	0.255	mg/L		0.001		1	E200.8	07/16/13 19:05/dck
Magnesium	24	mg/L		1		1	E200.7	07/16/13 12:53/sld
Manganese	129	mg/L	D	0.1		200	E200.8	07/18/13 05:21/dck
Nickel	0.039	mg/L		0.005		1	E200.8	07/16/13 19:05/dck
Potassium	ND	mg/L		1		1	E200.7	07/16/13 12:53/sld
Silver	ND	mg/L		0.001		1	E200.8	07/16/13 19:05/dck
Sodium	5	mg/L		1		1	E200.7	07/16/13 12:53/sld
Thallium	0.0025	mg/L		0.0005		1	E200.8	07/16/13 19:05/dck
Zinc	71	mg/L	D	1		200	E200.8	07/18/13 05:21/dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070211-002
Client Sample ID: 13BH-DT-PILOT-INFD-071113

Report Date: 07/29/13
Collection Date: 07/11/13 16:30
Date Received: 07/12/13
Matrix: AQUEOUS

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
PHYSICAL PROPERTIES								
Solids, Total Dissolved TDS @ 180 C	1860	mg/L		10		1	A2540 C	07/12/13 14:13/glj
INORGANICS								
Acidity, Total as CaCO3	740	mg/L	D	4.0		1	A2310 B	07/15/13 10:00/cmm
Alkalinity, Total as CaCO3	ND	mg/L		1		1	A2320 B	07/15/13 14:35/jaw
Bicarbonate as HCO3	ND	mg/L		1		1	A2320 B	07/15/13 14:35/jaw
Carbonate as CO3	ND	mg/L		1		1	A2320 B	07/15/13 14:35/jaw
Hydroxide as OH	ND	mg/L		1		1	A2320 B	07/15/13 14:35/jaw
Chloride	2	mg/L		1		5	E300.0	07/15/13 14:58/jaw
Sulfate	1700	mg/L		1		5	E300.0	07/15/13 14:58/jaw
Fluoride	0.6	mg/L	D	0.2	4	2	A4500-F C	07/16/13 10:05/cmm
NUTRIENTS								
Phosphorus, Orthophosphate as P	ND	mg/L	D	0.1		100	E365.1	07/12/13 14:25/reh
METALS, DISSOLVED								
Aluminum	7.87	mg/L		0.03		100	E200.8	07/18/13 05:26/dck
Arsenic	0.313	mg/L		0.001		10	E200.8	07/16/13 19:22/dck
Barium	ND	mg/L		0.05		10	E200.8	07/16/13 19:22/dck
Beryllium	0.008	mg/L		0.001		10	E200.8	07/16/13 19:22/dck
Cadmium	0.315	mg/L		0.001		10	E200.8	07/16/13 19:22/dck
Calcium	105	mg/L		1		5	E200.7	07/15/13 11:38/sld
Chromium	0.006	mg/L		0.005		10	E200.8	07/16/13 19:22/dck
Cobalt	0.057	mg/L		0.005		10	E200.8	07/16/13 19:22/dck
Copper	2.16	mg/L		0.005		10	E200.8	07/16/13 19:22/dck
Iron	177	mg/L		0.03		5	E200.7	07/15/13 11:38/sld
Lead	0.255	mg/L		0.001		10	E200.8	07/16/13 19:22/dck
Magnesium	23	mg/L		1		5	E200.7	07/15/13 11:38/sld
Manganese	63.7	mg/L	D	0.008		100	E200.8	07/18/13 05:26/dck
Nickel	0.037	mg/L		0.005		10	E200.8	07/16/13 19:22/dck
Potassium	ND	mg/L		1		5	E200.7	07/15/13 11:38/sld
Silver	ND	mg/L		0.001		10	E200.8	07/16/13 19:22/dck
Sodium	4	mg/L		1		5	E200.7	07/15/13 11:38/sld
Thallium	0.0032	mg/L		0.0005		10	E200.8	07/16/13 19:22/dck
Zinc	34.8	mg/L	D	0.03		100	E200.8	07/18/13 05:26/dck
METALS, TOTAL								
Aluminum	17.5	mg/L	D	0.4		100	E200.8	07/18/13 05:31/dck
Arsenic	0.337	mg/L		0.001		1	E200.8	07/16/13 19:27/dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070211-002
Client Sample ID: 13BH-DT-PILOT-INFD-071113

Report Date: 07/29/13
Collection Date: 07/11/13 16:30
Date Received: 07/12/13
Matrix: AQUEOUS

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
METALS, TOTAL								
Barium	ND	mg/L		0.05		1	E200.8	07/16/13 19:27/dck
Beryllium	0.008	mg/L		0.001		1	E200.8	07/16/13 19:27/dck
Cadmium	0.300	mg/L		0.001		1	E200.8	07/16/13 19:27/dck
Calcium	106	mg/L		1		1	E200.7	07/16/13 13:15/sld
Chromium	0.006	mg/L		0.005		1	E200.8	07/16/13 19:27/dck
Cobalt	0.056	mg/L		0.005		1	E200.8	07/16/13 19:27/dck
Copper	1.95	mg/L		0.005		1	E200.8	07/16/13 19:27/dck
Iron	179	mg/L		0.03		1	E200.7	07/16/13 13:15/sld
Lead	0.251	mg/L		0.001		1	E200.8	07/16/13 19:27/dck
Magnesium	23	mg/L		1		1	E200.7	07/16/13 13:15/sld
Manganese	131	mg/L	D	0.05		100	E200.8	07/18/13 05:31/dck
Nickel	0.039	mg/L		0.005		1	E200.8	07/16/13 19:27/dck
Potassium	ND	mg/L		1		1	E200.7	07/16/13 13:15/sld
Silver	ND	mg/L		0.001		1	E200.8	07/16/13 19:27/dck
Sodium	4	mg/L		1		1	E200.7	07/16/13 13:15/sld
Thallium	0.0026	mg/L		0.0005		1	E200.8	07/16/13 19:27/dck
Zinc	71.3	mg/L	D	0.5		100	E200.8	07/18/13 05:31/dck

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070211-003
Client Sample ID: 13BH-DT-PILOT-BCR1-071113

Report Date: 07/29/13
Collection Date: 07/11/13 16:50
Date Received: 07/12/13
Matrix: AQUEOUS

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
PHYSICAL PROPERTIES								
Solids, Total Dissolved TDS @ 180 C	3730	mg/L		10		1	A2540 C	07/12/13 14:13/glj
INORGANICS								
Acidity, Total as CaCO3	ND	mg/L	D	4.0		1	A2310 B	07/15/13 10:00/cmm
Alkalinity, Total as CaCO3	1400	mg/L		1		1	A2320 B	07/15/13 14:45/jaw
Bicarbonate as HCO3	1700	mg/L		1		1	A2320 B	07/15/13 14:45/jaw
Carbonate as CO3	ND	mg/L		1		1	A2320 B	07/15/13 14:45/jaw
Hydroxide as OH	ND	mg/L		1		1	A2320 B	07/15/13 14:45/jaw
Chloride	100	mg/L	D	2		10	E300.0	07/15/13 15:11/jaw
Sulfate	240	mg/L		1		10	E300.0	07/15/13 15:11/jaw
Fluoride	0.3	mg/L		0.1	4	1	A4500-F C	07/16/13 10:06/cmm
Sulfide	4	mg/L		1		1	A4500-S F	07/16/13 14:30/eli-b2
NUTRIENTS								
Phosphorus, Orthophosphate as P	43.8	mg/L	D	0.1		100	E365.1	07/12/13 14:26/reh
METALS, DISSOLVED								
Aluminum	0.13	mg/L		0.03		10	E200.8	07/16/13 21:19/dck
Arsenic	0.015	mg/L		0.001		10	E200.8	07/16/13 21:19/dck
Barium	0.55	mg/L		0.05		10	E200.8	07/16/13 21:19/dck
Beryllium	ND	mg/L		0.001		10	E200.8	07/16/13 21:19/dck
Cadmium	ND	mg/L		0.001		10	E200.8	07/16/13 21:19/dck
Calcium	428	mg/L		1		5	E200.7	07/15/13 11:41/sld
Chromium	ND	mg/L		0.005		10	E200.8	07/16/13 21:19/dck
Cobalt	ND	mg/L		0.005		10	E200.8	07/16/13 21:19/dck
Copper	0.006	mg/L		0.005		10	E200.8	07/16/13 21:19/dck
Iron	5.10	mg/L		0.03		5	E200.7	07/15/13 11:41/sld
Lead	ND	mg/L		0.001		10	E200.8	07/16/13 21:19/dck
Magnesium	162	mg/L		1		5	E200.7	07/15/13 11:41/sld
Manganese	21.7	mg/L	D	0.003		5	E200.7	07/15/13 11:41/sld
Nickel	0.022	mg/L		0.005		10	E200.8	07/16/13 21:19/dck
Potassium	166	mg/L		1		5	E200.7	07/15/13 11:41/sld
Silver	ND	mg/L		0.001		10	E200.8	07/16/13 21:19/dck
Sodium	23	mg/L		1		5	E200.7	07/15/13 11:41/sld
Thallium	ND	mg/L		0.0005		10	E200.8	07/16/13 21:19/dck
Zinc	0.05	mg/L		0.01		10	E200.8	07/16/13 21:19/dck
METALS, TOTAL								
Aluminum	1.07	mg/L		0.03		1	E200.8	07/16/13 19:31/dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070211-003
Client Sample ID: 13BH-DT-PILOT-BCR1-071113

Report Date: 07/29/13
Collection Date: 07/11/13 16:50
Date Received: 07/12/13
Matrix: AQUEOUS

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
METALS, TOTAL								
Arsenic	0.094	mg/L		0.001		1	E200.8	07/16/13 19:31/dck
Barium	0.64	mg/L		0.05		1	E200.8	07/16/13 19:31/dck
Beryllium	ND	mg/L		0.001		1	E200.8	07/16/13 19:31/dck
Cadmium	0.021	mg/L		0.001		1	E200.8	07/16/13 19:31/dck
Calcium	437	mg/L		1		2	E200.7	07/16/13 13:19/sld
Chromium	ND	mg/L		0.005		1	E200.8	07/16/13 19:31/dck
Cobalt	0.014	mg/L		0.005		1	E200.8	07/16/13 19:31/dck
Copper	0.191	mg/L		0.005		1	E200.8	07/16/13 19:31/dck
Iron	8.49	mg/L	D	0.05		2	E200.7	07/16/13 13:19/sld
Lead	0.060	mg/L		0.001		1	E200.8	07/16/13 19:31/dck
Magnesium	163	mg/L		1		2	E200.7	07/16/13 13:19/sld
Manganese	21.9	mg/L	D	0.006		2	E200.7	07/16/13 13:19/sld
Nickel	0.024	mg/L		0.005		1	E200.8	07/16/13 19:31/dck
Potassium	169	mg/L		1		2	E200.7	07/16/13 13:19/sld
Silver	ND	mg/L		0.001		1	E200.8	07/16/13 19:31/dck
Sodium	22	mg/L		1		2	E200.7	07/16/13 13:19/sld
Thallium	ND	mg/L		0.0005		1	E200.8	07/16/13 19:31/dck
Zinc	3.69	mg/L		0.01		2	E200.7	07/16/13 13:19/sld

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070211-004
Client Sample ID: 13BH-DT-PILOT-BCR2-071113

Report Date: 07/29/13
Collection Date: 07/11/13 17:05
Date Received: 07/12/13
Matrix: AQUEOUS

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
PHYSICAL PROPERTIES								
Solids, Total Dissolved TDS @ 180 C	5180	mg/L		10		1	A2540 C	07/12/13 14:13/glj
INORGANICS								
Acidity, Total as CaCO3	ND	mg/L	D	4.0		1	A2310 B	07/15/13 10:00/cmm
Alkalinity, Total as CaCO3	1700	mg/L		1		1	A2320 B	07/15/13 14:58/jaw
Bicarbonate as HCO3	2000	mg/L		1		1	A2320 B	07/15/13 14:58/jaw
Carbonate as CO3	ND	mg/L		1		1	A2320 B	07/15/13 14:58/jaw
Hydroxide as OH	ND	mg/L		1		1	A2320 B	07/15/13 14:58/jaw
Chloride	210	mg/L	D	5		20	E300.0	07/15/13 15:23/jaw
Sulfate	480	mg/L	D	2		20	E300.0	07/15/13 15:23/jaw
Fluoride	0.2	mg/L		0.1	4	1	A4500-F C	07/16/13 10:06/cmm
Sulfide	11	mg/L		1		1	A4500-S F	07/16/13 14:30/eli-b2
NUTRIENTS								
Phosphorus, Orthophosphate as P	57.8	mg/L	D	0.5		500	E365.1	07/12/13 16:51/reh
METALS, DISSOLVED								
Aluminum	0.14	mg/L		0.03		10	E200.8	07/16/13 19:36/dck
Arsenic	0.020	mg/L		0.001		10	E200.8	07/16/13 19:36/dck
Barium	0.57	mg/L		0.05		10	E200.8	07/16/13 19:36/dck
Beryllium	ND	mg/L		0.001		10	E200.8	07/16/13 19:36/dck
Cadmium	ND	mg/L		0.001		10	E200.8	07/16/13 19:36/dck
Calcium	453	mg/L		1		5	E200.7	07/15/13 11:45/sld
Chromium	ND	mg/L		0.005		10	E200.8	07/16/13 19:36/dck
Cobalt	0.011	mg/L		0.005		10	E200.8	07/16/13 19:36/dck
Copper	0.005	mg/L		0.005		10	E200.8	07/16/13 19:36/dck
Iron	5.08	mg/L		0.03		5	E200.7	07/15/13 11:45/sld
Lead	ND	mg/L		0.001		10	E200.8	07/16/13 19:36/dck
Magnesium	246	mg/L		1		5	E200.7	07/15/13 11:45/sld
Manganese	7.26	mg/L	D	0.003		5	E200.7	07/15/13 11:45/sld
Nickel	0.035	mg/L		0.005		10	E200.8	07/16/13 19:36/dck
Potassium	421	mg/L		1		5	E200.7	07/15/13 11:45/sld
Silver	ND	mg/L		0.001		10	E200.8	07/16/13 19:36/dck
Sodium	37	mg/L		1		5	E200.7	07/15/13 11:45/sld
Thallium	ND	mg/L		0.0005		10	E200.8	07/16/13 19:36/dck
Zinc	0.04	mg/L		0.01		10	E200.8	07/16/13 19:36/dck
METALS, TOTAL								
Aluminum	1.05	mg/L		0.03		1	E200.8	07/16/13 19:40/dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070211-004
Client Sample ID: 13BH-DT-PILOT-BCR2-071113

Report Date: 07/29/13
Collection Date: 07/11/13 17:05
Date Received: 07/12/13
Matrix: AQUEOUS

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
METALS, TOTAL								
Arsenic	0.064	mg/L		0.001		1	E200.8	07/16/13 19:40/dck
Barium	0.71	mg/L		0.05		1	E200.8	07/16/13 19:40/dck
Beryllium	ND	mg/L		0.001		1	E200.8	07/16/13 19:40/dck
Cadmium	0.009	mg/L		0.001		1	E200.8	07/16/13 19:40/dck
Calcium	461	mg/L		1		2	E200.7	07/16/13 13:22/sld
Chromium	0.005	mg/L		0.005		1	E200.8	07/16/13 19:40/dck
Cobalt	0.016	mg/L		0.005		1	E200.8	07/16/13 19:40/dck
Copper	0.186	mg/L		0.005		1	E200.8	07/16/13 19:40/dck
Iron	6.54	mg/L	D	0.05		2	E200.7	07/16/13 13:22/sld
Lead	0.072	mg/L		0.001		1	E200.8	07/16/13 19:40/dck
Magnesium	243	mg/L		1		2	E200.7	07/16/13 13:22/sld
Manganese	7.59	mg/L	D	0.006		2	E200.7	07/16/13 13:22/sld
Nickel	0.039	mg/L		0.005		1	E200.8	07/16/13 19:40/dck
Potassium	424	mg/L		1		2	E200.7	07/16/13 13:22/sld
Silver	ND	mg/L		0.001		1	E200.8	07/16/13 19:40/dck
Sodium	35	mg/L		1		2	E200.7	07/16/13 13:22/sld
Thallium	ND	mg/L		0.0005		1	E200.8	07/16/13 19:40/dck
Zinc	1.58	mg/L		0.01		2	E200.7	07/16/13 13:22/sld

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070211-005
Client Sample ID: 13BH-DT-PILOT-BCR3-071113

Report Date: 07/29/13
Collection Date: 07/11/13 17:20
Date Received: 07/12/13
Matrix: AQUEOUS

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
PHYSICAL PROPERTIES								
Solids, Total Dissolved TDS @ 180 C	7300	mg/L		10		1	A2540 C	07/12/13 14:13/glj
INORGANICS								
Acidity, Total as CaCO3	ND	mg/L	D	4.0		1	A2310 B	07/15/13 10:00/cmm
Alkalinity, Total as CaCO3	2600	mg/L		1		1	A2320 B	07/15/13 15:14/jaw
Bicarbonate as HCO3	3100	mg/L		1		1	A2320 B	07/15/13 15:14/jaw
Carbonate as CO3	ND	mg/L		1		1	A2320 B	07/15/13 15:14/jaw
Hydroxide as OH	ND	mg/L		1		1	A2320 B	07/15/13 15:14/jaw
Chloride	450	mg/L	D	10		50	E300.0	07/16/13 15:53/cmm
Sulfate	750	mg/L	D	5		50	E300.0	07/16/13 15:53/cmm
Fluoride	0.1	mg/L		0.1	4	1	A4500-F C	07/16/13 10:07/cmm
Sulfide	11	mg/L		1		1	A4500-S F	07/16/13 14:30/eli-b2
NUTRIENTS								
Phosphorus, Orthophosphate as P	72.3	mg/L	D	0.5		500	E365.1	07/12/13 16:52/reh
METALS, DISSOLVED								
Aluminum	0.17	mg/L		0.03		10	E200.8	07/16/13 19:44/dck
Arsenic	0.075	mg/L		0.001		10	E200.8	07/16/13 19:44/dck
Barium	0.79	mg/L		0.05		10	E200.8	07/16/13 19:44/dck
Beryllium	ND	mg/L		0.001		10	E200.8	07/16/13 19:44/dck
Cadmium	ND	mg/L		0.001		10	E200.8	07/16/13 19:44/dck
Calcium	593	mg/L		1		5	E200.7	07/15/13 11:49/sld
Chromium	ND	mg/L		0.005		10	E200.8	07/16/13 19:44/dck
Cobalt	0.024	mg/L		0.005		10	E200.8	07/16/13 19:44/dck
Copper	0.008	mg/L		0.005		10	E200.8	07/16/13 19:44/dck
Iron	8.71	mg/L		0.03		5	E200.7	07/15/13 11:49/sld
Lead	0.001	mg/L		0.001		10	E200.8	07/16/13 19:44/dck
Magnesium	288	mg/L		1		5	E200.7	07/15/13 11:49/sld
Manganese	6.36	mg/L	D	0.003		5	E200.7	07/15/13 11:49/sld
Nickel	0.066	mg/L		0.005		10	E200.8	07/16/13 19:44/dck
Potassium	379	mg/L		1		5	E200.7	07/15/13 11:49/sld
Silver	ND	mg/L		0.001		10	E200.8	07/16/13 19:44/dck
Sodium	350	mg/L		1		5	E200.7	07/15/13 11:49/sld
Thallium	ND	mg/L		0.0005		10	E200.8	07/16/13 19:44/dck
Zinc	0.04	mg/L		0.01		10	E200.8	07/16/13 19:44/dck
METALS, TOTAL								
Aluminum	0.79	mg/L		0.03		1	E200.8	07/16/13 20:07/dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070211-005
Client Sample ID: 13BH-DT-PILOT-BCR3-071113

Report Date: 07/29/13
Collection Date: 07/11/13 17:20
Date Received: 07/12/13
Matrix: AQUEOUS

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
METALS, TOTAL								
Arsenic	0.107	mg/L		0.001		1	E200.8	07/16/13 20:07/dck
Barium	0.85	mg/L		0.05		1	E200.8	07/16/13 20:07/dck
Beryllium	ND	mg/L		0.001		1	E200.8	07/16/13 20:07/dck
Cadmium	0.007	mg/L		0.001		1	E200.8	07/16/13 20:07/dck
Calcium	605	mg/L		1		2	E200.7	07/16/13 13:26/sld
Chromium	ND	mg/L		0.005		1	E200.8	07/16/13 20:07/dck
Cobalt	0.023	mg/L		0.005		1	E200.8	07/16/13 20:07/dck
Copper	0.169	mg/L		0.005		1	E200.8	07/16/13 20:07/dck
Iron	9.66	mg/L	D	0.05		2	E200.7	07/16/13 13:26/sld
Lead	0.074	mg/L		0.001		1	E200.8	07/16/13 20:07/dck
Magnesium	288	mg/L		1		2	E200.7	07/16/13 13:26/sld
Manganese	6.51	mg/L	D	0.006		2	E200.7	07/16/13 13:26/sld
Nickel	0.068	mg/L		0.005		1	E200.8	07/16/13 20:07/dck
Potassium	379	mg/L		1		2	E200.7	07/16/13 13:26/sld
Silver	ND	mg/L		0.001		1	E200.8	07/16/13 20:07/dck
Sodium	346	mg/L		1		2	E200.7	07/16/13 13:26/sld
Thallium	ND	mg/L		0.0005		1	E200.8	07/16/13 20:07/dck
Zinc	0.62	mg/L		0.01		1	E200.8	07/16/13 20:07/dck

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070211-006
Client Sample ID: 13BH-DT-PILOT-BCR4-071113

Report Date: 07/29/13
Collection Date: 07/11/13 17:35
Date Received: 07/12/13
Matrix: AQUEOUS

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
PHYSICAL PROPERTIES								
Solids, Total Dissolved TDS @ 180 C	4590	mg/L		10		1	A2540 C	07/12/13 14:13/glj
INORGANICS								
Acidity, Total as CaCO3	ND	mg/L	D	4.0		1	A2310 B	07/15/13 10:00/cmm
Alkalinity, Total as CaCO3	1500	mg/L		1		1	A2320 B	07/15/13 15:26/jaw
Bicarbonate as HCO3	1900	mg/L		1		1	A2320 B	07/15/13 15:26/jaw
Carbonate as CO3	ND	mg/L		1		1	A2320 B	07/15/13 15:26/jaw
Hydroxide as OH	ND	mg/L		1		1	A2320 B	07/15/13 15:26/jaw
Chloride	140	mg/L	D	5		20	E300.0	07/15/13 15:49/jaw
Sulfate	280	mg/L	D	2		20	E300.0	07/15/13 15:49/jaw
Fluoride	0.2	mg/L		0.1	4	1	A4500-F C	07/16/13 10:08/cmm
Sulfide	4	mg/L		1		1	A4500-S F	07/16/13 14:30/eli-b2
NUTRIENTS								
Phosphorus, Orthophosphate as P	46.8	mg/L	D	0.5		500	E365.1	07/12/13 16:53/reh
METALS, DISSOLVED								
Aluminum	0.13	mg/L		0.03		10	E200.8	07/16/13 20:11/dck
Arsenic	0.020	mg/L		0.001		10	E200.8	07/16/13 20:11/dck
Barium	0.55	mg/L		0.05		10	E200.8	07/16/13 20:11/dck
Beryllium	ND	mg/L		0.001		10	E200.8	07/16/13 20:11/dck
Cadmium	ND	mg/L		0.001		10	E200.8	07/16/13 20:11/dck
Calcium	409	mg/L		1		5	E200.7	07/15/13 11:52/sld
Chromium	ND	mg/L		0.005		10	E200.8	07/16/13 20:11/dck
Cobalt	0.006	mg/L		0.005		10	E200.8	07/16/13 20:11/dck
Copper	ND	mg/L		0.005		10	E200.8	07/16/13 20:11/dck
Iron	3.42	mg/L		0.03		5	E200.7	07/15/13 11:52/sld
Lead	ND	mg/L		0.001		10	E200.8	07/16/13 20:11/dck
Magnesium	241	mg/L		1		5	E200.7	07/15/13 11:52/sld
Manganese	11.0	mg/L	D	0.003		5	E200.7	07/15/13 11:52/sld
Nickel	0.029	mg/L		0.005		10	E200.8	07/16/13 20:11/dck
Potassium	227	mg/L		1		5	E200.7	07/15/13 11:52/sld
Silver	ND	mg/L		0.001		10	E200.8	07/16/13 20:11/dck
Sodium	31	mg/L		1		5	E200.7	07/15/13 11:52/sld
Thallium	ND	mg/L		0.0005		10	E200.8	07/16/13 20:11/dck
Zinc	0.04	mg/L		0.01		10	E200.8	07/16/13 20:11/dck
METALS, TOTAL								
Aluminum	1.07	mg/L		0.03		1	E200.8	07/16/13 20:16/dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070211-006
Client Sample ID: 13BH-DT-PILOT-BCR4-071113

Report Date: 07/29/13
Collection Date: 07/11/13 17:35
Date Received: 07/12/13
Matrix: AQUEOUS

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
METALS, TOTAL								
Arsenic	0.118	mg/L		0.001		1	E200.8	07/16/13 20:16/dck
Barium	0.65	mg/L		0.05		1	E200.8	07/16/13 20:16/dck
Beryllium	ND	mg/L		0.001		1	E200.8	07/16/13 20:16/dck
Cadmium	0.027	mg/L		0.001		1	E200.8	07/16/13 20:16/dck
Calcium	425	mg/L		1		2	E200.7	07/16/13 13:30/sld
Chromium	ND	mg/L		0.005		1	E200.8	07/16/13 20:16/dck
Cobalt	0.013	mg/L		0.005		1	E200.8	07/16/13 20:16/dck
Copper	0.172	mg/L		0.005		1	E200.8	07/16/13 20:16/dck
Iron	6.09	mg/L		0.03		1	E200.8	07/16/13 20:16/dck
Lead	0.084	mg/L		0.001		1	E200.8	07/16/13 20:16/dck
Magnesium	243	mg/L		1		2	E200.7	07/16/13 13:30/sld
Manganese	11.6	mg/L	D	0.006		2	E200.7	07/16/13 13:30/sld
Nickel	0.032	mg/L		0.005		1	E200.8	07/16/13 20:16/dck
Potassium	231	mg/L		1		2	E200.7	07/16/13 13:30/sld
Silver	ND	mg/L		0.001		1	E200.8	07/16/13 20:16/dck
Sodium	29	mg/L		1		2	E200.7	07/16/13 13:30/sld
Thallium	ND	mg/L		0.0005		1	E200.8	07/16/13 20:16/dck
Zinc	3.27	mg/L		0.01		2	E200.7	07/16/13 13:30/sld

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070211-007
Client Sample ID: 13BH-DT-PILOT-SAPS-071113

Report Date: 07/29/13
Collection Date: 07/11/13 17:55
Date Received: 07/12/13
Matrix: AQUEOUS

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
PHYSICAL PROPERTIES								
Solids, Total Dissolved TDS @ 180 C	2140	mg/L		10		1	A2540 C	07/12/13 14:13/glj
INORGANICS								
Acidity, Total as CaCO3	ND	mg/L	D	4.0		1	A2310 B	07/15/13 10:00/cmm
Alkalinity, Total as CaCO3	750	mg/L		1		1	A2320 B	07/15/13 15:34/jaw
Bicarbonate as HCO3	910	mg/L		1		1	A2320 B	07/15/13 15:34/jaw
Carbonate as CO3	ND	mg/L		1		1	A2320 B	07/15/13 15:34/jaw
Hydroxide as OH	ND	mg/L		1		1	A2320 B	07/15/13 15:34/jaw
Chloride	27	mg/L		1		5	E300.0	07/15/13 16:01/jaw
Sulfate	600	mg/L		1		5	E300.0	07/15/13 16:01/jaw
Fluoride	0.8	mg/L		0.1	4	1	A4500-F C	07/16/13 10:10/cmm
NUTRIENTS								
Phosphorus, Orthophosphate as P	10.4	mg/L	D	0.1		100	E365.1	07/12/13 14:30/reh
METALS, DISSOLVED								
Aluminum	0.04	mg/L		0.03		10	E200.8	07/16/13 20:20/dck
Arsenic	0.006	mg/L		0.001		10	E200.8	07/16/13 20:20/dck
Barium	0.30	mg/L		0.05		10	E200.8	07/16/13 20:20/dck
Beryllium	ND	mg/L		0.001		10	E200.8	07/16/13 20:20/dck
Cadmium	ND	mg/L		0.001		10	E200.8	07/16/13 20:20/dck
Calcium	371	mg/L		1		5	E200.7	07/15/13 11:56/sld
Chromium	ND	mg/L		0.005		10	E200.8	07/16/13 20:20/dck
Cobalt	ND	mg/L		0.005		10	E200.8	07/16/13 20:20/dck
Copper	ND	mg/L		0.005		10	E200.8	07/16/13 20:20/dck
Iron	2.63	mg/L		0.03		5	E200.7	07/15/13 11:56/sld
Lead	ND	mg/L		0.001		10	E200.8	07/16/13 20:20/dck
Magnesium	81	mg/L		1		5	E200.7	07/15/13 11:56/sld
Manganese	42.4	mg/L	D	0.003		5	E200.7	07/15/13 11:56/sld
Nickel	0.005	mg/L		0.005		10	E200.8	07/16/13 20:20/dck
Potassium	38	mg/L		1		5	E200.7	07/15/13 11:56/sld
Silver	ND	mg/L		0.001		10	E200.8	07/16/13 20:20/dck
Sodium	13	mg/L		1		5	E200.7	07/15/13 11:56/sld
Thallium	ND	mg/L		0.0005		10	E200.8	07/16/13 20:20/dck
Zinc	0.07	mg/L		0.01		10	E200.8	07/16/13 20:20/dck
METALS, TOTAL								
Aluminum	0.22	mg/L		0.03		1	E200.8	07/16/13 20:25/dck
Arsenic	0.056	mg/L		0.001		1	E200.8	07/16/13 20:25/dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070211-007
Client Sample ID: 13BH-DT-PILOT-SAPS-071113

Report Date: 07/29/13
Collection Date: 07/11/13 17:55
Date Received: 07/12/13
Matrix: AQUEOUS

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
METALS, TOTAL								
Barium	0.32	mg/L		0.05		1	E200.8	07/16/13 20:25/dck
Beryllium	ND	mg/L		0.001		1	E200.8	07/16/13 20:25/dck
Cadmium	0.019	mg/L		0.001		1	E200.8	07/16/13 20:25/dck
Calcium	375	mg/L		1		1	E200.7	07/16/13 13:33/sld
Chromium	ND	mg/L		0.005		1	E200.8	07/16/13 20:25/dck
Cobalt	0.008	mg/L		0.005		1	E200.8	07/16/13 20:25/dck
Copper	0.088	mg/L		0.005		1	E200.8	07/16/13 20:25/dck
Iron	4.86	mg/L		0.03		1	E200.7	07/16/13 13:33/sld
Lead	0.014	mg/L		0.001		1	E200.8	07/16/13 20:25/dck
Magnesium	81	mg/L		1		1	E200.7	07/16/13 13:33/sld
Manganese	42.6	mg/L	D	0.003		1	E200.7	07/16/13 13:33/sld
Nickel	0.010	mg/L		0.005		1	E200.8	07/16/13 20:25/dck
Potassium	38	mg/L		1		1	E200.7	07/16/13 13:33/sld
Silver	ND	mg/L		0.001		1	E200.8	07/16/13 20:25/dck
Sodium	11	mg/L		1		1	E200.7	07/16/13 13:33/sld
Thallium	ND	mg/L		0.0005		1	E200.8	07/16/13 20:25/dck
Zinc	6.05	mg/L		0.01		1	E200.7	07/16/13 13:33/sld

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070211-008
Client Sample ID: 13BH-DT-PILOT-CHIT-071113

Report Date: 07/29/13
Collection Date: 07/11/13 18:10
Date Received: 07/12/13
Matrix: AQUEOUS

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
PHYSICAL PROPERTIES								
Solids, Total Dissolved TDS @ 180 C	51300	mg/L		10		1	A2540 C	07/12/13 14:14/glj
INORGANICS								
Acidity, Total as CaCO3	ND	mg/L	D	4.0		1	A2310 B	07/15/13 10:00/cmm
Alkalinity, Total as CaCO3	23000	mg/L		1		1	A2320 B	07/17/13 14:45/cmm
Bicarbonate as HCO3	28000	mg/L		1		1	A2320 B	07/17/13 14:45/cmm
Carbonate as CO3	ND	mg/L		1		1	A2320 B	07/17/13 14:45/cmm
Hydroxide as OH	ND	mg/L		1		1	A2320 B	07/17/13 14:45/cmm
Chloride	12000	mg/L	D	50		200	E300.0	07/16/13 16:05/cmm
Sulfate	2300	mg/L	D	20		200	E300.0	07/16/13 16:05/cmm
Fluoride	ND	mg/L		0.1	4	1	A4500-F C	07/16/13 10:11/cmm
Sulfide	29	mg/L		1		1	A4500-S F	07/16/13 14:30/eli-b2
NUTRIENTS								
Phosphorus, Orthophosphate as P	47.7	mg/L	D	0.5		500	E365.1	07/12/13 16:54/reh
METALS, DISSOLVED								
Aluminum	0.30	mg/L		0.03		10	E200.8	07/16/13 20:29/dck
Arsenic	4.18	mg/L		0.001		10	E200.8	07/16/13 20:29/dck
Barium	0.28	mg/L		0.05		10	E200.8	07/16/13 20:29/dck
Beryllium	ND	mg/L		0.001		10	E200.8	07/16/13 20:29/dck
Cadmium	0.044	mg/L		0.001		10	E200.8	07/16/13 20:29/dck
Calcium	3010	mg/L		1		25	E200.7	07/15/13 12:00/sld
Chromium	0.023	mg/L		0.005		10	E200.8	07/16/13 20:29/dck
Cobalt	0.183	mg/L		0.005		10	E200.8	07/16/13 20:29/dck
Copper	0.430	mg/L		0.005		10	E200.8	07/16/13 20:29/dck
Iron	26.5	mg/L	D	0.1		25	E200.7	07/15/13 12:00/sld
Lead	0.007	mg/L		0.001		10	E200.8	07/16/13 20:29/dck
Magnesium	1270	mg/L		1		25	E200.7	07/15/13 12:00/sld
Manganese	3.11	mg/L		0.001		10	E200.8	07/16/13 20:29/dck
Nickel	1.06	mg/L		0.005		10	E200.8	07/16/13 20:29/dck
Potassium	1490	mg/L		1		25	E200.7	07/15/13 12:00/sld
Silver	ND	mg/L	D	0.002		50	E200.8	07/18/13 05:35/dck
Sodium	6850	mg/L		1		25	E200.7	07/15/13 12:00/sld
Thallium	ND	mg/L		0.0005		10	E200.8	07/16/13 20:29/dck
Zinc	1.04	mg/L		0.01		10	E200.8	07/16/13 20:29/dck
METALS, TOTAL								
Aluminum	0.71	mg/L		0.03		1	E200.8	07/16/13 20:47/dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070211-008
Client Sample ID: 13BH-DT-PILOT-CHIT-071113

Report Date: 07/29/13
Collection Date: 07/11/13 18:10
Date Received: 07/12/13
Matrix: AQUEOUS

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
METALS, TOTAL								
Arsenic	4.28	mg/L		0.001		1	E200.8	07/16/13 20:47/dck
Barium	0.30	mg/L		0.05		1	E200.8	07/16/13 20:47/dck
Beryllium	ND	mg/L		0.001		1	E200.8	07/16/13 20:47/dck
Cadmium	0.051	mg/L		0.001		1	E200.8	07/16/13 20:47/dck
Calcium	2880	mg/L		1		5	E200.7	07/16/13 13:37/sld
Chromium	0.025	mg/L		0.005		1	E200.8	07/16/13 20:47/dck
Cobalt	0.190	mg/L		0.005		1	E200.8	07/16/13 20:47/dck
Copper	0.550	mg/L		0.005		1	E200.8	07/16/13 20:47/dck
Iron	26.2	mg/L	D	0.1		5	E200.7	07/16/13 13:37/sld
Lead	0.011	mg/L		0.001		5	E200.8	07/19/13 01:14/dck
Magnesium	1210	mg/L		1		5	E200.7	07/16/13 13:37/sld
Manganese	3.29	mg/L		0.001		1	E200.8	07/16/13 20:47/dck
Nickel	1.11	mg/L		0.005		1	E200.8	07/16/13 20:47/dck
Potassium	1430	mg/L		1		5	E200.7	07/16/13 13:37/sld
Silver	ND	mg/L		0.001		1	E200.8	07/16/13 20:47/dck
Sodium	6520	mg/L		1		5	E200.7	07/16/13 13:37/sld
Thallium	ND	mg/L		0.0005		2	E200.8	07/18/13 05:53/dck
Zinc	1.46	mg/L	D	0.03		5	E200.7	07/16/13 13:37/sld

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070211-009
Client Sample ID: 13BH-DT-PILOT-MGOH-071113

Report Date: 07/29/13
Collection Date: 07/11/13 18:30
Date Received: 07/12/13
Matrix: AQUEOUS

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
PHYSICAL PROPERTIES								
Solids, Total Dissolved TDS @ 180 C	1800	mg/L		10		1	A2540 C	07/12/13 14:14/glj
INORGANICS								
Acidity, Total as CaCO3	330	mg/L	D	4.0		1	A2310 B	07/15/13 10:00/cmm
Alkalinity, Total as CaCO3	ND	mg/L		1		1	A2320 B	07/15/13 15:56/jaw
Bicarbonate as HCO3	ND	mg/L		1		1	A2320 B	07/15/13 15:56/jaw
Carbonate as CO3	ND	mg/L		1		1	A2320 B	07/15/13 15:56/jaw
Hydroxide as OH	ND	mg/L		1		1	A2320 B	07/15/13 15:56/jaw
Chloride	4	mg/L		1		5	E300.0	07/15/13 16:39/jaw
Sulfate	1200	mg/L		1		5	E300.0	07/15/13 16:39/jaw
Fluoride	ND	mg/L	D	0.5	4	5	A4500-F C	07/16/13 10:14/cmm
NUTRIENTS								
Phosphorus, Orthophosphate as P	ND	mg/L	D	0.1		100	E365.1	07/12/13 14:32/reh
METALS, DISSOLVED								
Aluminum	0.87	mg/L		0.03		10	E200.8	07/16/13 20:52/dck
Arsenic	0.007	mg/L		0.001		10	E200.8	07/16/13 20:52/dck
Barium	ND	mg/L		0.05		10	E200.8	07/16/13 20:52/dck
Beryllium	0.001	mg/L		0.001		10	E200.8	07/16/13 20:52/dck
Cadmium	0.249	mg/L		0.001		10	E200.8	07/16/13 20:52/dck
Calcium	102	mg/L		1		5	E200.7	07/15/13 12:04/sld
Chromium	ND	mg/L		0.005		10	E200.8	07/16/13 20:52/dck
Cobalt	0.044	mg/L		0.005		10	E200.8	07/16/13 20:52/dck
Copper	0.361	mg/L		0.005		10	E200.8	07/16/13 20:52/dck
Iron	41.0	mg/L		0.03		5	E200.7	07/15/13 12:04/sld
Lead	ND	mg/L		0.001		10	E200.8	07/16/13 20:52/dck
Magnesium	146	mg/L		1		5	E200.7	07/15/13 12:04/sld
Manganese	100	mg/L	D	0.003		5	E200.7	07/15/13 12:04/sld
Nickel	0.030	mg/L		0.005		10	E200.8	07/16/13 20:52/dck
Potassium	1	mg/L		1		5	E200.7	07/15/13 12:04/sld
Silver	ND	mg/L		0.001		10	E200.8	07/16/13 20:52/dck
Sodium	9	mg/L		1		5	E200.7	07/15/13 12:04/sld
Thallium	0.0021	mg/L		0.0005		10	E200.8	07/16/13 20:52/dck
Zinc	47.5	mg/L		0.01		5	E200.7	07/15/13 12:04/sld
METALS, TOTAL								
Aluminum	1.56	mg/L		0.03		1	E200.8	07/16/13 21:14/dck
Arsenic	0.034	mg/L		0.001		1	E200.8	07/16/13 21:14/dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070211-009
Client Sample ID: 13BH-DT-PILOT-MGOH-071113

Report Date: 07/29/13
Collection Date: 07/11/13 18:30
Date Received: 07/12/13
Matrix: AQUEOUS

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
METALS, TOTAL								
Barium	ND	mg/L		0.05		1	E200.8	07/16/13 21:14/dck
Beryllium	0.002	mg/L		0.001		1	E200.8	07/16/13 21:14/dck
Cadmium	0.248	mg/L		0.001		1	E200.8	07/16/13 21:14/dck
Calcium	103	mg/L		1		1	E200.7	07/16/13 13:41/sld
Chromium	ND	mg/L		0.005		1	E200.8	07/16/13 21:14/dck
Cobalt	0.044	mg/L		0.005		1	E200.8	07/16/13 21:14/dck
Copper	0.463	mg/L		0.005		1	E200.8	07/16/13 21:14/dck
Iron	54.8	mg/L		0.03		1	E200.7	07/16/13 13:41/sld
Lead	0.020	mg/L		0.001		1	E200.8	07/16/13 21:14/dck
Magnesium	148	mg/L		1		1	E200.7	07/16/13 13:41/sld
Manganese	101	mg/L	D	0.003		1	E200.7	07/16/13 13:41/sld
Nickel	0.031	mg/L		0.005		1	E200.8	07/16/13 21:14/dck
Potassium	ND	mg/L		1		1	E200.7	07/16/13 13:41/sld
Silver	ND	mg/L		0.001		1	E200.8	07/16/13 21:14/dck
Sodium	8	mg/L		1		1	E200.7	07/16/13 13:41/sld
Thallium	0.0022	mg/L		0.0005		1	E200.8	07/16/13 21:14/dck
Zinc	47.6	mg/L		0.01		1	E200.7	07/16/13 13:41/sld

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 07/29/13

Project: Barker Hughsville Pilot **Work Order:** H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2310 B									Batch: H13070211-001A
Sample ID: H13070211-009ADUP	Sample Duplicate				Run: MISC WC_130715A				07/15/13 10:00
Acidity, Total as CaCO3	350	mg/L	4.0				7.1	20	
Sample ID: LCS1307010000	Laboratory Control Sample				Run: MISC WC_130715A				07/15/13 10:00
Acidity, Total as CaCO3	670	mg/L	4.0	104	90	110			
Sample ID: MBLK1307010000	Method Blank				Run: MISC WC_130715A				07/15/13 10:00
Acidity, Total as CaCO3	ND	mg/L	3						
Method: A2310 B									Batch: H13070211-001A
Sample ID: H13070211-002A DUP	Sample Duplicate				Run: MISC WC_130722A				07/22/13 08:30
Acidity, Total as CaCO3	720	mg/L	4.0				2.8	20	
Sample ID: LCS1307220000	Laboratory Control Sample				Run: MISC WC_130722A				07/22/13 08:30
Acidity, Total as CaCO3	700	mg/L	4.0	107	90	110			
Sample ID: MBLK1307220000	Method Blank				Run: MISC WC_130722A				07/22/13 08:30
Acidity, Total as CaCO3	4	mg/L	3						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 07/29/13
Work Order: H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2320 B									Batch: R89739
Sample ID: MBLK	Method Blank				Run: MAN-TECH_130715B				07/15/13 13:58
Alkalinity, Total as CaCO3	ND	mg/L	2						
Sample ID: LCS-06192013	Laboratory Control Sample				Run: MAN-TECH_130715B				07/15/13 14:06
Alkalinity, Total as CaCO3	620	mg/L	4.0	103	90	110			
Sample ID: H13070209-001ADUP	Sample Duplicate				Run: MAN-TECH_130715B				07/15/13 14:21
Alkalinity, Total as CaCO3	340	mg/L	4.0				0.4	10	
Bicarbonate as HCO3	410	mg/L	4.0				0.5	10	
Carbonate as CO3	ND	mg/L	4.0					10	
Sample ID: H13070222-001ADUP	Sample Duplicate				Run: MAN-TECH_130715B				07/15/13 16:12
Alkalinity, Total as CaCO3	250	mg/L	4.0				0.5	10	
Bicarbonate as HCO3	310	mg/L	4.0				0.5	10	
Carbonate as CO3	ND	mg/L	4.0					10	
Sample ID: H13070222-002AMS	Sample Matrix Spike				Run: MAN-TECH_130715B				07/15/13 16:28
Alkalinity, Total as CaCO3	900	mg/L	4.0	110	80	120			
Method: A2320 B									Batch: 130717A-ALK-W
Sample ID: MBLK1_130717A	Method Blank				Run: PH_130717A				07/17/13 13:10
Alkalinity, Total as CaCO3	2	mg/L	0.9						
Sample ID: MBLK1_130717AMS	Sample Matrix Spike				Run: PH_130717A				07/17/13 13:11
Alkalinity, Total as CaCO3	500	mg/L	4.0	83	80	120			
Sample ID: LCS1_130717A	Laboratory Control Sample				Run: PH_130717A				07/17/13 13:39
Alkalinity, Total as CaCO3	560	mg/L	4.0	94	90	110			
Sample ID: H13070211-008ADUP	Sample Duplicate				Run: PH_130717A				07/17/13 14:45
Alkalinity, Total as CaCO3	22000	mg/L	4.0				3.2	10	
Bicarbonate as HCO3	27000	mg/L	4.0				3.2	10	
Carbonate as CO3	ND	mg/L	4.0					10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 07/29/13
Work Order: H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2540 C								Batch: TDS130712A	
Sample ID: MB-1_130712A	Method Blank				Run: ACCU-124 (14410200)_130712			07/12/13 14:11	
Solids, Total Dissolved TDS @ 180 C	ND	mg/L	1						
Sample ID: LCS-2_130712A	Laboratory Control Sample				Run: ACCU-124 (14410200)_130712			07/12/13 14:12	
Solids, Total Dissolved TDS @ 180 C	1990	mg/L	10	100	90	110			
Sample ID: H13070209-001A DUP	Sample Duplicate				Run: ACCU-124 (14410200)_130712			07/12/13 14:12	
Solids, Total Dissolved TDS @ 180 C	5110	mg/L	10				3.8	5	
Sample ID: H13070209-002A MS	Sample Matrix Spike				Run: ACCU-124 (14410200)_130712			07/12/13 14:12	
Solids, Total Dissolved TDS @ 180 C	8500	mg/L	10	96	80	120			
Sample ID: H13070211-009A DUP	Sample Duplicate				Run: ACCU-124 (14410200)_130712			07/12/13 14:14	
Solids, Total Dissolved TDS @ 180 C	1780	mg/L	10				0.7	5	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 07/29/13

Project: Barker Hughsville Pilot **Work Order:** H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-F C									Analytical Run: PH_130716A
Sample ID: ICV1_130716A	Initial Calibration Verification Standard								07/16/13 09:50
Fluoride	0.7	mg/L	0.1	99	90	110			
Sample ID: CCV2_130716A	Continuing Calibration Verification Standard								07/16/13 10:08
Fluoride	0.3	mg/L	0.1	101	90	110			
Method: A4500-F C									Batch: 130716A-F-ISE-W
Sample ID: MBLK1_130716A	Method Blank				Run: PH_130716A				07/16/13 09:49
Fluoride	0.010	mg/L	0.005						
Sample ID: LFB1_130716A	Laboratory Fortified Blank				Run: PH_130716A				07/16/13 09:51
Fluoride	0.5	mg/L	0.1	100	90	110			
Sample ID: H13070185-001AMS	Sample Matrix Spike				Run: PH_130716A				07/16/13 09:53
Fluoride	5.0	mg/L	0.5	103	85	115			
Sample ID: H13070185-001AMSD	Sample Matrix Spike Duplicate				Run: PH_130716A				07/16/13 09:54
Fluoride	5.0	mg/L	0.5	102	85	115	0.6	10	
Sample ID: H13070211-009AMS	Sample Matrix Spike				Run: PH_130716A				07/16/13 10:14
Fluoride	3.3	mg/L	0.5	114	85	115			
Sample ID: H13070211-009AMSD	Sample Matrix Spike Duplicate				Run: PH_130716A				07/16/13 10:15
Fluoride	3.2	mg/L	0.5	112	85	115	1.5	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 07/29/13

Project: Barker Hughsville Pilot **Work Order:** H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-S F									Batch: B_R208278
Sample ID: MB-R208278	Method Blank				Run: SUB-B208278				07/16/13 14:30
Sulfide	ND	mg/L	0.5						
Sample ID: LCS-R208278	Laboratory Control Sample				Run: SUB-B208278				07/16/13 14:30
Sulfide	26.6	mg/L	1.0	100	70	130			
Sample ID: B13070209-001FMS	Sample Matrix Spike				Run: SUB-B208278				07/16/13 14:30
Sulfide	27.4	mg/L	1.0	100	80	120			
Sample ID: B13070209-001FMSD	Sample Matrix Spike Duplicate				Run: SUB-B208278				07/16/13 14:30
Sulfide	27.4	mg/L	1.0	99	80	120	0.3	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 07/29/13
Project: Barker Hughsville Pilot **Work Order:** H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.7**									Analytical Run: ICP2-HE_130715A
Sample ID: **ICV**	Initial Calibration Verification Standard								07/15/13 10:34
Calcium	40.4	mg/L	1.0	101	95	105			
Iron	3.99	mg/L	0.030	100	95	105			
Magnesium	40.7	mg/L	1.0	102	95	105			
Manganese	3.96	mg/L	0.010	99	95	105			
Potassium	39.9	mg/L	1.0	100	95	105			
Sodium	40.1	mg/L	1.0	100	95	105			
Zinc	0.813	mg/L	0.010	102	95	105			
Sample ID: **CCV-1**	Continuing Calibration Verification Standard								07/15/13 10:38
Calcium	25.0	mg/L	1.0	100	95	105			
Iron	2.49	mg/L	0.030	100	95	105			
Magnesium	25.1	mg/L	1.0	100	95	105			
Manganese	2.47	mg/L	0.010	99	95	105			
Potassium	24.9	mg/L	1.0	100	95	105			
Sodium	24.9	mg/L	1.0	100	95	105			
Zinc	2.56	mg/L	0.010	102	95	105			
Sample ID: **ICSA**	Interference Check Sample A								07/15/13 10:48
Calcium	468	mg/L	1.0	94	80	120			
Iron	188	mg/L	0.030	94	80	120			
Magnesium	510	mg/L	1.0	102	80	120			
Manganese	0.00357	mg/L	0.010		0	0			
Potassium	0.0292	mg/L	1.0		0	0			
Sodium	0.0216	mg/L	1.0		0	0			
Zinc	0.0132	mg/L	0.010		0	0			
Sample ID: **ICSAB**	Interference Check Sample AB								07/15/13 10:53
Calcium	472	mg/L	1.0	94	80	120			
Iron	189	mg/L	0.030	94	80	120			
Magnesium	509	mg/L	1.0	102	80	120			
Manganese	0.482	mg/L	0.010	96	80	120			
Potassium	22.7	mg/L	1.0	114	80	120			
Sodium	22.9	mg/L	1.0	115	80	120			
Zinc	1.01	mg/L	0.010	101	80	120			
Sample ID: **CCV**	Continuing Calibration Verification Standard								07/15/13 11:23
Calcium	24.1	mg/L	1.0	96	90	110			
Iron	2.45	mg/L	0.030	98	90	110			
Magnesium	23.5	mg/L	1.0	94	90	110			
Manganese	2.41	mg/L	0.010	97	90	110			
Potassium	24.8	mg/L	1.0	99	90	110			
Sodium	25.0	mg/L	1.0	100	90	110			
Zinc	2.45	mg/L	0.010	98	90	110			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 07/29/13
Work Order: H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7								Batch: R89727	
Sample ID: ICB	Method Blank				Run: ICP2-HE_130715A			07/15/13 11:00	
Calcium	0.03	mg/L	0.03						
Iron	ND	mg/L	0.005						
Magnesium	ND	mg/L	0.02						
Manganese	ND	mg/L	0.0005						
Potassium	ND	mg/L	0.03						
Sodium	ND	mg/L	0.03						
Zinc	ND	mg/L	0.001						
Sample ID: LFB	Laboratory Fortified Blank				Run: ICP2-HE_130715A			07/15/13 11:04	
Calcium	49.3	mg/L	1.0	98	85	115			
Iron	4.90	mg/L	0.030	98	85	115			
Magnesium	50.0	mg/L	1.0	100	85	115			
Manganese	4.86	mg/L	0.010	97	85	115			
Potassium	48.0	mg/L	1.0	96	85	115			
Sodium	48.2	mg/L	1.0	96	85	115			
Zinc	0.994	mg/L	0.010	99	85	115			
Sample ID: H13070209-001BMS2	Sample Matrix Spike				Run: ICP2-HE_130715A			07/15/13 11:15	
Calcium	529	mg/L	1.0	94	70	130			
Iron	24.5	mg/L	0.030	98	70	130			
Magnesium	432	mg/L	1.0	95	70	130			
Manganese	24.4	mg/L	0.0027	97	70	130			
Potassium	250	mg/L	1.0	99	70	130			
Sodium	1190	mg/L	1.0	99	70	130			
Zinc	4.91	mg/L	0.010	98	70	130			
Sample ID: H13070209-001BMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_130715A			07/15/13 11:19	
Calcium	526	mg/L	1.0	93	70	130	0.6	20	
Iron	24.6	mg/L	0.030	98	70	130	0.3	20	
Magnesium	428	mg/L	1.0	94	70	130	1.0	20	
Manganese	24.5	mg/L	0.0027	98	70	130	0.5	20	
Potassium	252	mg/L	1.0	100	70	130	0.8	20	
Sodium	1180	mg/L	1.0	95	70	130	0.9	20	
Zinc	4.89	mg/L	0.010	98	70	130	0.4	20	
Sample ID: H13070211-009CMS2	Sample Matrix Spike				Run: ICP2-HE_130715A			07/15/13 12:18	
Calcium	347	mg/L	1.0	98	70	130			
Iron	65.2	mg/L	0.030	97	70	130			
Magnesium	399	mg/L	1.0	101	70	130			
Manganese	123	mg/L	0.0027		70	130			A
Potassium	249	mg/L	1.0	99	70	130			
Sodium	261	mg/L	1.0	101	70	130			
Zinc	52.1	mg/L	0.010		70	130			A

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 07/29/13

Work Order: H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7									Batch: R89727
Sample ID: H13070211-009CMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_130715A				07/15/13 12:22
Calcium	348	mg/L	1.0	99	70	130	0.4	20	
Iron	65.2	mg/L	0.030	97	70	130	0.1	20	
Magnesium	400	mg/L	1.0	102	70	130	0.3	20	
Manganese	123	mg/L	0.0027		70	130	0.2	20	A
Potassium	250	mg/L	1.0	100	70	130	0.5	20	
Sodium	263	mg/L	1.0	101	70	130	0.5	20	
Zinc	52.2	mg/L	0.010		70	130	0.2	20	A

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 07/29/13
Project: Barker Hughsville Pilot
Work Order: H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7									Analytical Run: ICP2-HE_130716A
Sample ID: ICV	Initial Calibration Verification Standard								07/16/13 10:43
Calcium	39.8	mg/L	1.0	99	95	105			
Iron	3.95	mg/L	0.030	99	95	105			
Magnesium	39.8	mg/L	1.0	100	95	105			
Manganese	3.87	mg/L	0.010	97	95	105			
Potassium	40.0	mg/L	1.0	100	95	105			
Sodium	40.3	mg/L	1.0	101	95	105			
Zinc	0.781	mg/L	0.010	98	95	105			
Sample ID: CCV-1	Continuing Calibration Verification Standard								07/16/13 10:46
Calcium	25.0	mg/L	1.0	100	95	105			
Iron	2.48	mg/L	0.030	99	95	105			
Magnesium	25.0	mg/L	1.0	100	95	105			
Manganese	2.43	mg/L	0.010	97	95	105			
Potassium	24.3	mg/L	1.0	97	95	105			
Sodium	24.3	mg/L	1.0	97	95	105			
Zinc	2.55	mg/L	0.010	102	95	105			
Sample ID: ICSA	Interference Check Sample A								07/16/13 10:57
Calcium	476	mg/L	1.0	95	80	120			
Iron	188	mg/L	0.030	94	80	120			
Magnesium	501	mg/L	1.0	100	80	120			
Manganese	0.00465	mg/L	0.010		0	0			
Potassium	-0.00887	mg/L	1.0		0	0			
Sodium	0.0212	mg/L	1.0		0	0			
Zinc	0.0128	mg/L	0.010		0	0			
Sample ID: ICSAB	Interference Check Sample AB								07/16/13 11:01
Calcium	474	mg/L	1.0	95	80	120			
Iron	190	mg/L	0.030	95	80	120			
Magnesium	505	mg/L	1.0	101	80	120			
Manganese	0.481	mg/L	0.010	96	80	120			
Potassium	22.9	mg/L	1.0	115	80	120			
Sodium	23.1	mg/L	1.0	115	80	120			
Zinc	0.995	mg/L	0.010	99	80	120			
Sample ID: CCV	Continuing Calibration Verification Standard								07/16/13 12:16
Calcium	24.1	mg/L	1.0	96	90	110			
Iron	2.42	mg/L	0.030	97	90	110			
Magnesium	23.8	mg/L	1.0	95	90	110			
Manganese	2.37	mg/L	0.010	95	90	110			
Potassium	24.7	mg/L	1.0	99	90	110			
Sodium	24.7	mg/L	1.0	99	90	110			
Zinc	2.37	mg/L	0.010	95	90	110			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Report Date: 07/29/13

Project: Barker Hughsville Pilot

Work Order: H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7									Analytical Run: ICP2-HE_130716A
Sample ID: CCV	Continuing Calibration Verification Standard								07/16/13 13:01
Calcium	24.3	mg/L	1.0	97	90	110			
Iron	2.43	mg/L	0.030	97	90	110			
Magnesium	24.0	mg/L	1.0	96	90	110			
Manganese	2.38	mg/L	0.010	95	90	110			
Potassium	23.8	mg/L	1.0	95	90	110			
Sodium	23.9	mg/L	1.0	96	90	110			
Zinc	2.41	mg/L	0.010	96	90	110			
Method: E200.7									Batch: 20955
Sample ID: MB-20955	Method Blank				Run: ICP2-HE_130716A				07/16/13 11:50
Calcium	ND	mg/L	0.06						
Iron	ND	mg/L	0.005						
Magnesium	ND	mg/L	0.006						
Manganese	ND	mg/L	0.0006						
Potassium	ND	mg/L	0.03						
Sodium	ND	mg/L	0.03						
Zinc	0.002	mg/L	0.001						
Sample ID: LCS-20955	Laboratory Control Sample				Run: ICP2-HE_130716A				07/16/13 11:54
Calcium	24.2	mg/L	1.0	97	85	115			
Iron	2.41	mg/L	0.030	96	85	115			
Magnesium	24.1	mg/L	1.0	96	85	115			
Manganese	2.37	mg/L	0.0010	95	85	115			
Potassium	24.5	mg/L	1.0	98	85	115			
Sodium	24.6	mg/L	1.0	98	85	115			
Zinc	0.479	mg/L	0.010	95	85	115			
Sample ID: H13070211-001DMS3	Sample Matrix Spike				Run: ICP2-HE_130716A				07/16/13 13:08
Calcium	232	mg/L	1.0	100	70	130			
Iron	192	mg/L	0.030		70	130			A
Magnesium	148	mg/L	1.0	100	70	130			
Manganese	136	mg/L	0.0031		70	130			A
Potassium	129	mg/L	1.0	102	70	130			
Sodium	133	mg/L	1.0	103	70	130			
Zinc	64.7	mg/L	0.010		70	130			A
Sample ID: H13070211-001DMSD3	Sample Matrix Spike Duplicate				Run: ICP2-HE_130716A				07/16/13 13:12
Calcium	231	mg/L	1.0	99	70	130	0.7	20	
Iron	191	mg/L	0.030		70	130	0.3	20	A
Magnesium	147	mg/L	1.0	98	70	130	1.1	20	
Manganese	135	mg/L	0.0031		70	130	0.4	20	A
Potassium	129	mg/L	1.0	102	70	130	0.4	20	
Sodium	133	mg/L	1.0	103	70	130	0.0	20	

Qualifiers:

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ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 07/29/13

Work Order: H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.7**									Batch: 20955
Sample ID: **H13070211-001DMSD3**	Sample Matrix Spike Duplicate				Run: ICP2-HE_130716A				07/16/13 13:12
Zinc	64.1	mg/L	0.010		70	130	1.1	20	A

Qualifiers:

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ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 07/29/13
Project: Barker Hughsville Pilot **Work Order:** H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS204-B_130716A
Sample ID: ICV STD	Initial Calibration Verification Standard								07/16/13 11:41
Aluminum	0.291	mg/L	0.10	97	90	110			
Arsenic	0.0600	mg/L	0.0050	100	90	110			
Barium	0.0596	mg/L	0.10	99	90	110			
Beryllium	0.0310	mg/L	0.0010	103	90	110			
Cadmium	0.0318	mg/L	0.0010	106	90	110			
Chromium	0.0599	mg/L	0.010	100	90	110			
Cobalt	0.0596	mg/L	0.010	99	90	110			
Copper	0.0610	mg/L	0.010	102	90	110			
Iron	0.299	mg/L	0.030	100	90	110			
Lead	0.0618	mg/L	0.010	103	90	110			
Manganese	0.301	mg/L	0.010	101	90	110			
Nickel	0.0606	mg/L	0.010	101	90	110			
Silver	0.0300	mg/L	0.0050	100	90	110			
Thallium	0.0601	mg/L	0.10	100	90	110			
Zinc	0.0620	mg/L	0.010	103	90	110			
Sample ID: ICSA	Interference Check Sample A								07/16/13 11:45
Aluminum	36.5	mg/L	0.10	91	70	130			
Arsenic	0.000313	mg/L	0.0050						
Barium	0.000266	mg/L	0.10						
Beryllium	3.00E-06	mg/L	0.0010						
Cadmium	0.00118	mg/L	0.0010						
Chromium	0.00125	mg/L	0.010						
Cobalt	0.000415	mg/L	0.010						
Copper	0.000338	mg/L	0.010						
Iron	93.4	mg/L	0.030	93	70	130			
Lead	0.000184	mg/L	0.010						
Manganese	0.000666	mg/L	0.010						
Nickel	0.000736	mg/L	0.010						
Silver	0.000177	mg/L	0.0050						
Thallium	7.70E-05	mg/L	0.10						
Zinc	0.00123	mg/L	0.010						
Sample ID: ICSAB	Interference Check Sample AB								07/16/13 11:57
Aluminum	37.0	mg/L	0.10	93	70	130			
Arsenic	0.0106	mg/L	0.0050	106	70	130			
Barium	0.000105	mg/L	0.10		0	0			
Beryllium	6.00E-06	mg/L	0.0010		0	0			
Cadmium	0.0103	mg/L	0.0010	103	70	130			
Chromium	0.0219	mg/L	0.010	110	70	130			
Cobalt	0.0218	mg/L	0.010	109	70	130			
Copper	0.0203	mg/L	0.010	101	70	130			
Iron	93.2	mg/L	0.030	93	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 07/29/13
Work Order: H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS204-B_130716A
Sample ID: ICSAB	Interference Check Sample AB								07/16/13 11:57
Lead	0.000219	mg/L	0.010		0	0			
Manganese	0.0211	mg/L	0.010	105	70	130			
Nickel	0.0208	mg/L	0.010	104	70	130			
Silver	0.0183	mg/L	0.0050	92	70	130			
Thallium	4.50E-05	mg/L	0.10		0	0			
Zinc	0.0105	mg/L	0.010	105	70	130			
Sample ID: ICV STD	Initial Calibration Verification Standard								07/16/13 17:06
Aluminum	0.300	mg/L	0.10	100	90	110			
Arsenic	0.0626	mg/L	0.0050	104	90	110			
Barium	0.0602	mg/L	0.10	100	90	110			
Beryllium	0.0315	mg/L	0.0010	105	90	110			
Cadmium	0.0328	mg/L	0.0010	109	90	110			
Chromium	0.0627	mg/L	0.010	104	90	110			
Cobalt	0.0590	mg/L	0.010	98	90	110			
Copper	0.0644	mg/L	0.010	107	90	110			
Iron	0.325	mg/L	0.030	108	90	110			
Lead	0.0621	mg/L	0.010	104	90	110			
Manganese	0.301	mg/L	0.010	100	90	110			
Nickel	0.0636	mg/L	0.010	106	90	110			
Silver	0.0306	mg/L	0.0050	102	90	110			
Thallium	0.0605	mg/L	0.10	101	90	110			
Zinc	0.0646	mg/L	0.010	108	90	110			
Sample ID: ICSA	Interference Check Sample A								07/16/13 17:10
Aluminum	38.1	mg/L	0.10	95	70	130			
Arsenic	0.000345	mg/L	0.0050						
Barium	0.000245	mg/L	0.10						
Beryllium	1.00E-06	mg/L	0.0010						
Cadmium	0.00116	mg/L	0.0010						
Chromium	0.00116	mg/L	0.010						
Cobalt	0.000416	mg/L	0.010						
Copper	0.000301	mg/L	0.010						
Iron	97.9	mg/L	0.030	98	70	130			
Lead	0.000169	mg/L	0.010						
Manganese	0.000604	mg/L	0.010						
Nickel	0.000686	mg/L	0.010						
Silver	0.000182	mg/L	0.0050						
Thallium	7.50E-05	mg/L	0.10						
Zinc	0.00107	mg/L	0.010						
Sample ID: ICSAB	Interference Check Sample AB								07/16/13 17:14
Aluminum	38.1	mg/L	0.10	95	70	130			
Arsenic	0.0111	mg/L	0.0050	111	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 07/29/13

Project: Barker Hughsville Pilot **Work Order:** H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS204-B_130716A
Sample ID: ICSAB	Interference Check Sample AB								07/16/13 17:14
Barium	8.10E-05	mg/L	0.10		0	0			
Beryllium	6.00E-06	mg/L	0.0010		0	0			
Cadmium	0.0108	mg/L	0.0010	108	70	130			
Chromium	0.0227	mg/L	0.010	114	70	130			
Cobalt	0.0229	mg/L	0.010	114	70	130			
Copper	0.0209	mg/L	0.010	105	70	130			
Iron	99.6	mg/L	0.030	100	70	130			
Lead	0.000221	mg/L	0.010		0	0			
Manganese	0.0216	mg/L	0.010	108	70	130			
Nickel	0.0219	mg/L	0.010	109	70	130			
Silver	0.0184	mg/L	0.0050	92	70	130			
Thallium	5.30E-05	mg/L	0.10		0	0			
Zinc	0.0107	mg/L	0.010	107	70	130			
Sample ID: ICV STD	Initial Calibration Verification Standard								07/17/13 00:59
Aluminum	0.302	mg/L	0.10	101	90	110			
Arsenic	0.0603	mg/L	0.0050	100	90	110			
Barium	0.0603	mg/L	0.10	100	90	110			
Beryllium	0.0310	mg/L	0.0010	103	90	110			
Cadmium	0.0326	mg/L	0.0010	109	90	110			
Chromium	0.0604	mg/L	0.010	101	90	110			
Cobalt	0.0645	mg/L	0.010	108	90	110			
Copper	0.0613	mg/L	0.010	102	90	110			
Iron	0.314	mg/L	0.030	105	90	110			
Lead	0.0641	mg/L	0.010	107	90	110			
Manganese	0.297	mg/L	0.010	99	90	110			
Nickel	0.0607	mg/L	0.010	101	90	110			
Silver	0.0304	mg/L	0.0050	101	90	110			
Thallium	0.0592	mg/L	0.10	99	90	110			
Zinc	0.0631	mg/L	0.010	105	90	110			
Sample ID: ICSA	Interference Check Sample A								07/17/13 01:03
Aluminum	37.6	mg/L	0.10	94	70	130			
Arsenic	0.000348	mg/L	0.0050						
Barium	0.000276	mg/L	0.10						
Beryllium	4.00E-06	mg/L	0.0010						
Cadmium	0.00110	mg/L	0.0010						
Chromium	0.00117	mg/L	0.010						
Cobalt	0.000439	mg/L	0.010						
Copper	0.000296	mg/L	0.010						
Iron	93.3	mg/L	0.030	93	70	130			
Lead	0.000177	mg/L	0.010						
Manganese	0.000563	mg/L	0.010						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 07/29/13

Project: Barker Hughsville Pilot **Work Order:** H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS204-B_130716A
Sample ID: ICSA	Interference Check Sample A								07/17/13 01:03
Nickel	0.000619	mg/L	0.010						
Silver	0.000196	mg/L	0.0050						
Thallium	4.30E-05	mg/L	0.10						
Zinc	0.000902	mg/L	0.010						
Sample ID: ICSAB	Interference Check Sample AB								07/17/13 01:08
Aluminum	36.9	mg/L	0.10	92	70	130			
Arsenic	0.0105	mg/L	0.0050	105	70	130			
Barium	0.000111	mg/L	0.10		0	0			
Beryllium	1.20E-05	mg/L	0.0010		0	0			
Cadmium	0.0107	mg/L	0.0010	107	70	130			
Chromium	0.0216	mg/L	0.010	108	70	130			
Cobalt	0.0226	mg/L	0.010	113	70	130			
Copper	0.0201	mg/L	0.010	101	70	130			
Iron	91.0	mg/L	0.030	91	70	130			
Lead	0.000235	mg/L	0.010		0	0			
Manganese	0.0210	mg/L	0.010	105	70	130			
Nickel	0.0212	mg/L	0.010	106	70	130			
Silver	0.0184	mg/L	0.0050	92	70	130			
Thallium	3.10E-05	mg/L	0.10		0	0			
Zinc	0.0102	mg/L	0.010	102	70	130			
Sample ID: ICV STD	Initial Calibration Verification Standard								07/17/13 09:50
Aluminum	0.291	mg/L	0.10	97	90	110			
Arsenic	0.0601	mg/L	0.0050	100	90	110			
Barium	0.0602	mg/L	0.10	100	90	110			
Beryllium	0.0306	mg/L	0.0010	102	90	110			
Cadmium	0.0324	mg/L	0.0010	108	90	110			
Chromium	0.0611	mg/L	0.010	102	90	110			
Cobalt	0.0591	mg/L	0.010	98	90	110			
Copper	0.0622	mg/L	0.010	104	90	110			
Iron	0.312	mg/L	0.030	104	90	110			
Lead	0.0628	mg/L	0.010	105	90	110			
Manganese	0.301	mg/L	0.010	100	90	110			
Nickel	0.0616	mg/L	0.010	103	90	110			
Silver	0.0304	mg/L	0.0050	101	90	110			
Thallium	0.0601	mg/L	0.10	100	90	110			
Zinc	0.0631	mg/L	0.010	105	90	110			
Sample ID: ICSA	Interference Check Sample A								07/17/13 09:54
Aluminum	36.9	mg/L	0.10	92	70	130			
Arsenic	0.000287	mg/L	0.0050						
Barium	0.000283	mg/L	0.10						
Beryllium	9.00E-06	mg/L	0.0010						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 07/29/13

Project: Barker Hughsville Pilot **Work Order:** H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS204-B_130716A
Sample ID: ICSA	Interference Check Sample A								07/17/13 09:54
Cadmium	0.00116	mg/L	0.0010						
Chromium	0.00116	mg/L	0.010						
Cobalt	0.000412	mg/L	0.010						
Copper	0.000263	mg/L	0.010						
Iron	93.8	mg/L	0.030	94	70	130			
Lead	0.000171	mg/L	0.010						
Manganese	0.000533	mg/L	0.010						
Nickel	0.000713	mg/L	0.010						
Silver	0.000193	mg/L	0.0050						
Thallium	8.70E-05	mg/L	0.10						
Zinc	0.00118	mg/L	0.010						
Sample ID: ICSAB	Interference Check Sample AB								07/17/13 09:59
Aluminum	36.1	mg/L	0.10	90	70	130			
Arsenic	0.0108	mg/L	0.0050	108	70	130			
Barium	0.000103	mg/L	0.10		0	0			
Beryllium	1.10E-05	mg/L	0.0010		0	0			
Cadmium	0.0107	mg/L	0.0010	107	70	130			
Chromium	0.0224	mg/L	0.010	112	70	130			
Cobalt	0.0226	mg/L	0.010	113	70	130			
Copper	0.0206	mg/L	0.010	103	70	130			
Iron	95.2	mg/L	0.030	95	70	130			
Lead	0.000219	mg/L	0.010		0	0			
Manganese	0.0212	mg/L	0.010	106	70	130			
Nickel	0.0212	mg/L	0.010	106	70	130			
Silver	0.0183	mg/L	0.0050	91	70	130			
Thallium	6.80E-05	mg/L	0.10		0	0			
Zinc	0.0108	mg/L	0.010	108	70	130			
Sample ID: ICSA	Interference Check Sample A								07/18/13 04:59
Aluminum	36.2	mg/L	0.10	91	70	130			
Arsenic	0.000329	mg/L	0.0050						
Barium	0.000306	mg/L	0.10						
Beryllium	8.00E-06	mg/L	0.0010						
Cadmium	0.000928	mg/L	0.0010						
Chromium	0.00115	mg/L	0.010						
Cobalt	0.000426	mg/L	0.010						
Copper	0.000285	mg/L	0.010						
Iron	95.6	mg/L	0.030	96	70	130			
Lead	0.000190	mg/L	0.010						
Manganese	0.000426	mg/L	0.010						
Nickel	0.000750	mg/L	0.010						
Silver	0.000211	mg/L	0.0050						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 07/29/13
Project: Barker Hughsville Pilot **Work Order:** H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS204-B_130716A
Sample ID: ICSA	Interference Check Sample A								07/18/13 04:59
Thallium	0.000161	mg/L	0.10						
Zinc	0.00123	mg/L	0.010						
Sample ID: ICSAB	Interference Check Sample AB								07/18/13 05:03
Aluminum	36.4	mg/L	0.10	91	70	130			
Arsenic	0.0108	mg/L	0.0050	108	70	130			
Barium	0.000125	mg/L	0.10		0	0			
Beryllium	1.30E-05	mg/L	0.0010		0	0			
Cadmium	0.0116	mg/L	0.0010	116	70	130			
Chromium	0.0222	mg/L	0.010	111	70	130			
Cobalt	0.0234	mg/L	0.010	117	70	130			
Copper	0.0209	mg/L	0.010	105	70	130			
Iron	94.6	mg/L	0.030	95	70	130			
Lead	0.000229	mg/L	0.010		0	0			
Manganese	0.0222	mg/L	0.010	111	70	130			
Nickel	0.0219	mg/L	0.010	109	70	130			
Silver	0.0188	mg/L	0.0050	94	70	130			
Thallium	0.000112	mg/L	0.10		0	0			
Zinc	0.0107	mg/L	0.010	107	70	130			
Sample ID: ICV STD	Initial Calibration Verification Standard								07/18/13 09:04
Aluminum	0.306	mg/L	0.10	102	90	110			
Arsenic	0.0606	mg/L	0.0050	101	90	110			
Barium	0.0613	mg/L	0.10	102	90	110			
Beryllium	0.0320	mg/L	0.0010	107	90	110			
Cadmium	0.0328	mg/L	0.0010	109	90	110			
Chromium	0.0609	mg/L	0.010	102	90	110			
Cobalt	0.0600	mg/L	0.010	100	90	110			
Copper	0.0632	mg/L	0.010	105	90	110			
Iron	0.318	mg/L	0.030	106	90	110			
Lead	0.0637	mg/L	0.010	106	90	110			
Manganese	0.301	mg/L	0.010	100	90	110			
Nickel	0.0617	mg/L	0.010	103	90	110			
Silver	0.0302	mg/L	0.0050	101	90	110			
Thallium	0.0593	mg/L	0.10	99	90	110			
Zinc	0.0638	mg/L	0.010	106	90	110			
Sample ID: ICSA	Interference Check Sample A								07/18/13 09:08
Aluminum	37.0	mg/L	0.10	92	70	130			
Arsenic	0.000229	mg/L	0.0050						
Barium	0.000234	mg/L	0.10						
Beryllium	1.30E-05	mg/L	0.0010						
Cadmium	0.00111	mg/L	0.0010						
Chromium	0.00112	mg/L	0.010						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs | **Report Date:** 07/29/13

Project: Barker Hughsville Pilot | **Work Order:** H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS204-B_130716A
Sample ID: ICSA	Interference Check Sample A								07/18/13 09:08
Cobalt	0.000449	mg/L	0.010						
Copper	0.000289	mg/L	0.010						
Iron	92.2	mg/L	0.030	92	70	130			
Lead	0.000178	mg/L	0.010						
Manganese	0.000589	mg/L	0.010						
Nickel	0.000741	mg/L	0.010						
Silver	0.000178	mg/L	0.0050						
Thallium	0.000105	mg/L	0.10						
Zinc	0.00103	mg/L	0.010						
Sample ID: ICSAB	Interference Check Sample AB								07/18/13 09:13
Aluminum	37.2	mg/L	0.10	93	70	130			
Arsenic	0.0103	mg/L	0.0050	103	70	130			
Barium	8.50E-05	mg/L	0.10		0	0			
Beryllium	9.00E-06	mg/L	0.0010		0	0			
Cadmium	0.0106	mg/L	0.0010	106	70	130			
Chromium	0.0215	mg/L	0.010	108	70	130			
Cobalt	0.0227	mg/L	0.010	113	70	130			
Copper	0.0201	mg/L	0.010	101	70	130			
Iron	93.6	mg/L	0.030	94	70	130			
Lead	0.000226	mg/L	0.010		0	0			
Manganese	0.0213	mg/L	0.010	106	70	130			
Nickel	0.0209	mg/L	0.010	104	70	130			
Silver	0.0180	mg/L	0.0050	90	70	130			
Thallium	7.40E-05	mg/L	0.10		0	0			
Zinc	0.0105	mg/L	0.010	105	70	130			
Sample ID: ICV STD	Initial Calibration Verification Standard								07/18/13 16:56
Aluminum	0.296	mg/L	0.10	99	90	110			
Arsenic	0.0608	mg/L	0.0050	101	90	110			
Barium	0.0600	mg/L	0.10	100	90	110			
Beryllium	0.0310	mg/L	0.0010	103	90	110			
Cadmium	0.0323	mg/L	0.0010	108	90	110			
Chromium	0.0611	mg/L	0.010	102	90	110			
Cobalt	0.0623	mg/L	0.010	104	90	110			
Copper	0.0623	mg/L	0.010	104	90	110			
Iron	0.331	mg/L	0.030	110	90	110			
Lead	0.0638	mg/L	0.010	106	90	110			
Manganese	0.299	mg/L	0.010	100	90	110			
Nickel	0.0616	mg/L	0.010	103	90	110			
Silver	0.0302	mg/L	0.0050	101	90	110			
Thallium	0.0577	mg/L	0.10	96	90	110			
Zinc	0.0644	mg/L	0.010	107	90	110			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 07/29/13
Project: Barker Hughsville Pilot **Work Order:** H13070211

Method: **E200.8** Analytical Run: ICPMS204-B_130716A

Sample ID: **ICSA** Interference Check Sample A 07/18/13 17:00

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Aluminum	37.4	mg/L	0.10	94	70	130			
Arsenic	0.000325	mg/L	0.0050						
Barium	0.000273	mg/L	0.10						
Beryllium	9.00E-06	mg/L	0.0010						
Cadmium	0.00115	mg/L	0.0010						
Chromium	0.00117	mg/L	0.010						
Cobalt	0.000463	mg/L	0.010						
Copper	0.000300	mg/L	0.010						
Iron	96.7	mg/L	0.030	97	70	130			
Lead	0.000179	mg/L	0.010						
Manganese	0.000597	mg/L	0.010						
Nickel	0.000687	mg/L	0.010						
Silver	0.000179	mg/L	0.0050						
Thallium	0.000121	mg/L	0.10						
Zinc	0.00102	mg/L	0.010						

Sample ID: **ICSAB** Interference Check Sample AB 07/18/13 17:04

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Aluminum	36.3	mg/L	0.10	91	70	130			
Arsenic	0.0103	mg/L	0.0050	103	70	130			
Barium	0.000108	mg/L	0.10		0	0			
Beryllium	1.10E-05	mg/L	0.0010		0	0			
Cadmium	0.0106	mg/L	0.0010	106	70	130			
Chromium	0.0212	mg/L	0.010	106	70	130			
Cobalt	0.0230	mg/L	0.010	115	70	130			
Copper	0.0197	mg/L	0.010	98	70	130			
Iron	92.8	mg/L	0.030	93	70	130			
Lead	0.000233	mg/L	0.010		0	0			
Manganese	0.0213	mg/L	0.010	106	70	130			
Nickel	0.0202	mg/L	0.010	101	70	130			
Silver	0.0183	mg/L	0.0050	91	70	130			
Thallium	9.60E-05	mg/L	0.10		0	0			
Zinc	0.0101	mg/L	0.010	101	70	130			

Method: **E200.8** Batch: 20955

Sample ID: **MB-20955** Method Blank Run: ICPMS204-B_130716A 07/16/13 17:42

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Aluminum	0.0008	mg/L	0.0007						
Arsenic	ND	mg/L	0.0002						
Barium	ND	mg/L	0.0002						
Beryllium	ND	mg/L	2E-05						
Cadmium	ND	mg/L	2E-05						
Chromium	ND	mg/L	0.0002						
Cobalt	ND	mg/L	5E-05						
Copper	ND	mg/L	0.0002						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs | **Report Date:** 07/29/13
Project: Barker Hughsville Pilot | **Work Order:** H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Batch: 20955
Sample ID: MB-20955	Method Blank				Run: ICPMS204-B_130716A				07/16/13 17:42
Iron	ND	mg/L	0.002						
Lead	ND	mg/L	3E-05						
Manganese	ND	mg/L	0.0001						
Nickel	ND	mg/L	0.0001						
Silver	ND	mg/L	0.0001						
Thallium	ND	mg/L	5E-05						
Zinc	0.002	mg/L	0.001						
Sample ID: LCS-20955	Laboratory Control Sample				Run: ICPMS204-B_130716A				07/16/13 17:46
Aluminum	2.31	mg/L	0.030	92	85	115			
Arsenic	0.503	mg/L	0.0010	101	85	115			
Barium	0.459	mg/L	0.050	92	85	115			
Beryllium	0.245	mg/L	0.0010	98	85	115			
Cadmium	0.235	mg/L	0.0010	94	85	115			
Chromium	0.473	mg/L	0.0050	95	85	115			
Cobalt	0.457	mg/L	0.0050	91	85	115			
Copper	0.470	mg/L	0.0050	94	85	115			
Iron	2.49	mg/L	0.030	100	85	115			
Lead	0.456	mg/L	0.0010	91	85	115			
Manganese	2.37	mg/L	0.0010	95	85	115			
Nickel	0.508	mg/L	0.0050	102	85	115			
Silver	0.0486	mg/L	0.0010	97	85	115			
Thallium	0.439	mg/L	0.00050	88	85	115			
Zinc	0.513	mg/L	0.010	102	85	115			
Sample ID: H13070211-001DMS3	Sample Matrix Spike				Run: ICPMS204-B_130716A				07/16/13 19:10
Aluminum	25.6	mg/L	0.030	88	70	130			
Arsenic	2.83	mg/L	0.0010	100	70	130			
Barium	2.39	mg/L	0.050	95	70	130			
Beryllium	1.18	mg/L	0.0010	94	70	130			
Cadmium	1.37	mg/L	0.0010	86	70	130			
Chromium	2.36	mg/L	0.0050	94	70	130			
Cobalt	2.25	mg/L	0.0050	88	70	130			
Copper	4.23	mg/L	0.0050	87	70	130			
Iron	189	mg/L	0.030		70	130			A
Lead	2.58	mg/L	0.0010	93	70	130			
Manganese	126	mg/L	0.0010		70	130			A
Nickel	2.56	mg/L	0.0050	101	70	130			
Silver	0.242	mg/L	0.0010	97	70	130			
Thallium	2.27	mg/L	0.00050	91	70	130			
Zinc	60.7	mg/L	0.010		70	130			A
Sample ID: H13070211-001DMSD3	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130716A				07/16/13 19:14
Aluminum	25.9	mg/L	0.030	90	70	130	1.0	20	

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 07/29/13
Project: Barker Hughsville Pilot
Work Order: H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**									Batch: 20955
Sample ID: **H13070211-001DMSD3**	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130716A				07/16/13 19:14
Arsenic	2.90	mg/L	0.0010	103	70	130	2.5	20	
Barium	2.45	mg/L	0.050	98	70	130	2.5	20	
Beryllium	1.19	mg/L	0.0010	95	70	130	0.8	20	
Cadmium	1.41	mg/L	0.0010	89	70	130	2.6	20	
Chromium	2.44	mg/L	0.0050	97	70	130	3.2	20	
Cobalt	2.32	mg/L	0.0050	90	70	130	2.9	20	
Copper	4.36	mg/L	0.0050	93	70	130	3.0	20	
Iron	198	mg/L	0.030		70	130	4.7	20	A
Lead	2.60	mg/L	0.0010	94	70	130	1.0	20	
Manganese	130	mg/L	0.0010		70	130	3.2	20	A
Nickel	2.65	mg/L	0.0050	104	70	130	3.3	20	
Silver	0.248	mg/L	0.0010	99	70	130	2.4	20	
Thallium	2.29	mg/L	0.00050	91	70	130	0.9	20	
Zinc	62.8	mg/L	0.010		70	130	3.5	20	A
Method: **E200.8**									Batch: R89782
Sample ID: **ICB**	Method Blank				Run: ICPMS204-B_130716A				07/16/13 14:56
Aluminum	0.001	mg/L	0.0001						
Arsenic	ND	mg/L	7E-05						
Barium	ND	mg/L	5E-05						
Beryllium	ND	mg/L	2E-05						
Cadmium	ND	mg/L	7E-06						
Chromium	ND	mg/L	4E-05						
Cobalt	ND	mg/L	2E-05						
Copper	ND	mg/L	3E-05						
Lead	ND	mg/L	6E-06						
Manganese	ND	mg/L	8E-05						
Nickel	ND	mg/L	6E-05						
Silver	ND	mg/L	4E-05						
Thallium	ND	mg/L	1E-05						
Zinc	0.0005	mg/L	0.0003						
Sample ID: **LFB**	Laboratory Fortified Blank				Run: ICPMS204-B_130716A				07/16/13 15:01
Aluminum	0.0507	mg/L	0.10	99	85	115			
Arsenic	0.0530	mg/L	0.0050	106	85	115			
Barium	0.0515	mg/L	0.10	103	85	115			
Beryllium	0.0518	mg/L	0.0010	104	85	115			
Cadmium	0.0542	mg/L	0.0010	108	85	115			
Chromium	0.0524	mg/L	0.010	105	85	115			
Cobalt	0.0563	mg/L	0.010	113	85	115			
Copper	0.0540	mg/L	0.010	108	85	115			
Lead	0.0547	mg/L	0.010	109	85	115			
Manganese	0.0513	mg/L	0.010	103	85	115			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 07/29/13
Work Order: H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Batch: R89782
Sample ID: LFB	Laboratory Fortified Blank				Run: ICPMS204-B_130716A				07/16/13 15:01
Nickel	0.0540	mg/L	0.010	108	85	115			
Silver	0.0213	mg/L	0.0050	106	85	115			
Thallium	0.0493	mg/L	0.10	99	85	115			
Zinc	0.0553	mg/L	0.010	109	85	115			
Sample ID: H13070211-008CMS	Sample Matrix Spike				Run: ICPMS204-B_130716A				07/16/13 20:34
Aluminum	0.799	mg/L	0.030	100	70	130			
Arsenic	5.26	mg/L	0.0010		70	130			A
Barium	0.797	mg/L	0.050	104	70	130			
Beryllium	0.427	mg/L	0.0010	85	70	130			
Cadmium	0.477	mg/L	0.0010	87	70	130			
Chromium	0.563	mg/L	0.0050	108	70	130			
Cobalt	0.718	mg/L	0.0050	107	70	130			
Copper	0.954	mg/L	0.0050	105	70	130			
Lead	0.570	mg/L	0.0010	113	70	130			
Manganese	3.68	mg/L	0.0010		70	130			A
Nickel	1.62	mg/L	0.0050	112	70	130			
Thallium	0.594	mg/L	0.00050	119	70	130			
Zinc	1.53	mg/L	0.010	97	70	130			
Sample ID: H13070211-008CMSD	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130716A				07/16/13 20:38
Aluminum	0.780	mg/L	0.030	96	70	130	2.4	20	
Arsenic	5.30	mg/L	0.0010		70	130	0.9	20	A
Barium	0.799	mg/L	0.050	105	70	130	0.3	20	
Beryllium	0.425	mg/L	0.0010	85	70	130	0.3	20	
Cadmium	0.477	mg/L	0.0010	87	70	130	0.1	20	
Chromium	0.560	mg/L	0.0050	107	70	130	0.6	20	
Cobalt	0.714	mg/L	0.0050	106	70	130	0.5	20	
Copper	0.951	mg/L	0.0050	104	70	130	0.3	20	
Lead	0.571	mg/L	0.0010	113	70	130	0.1	20	
Manganese	3.71	mg/L	0.0010		70	130	0.8	20	A
Nickel	1.62	mg/L	0.0050	113	70	130	0.2	20	
Thallium	0.599	mg/L	0.00050	120	70	130	0.9	20	
Zinc	1.53	mg/L	0.010	98	70	130	0.1	20	
Sample ID: ICB	Method Blank				Run: ICPMS204-B_130716A				07/17/13 16:01
Aluminum	0.0005	mg/L	0.0001						
Arsenic	ND	mg/L	7E-05						
Barium	ND	mg/L	5E-05						
Beryllium	ND	mg/L	2E-05						
Cadmium	ND	mg/L	7E-06						
Chromium	ND	mg/L	4E-05						
Cobalt	ND	mg/L	2E-05						
Copper	0.0004	mg/L	3E-05						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 07/29/13
Project: Barker Hughsville Pilot **Work Order:** H13070211

Analyte		Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method:	**E200.8**									Batch: R89782
Sample ID:	**ICB**	Method Blank				Run: ICPMS204-B_130716A				07/17/13 16:01
Lead		4E-05	mg/L	6E-06						
Manganese		ND	mg/L	8E-05						
Nickel		ND	mg/L	6E-05						
Silver		ND	mg/L	4E-05						
Thallium		ND	mg/L	1E-05						
Zinc		0.002	mg/L	0.0003						
Sample ID:	**LFB**	Laboratory Fortified Blank				Run: ICPMS204-B_130716A				07/17/13 16:05
Aluminum		0.0500	mg/L	0.10	99	85	115			
Arsenic		0.0503	mg/L	0.0050	101	85	115			
Barium		0.0494	mg/L	0.10	99	85	115			
Beryllium		0.0501	mg/L	0.0010	100	85	115			
Cadmium		0.0530	mg/L	0.0010	106	85	115			
Chromium		0.0497	mg/L	0.010	99	85	115			
Cobalt		0.0504	mg/L	0.010	101	85	115			
Copper		0.0511	mg/L	0.010	101	85	115			
Lead		0.0532	mg/L	0.010	106	85	115			
Manganese		0.0487	mg/L	0.010	97	85	115			
Nickel		0.0506	mg/L	0.010	101	85	115			
Silver		0.0200	mg/L	0.0050	100	85	115			
Thallium		0.0490	mg/L	0.10	98	85	115			
Zinc		0.0529	mg/L	0.010	102	85	115			
Sample ID:	**H13070211-008CMS**	Sample Matrix Spike				Run: ICPMS204-B_130716A				07/18/13 05:40
Aluminum		2.92	mg/L	0.030	96	70	130			
Arsenic		6.58	mg/L	0.0033	111	70	130			
Barium		2.95	mg/L	0.050	106	70	130			
Beryllium		2.40	mg/L	0.0010	96	70	130			
Cadmium		2.59	mg/L	0.0010	101	70	130			
Chromium		2.53	mg/L	0.0050	100	70	130			
Cobalt		3.02	mg/L	0.0050	112	70	130			
Copper		3.00	mg/L	0.0050	101	70	130			
Lead		2.77	mg/L	0.0010	111	70	130			
Manganese		5.72	mg/L	0.0038	103	70	130			
Nickel		3.64	mg/L	0.0050	101	70	130			
Silver		0.654	mg/L	0.0020	65	70	130			S
Thallium		2.74	mg/L	0.00056	110	70	130			
Zinc		3.70	mg/L	0.017	99	70	130			
Sample ID:	**H13070211-008CMSD**	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130716A				07/18/13 05:44
Aluminum		2.80	mg/L	0.030	92	70	130	4.2	20	
Arsenic		6.54	mg/L	0.0033	110	70	130	0.5	20	
Barium		2.86	mg/L	0.050	103	70	130	2.9	20	
Beryllium		2.31	mg/L	0.0010	92	70	130	4.1	20	

Qualifiers:

RL - Analyte reporting limit. ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs | **Report Date:** 07/29/13

Project: Barker Hughsville Pilot | **Work Order:** H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Batch: R89782
Sample ID: H13070211-008CMSD	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130716A				07/18/13 05:44
Cadmium	2.50	mg/L	0.0010	98	70	130	3.3	20	
Chromium	2.52	mg/L	0.0050	100	70	130	0.0	20	
Cobalt	2.96	mg/L	0.0050	110	70	130	2.0	20	
Copper	2.97	mg/L	0.0050	100	70	130	0.9	20	
Lead	2.73	mg/L	0.0010	109	70	130	1.7	20	
Manganese	5.60	mg/L	0.0038	98	70	130	2.3	20	
Nickel	3.64	mg/L	0.0050	101	70	130	0.2	20	
Silver	0.613	mg/L	0.0020	61	70	130	6.5	20	S
Thallium	2.82	mg/L	0.00056	113	70	130	2.9	20	
Zinc	3.66	mg/L	0.017	97	70	130	1.1	20	
Sample ID: ICB	Method Blank				Run: ICPMS204-B_130716A				07/18/13 17:32
Aluminum	0.002	mg/L	0.0001						
Arsenic	ND	mg/L	7E-05						
Barium	0.0001	mg/L	5E-05						
Beryllium	ND	mg/L	2E-05						
Cadmium	ND	mg/L	7E-06						
Chromium	8E-05	mg/L	4E-05						
Cobalt	ND	mg/L	2E-05						
Copper	6E-05	mg/L	3E-05						
Lead	1E-05	mg/L	6E-06						
Manganese	ND	mg/L	8E-05						
Nickel	ND	mg/L	6E-05						
Silver	ND	mg/L	4E-05						
Thallium	ND	mg/L	1E-05						
Zinc	0.0009	mg/L	0.0003						
Sample ID: LFB	Laboratory Fortified Blank				Run: ICPMS204-B_130716A				07/18/13 17:36
Aluminum	0.0513	mg/L	0.10	99	85	115			
Arsenic	0.0502	mg/L	0.0050	100	85	115			
Barium	0.0497	mg/L	0.10	99	85	115			
Beryllium	0.0513	mg/L	0.0010	103	85	115			
Cadmium	0.0530	mg/L	0.0010	106	85	115			
Chromium	0.0494	mg/L	0.010	99	85	115			
Cobalt	0.0565	mg/L	0.010	113	85	115			
Copper	0.0502	mg/L	0.010	100	85	115			
Lead	0.0532	mg/L	0.010	106	85	115			
Manganese	0.0500	mg/L	0.010	100	85	115			
Nickel	0.0504	mg/L	0.010	101	85	115			
Silver	0.0206	mg/L	0.0050	103	85	115			
Thallium	0.0542	mg/L	0.10	108	85	115			
Zinc	0.0538	mg/L	0.010	106	85	115			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 07/29/13
Project: Barker Hughsville Pilot **Work Order:** H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Batch: R89782
Sample ID: H13070185-001BMS	Sample Matrix Spike				Run: ICPMS204-B_130716A				07/19/13 00:52
Aluminum	1.01	mg/L	0.030	97	70	130			
Arsenic	0.983	mg/L	0.0013	98	70	130			
Barium	1.03	mg/L	0.050	101	70	130			
Beryllium	0.934	mg/L	0.0010	93	70	130			
Cadmium	0.939	mg/L	0.0010	94	70	130			
Chromium	0.978	mg/L	0.0050	98	70	130			
Cobalt	1.15	mg/L	0.0050	115	70	130			
Copper	1.00	mg/L	0.0050	100	70	130			
Lead	1.10	mg/L	0.0010	110	70	130			
Manganese	1.08	mg/L	0.0015	105	70	130			
Nickel	1.04	mg/L	0.0050	97	70	130			
Silver	0.356	mg/L	0.0010	89	70	130			
Thallium	1.12	mg/L	0.00050	112	70	130			
Zinc	0.939	mg/L	0.010	91	70	130			
Sample ID: H13070185-001BMSD	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130716A				07/19/13 00:56
Aluminum	1.01	mg/L	0.030	96	70	130	0.3	20	
Arsenic	1.01	mg/L	0.0013	101	70	130	2.7	20	
Barium	1.03	mg/L	0.050	101	70	130	0.2	20	
Beryllium	0.928	mg/L	0.0010	93	70	130	0.7	20	
Cadmium	0.935	mg/L	0.0010	94	70	130	0.4	20	
Chromium	1.01	mg/L	0.0050	101	70	130	2.8	20	
Cobalt	1.14	mg/L	0.0050	113	70	130	1.1	20	
Copper	0.984	mg/L	0.0050	98	70	130	1.9	20	
Lead	1.09	mg/L	0.0010	109	70	130	0.9	20	
Manganese	1.08	mg/L	0.0015	104	70	130	0.6	20	
Nickel	1.05	mg/L	0.0050	98	70	130	0.9	20	
Silver	0.360	mg/L	0.0010	90	70	130	1.1	20	
Thallium	1.12	mg/L	0.00050	112	70	130	0.2	20	
Zinc	0.949	mg/L	0.010	92	70	130	1.1	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 07/29/13
Work Order: H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E300.0									Analytical Run: IC102-H_130715A
Sample ID: ICV	Initial Calibration Verification Standard								07/15/13 10:08
Chloride	100	mg/L	1.0	102	90	110			
Sulfate	400	mg/L	1.0	100	90	110			
Sample ID: CCV071513-2	Continuing Calibration Verification Standard								07/15/13 13:43
Chloride	100	mg/L	1.0	100	90	110			
Sulfate	400	mg/L	1.0	100	90	110			
Method: E300.0									Batch: R89737
Sample ID: ICB	Method Blank				Run: IC102-H_130715A				07/15/13 10:21
Chloride	ND	mg/L	0.008						
Sulfate	0.5	mg/L	0.08						
Sample ID: LFB	Laboratory Fortified Blank				Run: IC102-H_130715A				07/15/13 10:34
Chloride	49	mg/L	1.0	99	90	110			
Sulfate	200	mg/L	1.0	99	90	110			
Sample ID: H13070207-008AMS	Sample Matrix Spike				Run: IC102-H_130715A				07/15/13 16:52
Chloride	51	mg/L	1.0	101	90	110			
Sulfate	200	mg/L	1.0	102	90	110			
Sample ID: H13070207-008AMSD	Sample Matrix Spike Duplicate				Run: IC102-H_130715A				07/15/13 17:04
Chloride	51	mg/L	1.0	102	90	110	0.8	20	
Sulfate	210	mg/L	1.0	103	90	110	0.5	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 07/29/13
Project: Barker Hughsville Pilot **Work Order:** H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E300.0									Analytical Run: IC102-H_130716A
Sample ID: ICV	Initial Calibration Verification Standard								07/16/13 13:59
Chloride	100	mg/L	1.0	102	90	110			
Sulfate	400	mg/L	1.0	101	90	110			
Sample ID: CCV071613-1	Continuing Calibration Verification Standard								07/16/13 14:37
Chloride	99	mg/L	1.0	99	90	110			
Sulfate	400	mg/L	1.0	100	90	110			
Method: E300.0									Batch: R89776
Sample ID: ICB	Method Blank				Run: IC102-H_130716A				07/16/13 14:12
Chloride	ND	mg/L	0.008						
Sulfate	ND	mg/L	0.08						
Sample ID: LFB	Laboratory Fortified Blank				Run: IC102-H_130716A				07/16/13 14:25
Chloride	52	mg/L	1.0	104	90	110			
Sulfate	210	mg/L	1.0	105	90	110			
Sample ID: H13070211-002AMS	Sample Matrix Spike				Run: IC102-H_130716A				07/16/13 15:28
Chloride	250	mg/L	1.4	100	90	110			
Sulfate	2300	mg/L	1.0	67	90	110			S
Sample ID: H13070211-002AMSD	Sample Matrix Spike Duplicate				Run: IC102-H_130716A				07/16/13 15:40
Chloride	240	mg/L	1.4	96	90	110	3.1	20	
Sulfate	2300	mg/L	1.0	69	90	110	0.7	20	S

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 07/29/13

Project: Barker Hughsville Pilot **Work Order:** H13070211

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E365.1									Analytical Run: FIA202-HE_130712C
Sample ID: ICV	Initial Calibration Verification Standard								07/12/13 14:15
Phosphorus, Orthophosphate as P	0.240	mg/L	0.0050	96	90	110			
Sample ID: ICB	Initial Calibration Blank, Instrument Blank								07/12/13 14:16
Phosphorus, Orthophosphate as P	-0.00194	mg/L	0.0050		0	0			
Sample ID: CCV	Continuing Calibration Verification Standard								07/12/13 14:18
Phosphorus, Orthophosphate as P	0.104	mg/L	0.0050	104	90	110			
Sample ID: CCV	Continuing Calibration Verification Standard								07/12/13 14:34
Phosphorus, Orthophosphate as P	0.108	mg/L	0.0050	108	90	110			
Method: E365.1									Batch: R89703
Sample ID: LFB	Laboratory Fortified Blank				Run: FIA202-HE_130712C				07/12/13 14:17
Phosphorus, Orthophosphate as P	0.204	mg/L	0.0050	102	90	110			
Sample ID: H13070209-001AMS	Sample Matrix Spike				Run: FIA202-HE_130712C				07/12/13 14:21
Phosphorus, Orthophosphate as P	0.221	mg/L	0.0050	101	90	110			
Sample ID: H13070209-001AMSD	Sample Matrix Spike Duplicate				Run: FIA202-HE_130712C				07/12/13 14:22
Phosphorus, Orthophosphate as P	0.224	mg/L	0.0050	103	90	110	1.2	20	
Method: E365.1									Analytical Run: FIA202-HE_130712D
Sample ID: ICV	Initial Calibration Verification Standard								07/12/13 16:42
Phosphorus, Orthophosphate as P	0.235	mg/L	0.0050	94	90	110			
Sample ID: ICB	Initial Calibration Blank, Instrument Blank								07/12/13 16:43
Phosphorus, Orthophosphate as P	-0.00170	mg/L	0.0050		0	0			
Sample ID: CCV	Continuing Calibration Verification Standard								07/12/13 16:45
Phosphorus, Orthophosphate as P	0.0918	mg/L	0.0050	92	90	110			
Sample ID: CCV	Continuing Calibration Verification Standard								07/12/13 16:56
Phosphorus, Orthophosphate as P	0.0931	mg/L	0.0050	93	90	110			
Method: E365.1									Batch: R89708
Sample ID: H13070211-007AMS	Sample Matrix Spike				Run: FIA202-HE_130712D				07/12/13 16:48
Phosphorus, Orthophosphate as P	0.299	mg/L	0.0050	115	90	110			S
Sample ID: H13070211-007AMSD	Sample Matrix Spike Duplicate				Run: FIA202-HE_130712D				07/12/13 16:49
Phosphorus, Orthophosphate as P	0.307	mg/L	0.0050	119	90	110	2.4	20	S
Sample ID: LFB	Laboratory Fortified Blank				Run: FIA202-HE_130712D				07/12/13 16:50
Phosphorus, Orthophosphate as P	0.195	mg/L	0.0050	97	90	110			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

Standard Reporting Procedures

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Workorder Receipt Checklist

CDM Federal Programs H13070211

Login completed by: Tracy L. Lorash
Reviewed by: BL2000\sdull
Reviewed Date: 7/19/2013

Date Received: 7/12/2013
Received by: TLL
Carrier name: Hand Del

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☐	No ☑	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Applicable ☐
Container/Temp Blank temperature:	5.4℃ On Ice		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☑	Not Applicable ☐

Contact and Corrective Action Comments:

No collection time on the following bottles; INFL total metals, all sulfides, all of MGOH and BCR1 - took from COC.
BCR3 Total Metals sample was preserved with 2 mL nitric acid upon receipt to pH <2 in the laboratory. In accordance with the Clean Water Act, these samples must be held for 24 hours prior to analysis.
BCR3 Dissolved Metals sample was preserved with 2 mL nitric acid upon receipt to pH <2 in the laboratory.
CHIT Total Metals sample was preserved with 8 mL nitric acid upon receipt in the laboratory; however, due to sample matrix we were unable to reach a pH of <2. In accordance with the Clean Water Act, these samples must be held for 24 hours prior to analysis.
CHIT Dissolved Metals sample was preserved with 8 mL nitric acid upon receipt in the laboratory; however, due to sample matrix we were unable to reach a pH of <2. Tl 7/12/13

Chain of Custody and Analytical Request Record

PLEASE PRINT (Provide as much information as possible.)

Page 1 of 1

Company Name: CDM Smith

Project Name, PWS, Permit, Etc.: Barker Hughesville Pilot

Sample Origin State: MT

EPA/State Compliance: Yes ☐ No ☒

Report Mail Address (Required):
50 W. 14th St, Suite 200
Helena, MT 59601

Contact Name: Angela Frandsen

Phone/Fax: 441-1435

Cell: 439-3776

Sampler: (Please Print) Angela Frandsen

☒ No Hard Copy Email: frandsenak@cdmsmith.com

Invoice Contact & Phone: Raquel Cisneros - Denver Office

Purchase Order:

Quote/Bottle Order: H823 (marbe?)

Invoice Address (Required):
call Angela Frandsen (don't know from here today) for R. Cisneros in Denver

☐ No Hard Copy Email:

Special Report/Formats:

☐ DW
☐ POTW/WWTP
☐ State:
☐ Other:
☒ EDD/EDT (Electronic Data) Format: excel
☐ LEVEL IV
☐ NELAC

Number of Containers
Sample Type: A W S V B O DW
Air Water Soils/Solids
Vegetation Bioassay Other
DW - Drinking Water

ANALYSIS REQUESTED

Contact ELI prior to **RUSH** sample submittal for charges and scheduling – See Instruction Page

Comments: ·10 day TAT ·pull phosphate from 1L bottle

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	Dissolved Metals	Total Metals	Sulfide	Phosphate (ortho)	Alkalinity + Acidity	SO4, Cl, F, TDS				SEE ATTACHED	Standard Turnaround (TAT)	RUSH		LABORATORY USE ONLY
1 13BH-DT-PILOT-INFL-071113	7/11/13	16:20	W-3	X	X		X	X	X						X		H13070211
2 13BH-DT-PILOT-INFD-071113	7/11/13	16:30	W-3	X	X		X	X	X						X		
3 13BH-DT-PILOT-BCR1-071113	7/11/13	16:50	W-4	X	X	X	X	X	X						X		
4 13BH-DT-PILOT-BCR2-071113	7/11/13	17:05	W-4	X	X	X	X	X	X						X		
5 13BH-DT-PILOT-BCR3-071113	7/11/13	17:20	W-4	X	X	X	X	X	X						X		
6 13BH-DT-PILOT-BCR4-071113	7/11/13	17:35	W-4	X	X	X	X	X	X						X		
7 13BH-DT-PILOT-SAPS-071113	7/11/13	17:55	W-3	X	X		X	X	X						X		
8 13BH-DT-PILOT-CHIT-071113	7/11/13	18:10	W-4	X	X	X	X	X	X						X	Metals samples foamed with HNO_3 addn.	
9 13BH-DT-PILOT-MGOH-071113	7/11/13	18:30	W-3	X	X		X	X	X						X		
10											7/12/13						

Shipped by: Hand

Cooler ID(s): Y

Receipt Temp 5.4 °C TB

On Ice: [✓ Y] N

Custody Seal
On Bottle Y [✓ N]
On Cooler Y [✓ N]

Intact Y N

Signature Match Y N

Custody Record MUST be Signed

Relinquished by (print): Angela Frandsen Date/Time: 7/12/13 0930 Signature:

Relinquished by (print): Date/Time: Signature:

Received by (print): Date/Time: Signature:

Received by (print): Date/Time: Signature:

Received by Laboratory: Tracy Orwat Date/Time: 7/12/13 9:30 Signature: Tracy Orwat

Sample Disposal: Return to Client: Lab Disposal:

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.
Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

Notes –

- 10 business day TAT required
- Pull orthophosphate aliquot from 1 L raw bottle
- Dissolved + Total Metals include:
  Al, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg,
  Mn, Ni, K, Ag, Na, Tl, Zn
- Other parameters = Alkalinity, Acidity, Cl, SO_4, F, TDS
  + orthophosphate
- Sulfide samples self explanatory
- All sample IDs have the format:

13BH-DT-PILOT-_ _ _ _-071113

Where the blanks are: INFL
INFD
BCR1
BCR2
BCR3
BCR4
SAPS
CHIT
MGOH

Thank you
Angela Frandsen

ANALYTICAL SUMMARY REPORT

August 07, 2013

CDM Federal Programs
555 17th St Ste 1100
Denver, CO 80202

Workorder No.: H13070431 Quote ID: H823 - Baker-Hughsville Superfund Site

Project Name: Barker Hughsville Pilot

Energy Laboratories Inc Helena MT received the following 10 samples for CDM Federal Programs on 7/24/2013 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H13070431-001	13BH-DT-PILOT-INFL-072313	07/23/13 10:30	07/24/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Conductivity Fluoride Anions by Ion Chromatography Phosphorus, Orthophosphate as P Solids, Total Dissolved
H13070431-002	13BH-DT-PILOT-MGOH-072313	07/23/13 10:00	07/24/13	Aqueous	Same As Above
H13070431-003	13BH-DT-PILOT-SAPS-072313	07/23/13 11:15	07/24/13	Aqueous	Same As Above
H13070431-004	13BH-DT-PILOT-CHIT-072313	07/23/13 11:30	07/24/13	Aqueous	Same As Above
H13070431-005	13BH-DT-PILOT-BCR1-072313	07/23/13 12:00	07/24/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Conductivity Fluoride Anions by Ion Chromatography Phosphorus, Orthophosphate as P Solids, Total Dissolved Sulfide, Methylene Blue Colorimetric
H13070431-006	13BH-DT-PILOT-BDR1-072313	07/23/13 12:05	07/24/13	Aqueous	Same As Above
H13070431-007	13BH-DT-PILOT-BCR2-072313	07/23/13 12:50	07/24/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Biochemical Oxygen Demand, 5 Day Conductivity Fluoride Anions by Ion Chromatography Nitrogen, Ammonia Phosphorus, Orthophosphate as P Solids, Total Dissolved Sulfide, Methylene Blue Colorimetric
H13070431-008	13BH-DT-PILOT-BCR3-072313	07/23/13 13:45	07/24/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Conductivity Fluoride Anions by Ion Chromatography Phosphorus, Orthophosphate as P Solids, Total Dissolved Sulfide, Iodine Titrimetric

ANALYTICAL SUMMARY REPORT

H13070431-009	13BH-DT-PILOT-BCR4-072313	07/23/13 14:15	07/24/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Conductivity Fluoride Anions by Ion Chromatography Phosphorus, Orthophosphate as P Solids, Total Dissolved Sulfide, Methylene Blue Colorimetric
H13070431-010	13BH-DT-PILOT-BCR2-POST	07/23/13 14:45	07/24/13	Aqueous	Biochemical Oxygen Demand, 5 Day Nitrogen, Ammonia Sulfide, Methylene Blue Colorimetric

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By:

CLIENT: CDM Federal Programs
Project: Barker Hughsville Pilot
Sample Delivery Group: H13070431

Report Date: 08/07/13

CASE NARRATIVE

Tests associated with analyst identified as ELI-B were subcontracted to Energy Laboratories, 1120 S. 27th St., Billings, MT, EPA Number MT00005.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070431-001
Client Sample ID 13BH-DT-PILOT-INFL-072313

Report Date: 08/07/13
Collection Date: 07/23/13 10:30
DateReceived: 07/24/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1860	mg/L		10		A2540 C	07/24/13 13:58 / glj
INORGANICS							
Acidity, Total as CaCO3	820	mg/L	D	4.0		A2310 B	08/05/13 09:00 / cmm
Alkalinity, Total as CaCO3	ND	mg/L		1		A2320 B	07/24/13 17:35 / cmm
Bicarbonate as HCO3	ND	mg/L		1		A2320 B	07/24/13 17:35 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	07/24/13 17:35 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	07/24/13 17:35 / cmm
Chloride	1	mg/L		1		E300.0	07/25/13 13:55 / cmm
Sulfate	2000	mg/L		1		E300.0	07/25/13 13:55 / cmm
Fluoride	0.2	mg/L		0.1	4	A4500-F C	08/05/13 15:35 / cmm
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.28	mg/L	D	0.01		E365.1	07/24/13 10:51 / reh
METALS, DISSOLVED							
Aluminum	14.9	mg/L		0.03		E200.7	07/25/13 14:51 / sld
Arsenic	0.278	mg/L		0.001		E200.8	07/24/13 23:03 / raw
Barium	ND	mg/L		0.05		E200.8	07/24/13 23:03 / raw
Beryllium	0.008	mg/L		0.001		E200.8	07/24/13 23:03 / raw
Cadmium	0.298	mg/L		0.001		E200.8	07/24/13 23:03 / raw
Calcium	106	mg/L		1		E200.8	07/24/13 23:03 / raw
Chromium	0.006	mg/L		0.005		E200.8	07/24/13 23:03 / raw
Cobalt	0.048	mg/L		0.005		E200.8	07/25/13 21:25 / dck
Copper	1.94	mg/L		0.005		E200.8	07/24/13 23:03 / raw
Iron	179	mg/L		0.03		E200.8	07/24/13 23:03 / raw
Lead	0.212	mg/L		0.001		E200.8	07/24/13 23:03 / raw
Magnesium	25	mg/L		1		E200.8	07/24/13 23:03 / raw
Manganese	128	mg/L	D	0.003		E200.7	07/26/13 10:38 / sld
Nickel	0.037	mg/L		0.005		E200.8	07/24/13 23:03 / raw
Potassium	1	mg/L		1		E200.8	07/24/13 23:03 / raw
Silver	ND	mg/L		0.001		E200.8	07/24/13 23:03 / raw
Sodium	7	mg/L		1		E200.8	07/24/13 23:03 / raw
Thallium	0.0022	mg/L		0.0005		E200.8	07/24/13 23:03 / raw
Zinc	57.4	mg/L		0.01		E200.7	07/25/13 14:51 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	08/07/13
Project:	Barker Hughsville Pilot	**Collection Date:**	07/23/13 10:00
Lab ID:	H13070431-002	**DateReceived:**	07/24/13
Client Sample ID	13BH-DT-PILOT-MGOH-072313	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1810	mg/L		10		A2540 C	07/24/13 13:58 / glj
INORGANICS							
Acidity, Total as CaCO3	390	mg/L	D	4.0		A2310 B	08/05/13 09:00 / cmm
Alkalinity, Total as CaCO3	ND	mg/L		1		A2320 B	07/24/13 17:39 / cmm
Bicarbonate as HCO3	ND	mg/L		1		A2320 B	07/24/13 17:39 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	07/24/13 17:39 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	07/24/13 17:39 / cmm
Chloride	4	mg/L		1		E300.0	07/25/13 14:08 / cmm
Sulfate	1600	mg/L		1		E300.0	07/25/13 14:08 / cmm
Fluoride	1.5	mg/L	D	0.2	4	A4500-F C	08/05/13 15:43 / cmm
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.10	mg/L	D	0.01		E365.1	07/24/13 10:52 / reh
METALS, DISSOLVED							
Aluminum	7.52	mg/L		0.03		E200.7	07/25/13 14:55 / sld
Arsenic	0.004	mg/L		0.001		E200.8	07/24/13 23:07 / raw
Barium	ND	mg/L		0.05		E200.8	07/24/13 23:07 / raw
Beryllium	0.005	mg/L		0.001		E200.8	07/24/13 23:07 / raw
Cadmium	0.280	mg/L		0.001		E200.8	07/24/13 23:07 / raw
Calcium	111	mg/L		1		E200.8	07/24/13 23:07 / raw
Chromium	ND	mg/L		0.005		E200.8	07/24/13 23:07 / raw
Cobalt	0.047	mg/L		0.005		E200.8	07/25/13 21:30 / dck
Copper	1.40	mg/L		0.005		E200.8	07/24/13 23:07 / raw
Iron	0.47	mg/L		0.03		E200.8	07/24/13 23:07 / raw
Lead	0.023	mg/L		0.001		E200.8	07/24/13 23:07 / raw
Magnesium	149	mg/L		1		E200.8	07/24/13 23:07 / raw
Manganese	122	mg/L	D	0.003		E200.7	07/26/13 10:59 / sld
Nickel	0.036	mg/L		0.005		E200.8	07/24/13 23:07 / raw
Potassium	1	mg/L		1		E200.8	07/24/13 23:07 / raw
Silver	ND	mg/L		0.001		E200.8	07/24/13 23:07 / raw
Sodium	9	mg/L		1		E200.8	07/24/13 23:07 / raw
Thallium	0.0022	mg/L		0.0005		E200.8	07/24/13 23:07 / raw
Zinc	52.8	mg/L		0.01		E200.7	07/25/13 14:55 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070431-003
Client Sample ID 13BH-DT-PILOT-SAPS-072313

Report Date: 08/07/13
Collection Date: 07/23/13 11:15
DateReceived: 07/24/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1950	mg/L		10		A2540 C	07/24/13 13:58 / glj
INORGANICS							
Acidity, Total as CaCO3	440	mg/L	D	4.0		A2310 B	08/05/13 09:00 / cmm
Alkalinity, Total as CaCO3	10	mg/L		1		A2320 B	07/24/13 17:45 / cmm
Bicarbonate as HCO3	12	mg/L		1		A2320 B	07/24/13 17:45 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	07/24/13 17:45 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	07/24/13 17:45 / cmm
Chloride	ND	mg/L		1		E300.0	07/30/13 15:33 / abb
Sulfate	1500	mg/L		1		E300.0	07/31/13 11:24 / jaw
Fluoride	1.4	mg/L	D	0.2	4	A4500-F C	08/05/13 15:48 / cmm
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.07	mg/L	D	0.01		E365.1	07/24/13 11:43 / reh
METALS, DISSOLVED							
Aluminum	1.44	mg/L		0.03		E200.8	07/24/13 23:12 / raw
Arsenic	0.005	mg/L		0.001		E200.8	07/24/13 23:12 / raw
Barium	0.09	mg/L		0.05		E200.8	07/24/13 23:12 / raw
Beryllium	0.001	mg/L		0.001		E200.8	07/24/13 23:12 / raw
Cadmium	0.045	mg/L		0.001		E200.8	07/24/13 23:12 / raw
Calcium	267	mg/L		1		E200.8	07/24/13 23:12 / raw
Chromium	ND	mg/L		0.005		E200.8	07/24/13 23:12 / raw
Cobalt	0.062	mg/L		0.005		E200.8	07/25/13 21:34 / dck
Copper	0.007	mg/L		0.005		E200.8	07/24/13 23:12 / raw
Iron	108	mg/L		0.03		E200.8	07/24/13 23:12 / raw
Lead	ND	mg/L		0.001		E200.8	07/24/13 23:12 / raw
Magnesium	28	mg/L		1		E200.8	07/24/13 23:12 / raw
Manganese	135	mg/L	D	0.003		E200.7	07/26/13 11:03 / sld
Nickel	0.037	mg/L		0.005		E200.8	07/24/13 23:12 / raw
Potassium	2	mg/L		1		E200.8	07/24/13 23:12 / raw
Silver	ND	mg/L		0.001		E200.8	07/24/13 23:12 / raw
Sodium	7	mg/L		1		E200.8	07/24/13 23:12 / raw
Thallium	ND	mg/L		0.0005		E200.8	07/24/13 23:12 / raw
Zinc	42.9	mg/L		0.01		E200.7	07/25/13 14:59 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	08/07/13
Project:	Barker Hughsville Pilot	**Collection Date:**	07/23/13 11:30
Lab ID:	H13070431-004	**DateReceived:**	07/24/13
Client Sample ID	13BH-DT-PILOT-CHIT-072313	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	3980	mg/L		10		A2540 C	07/24/13 13:59 / glj
INORGANICS							
Acidity, Total as CaCO3	ND	mg/L	D	4.0		A2310 B	08/05/13 09:00 / cmm
Alkalinity, Total as CaCO3	1800	mg/L		1		A2320 B	07/24/13 17:58 / cmm
Bicarbonate as HCO3	2200	mg/L		1		A2320 B	07/24/13 17:58 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	07/24/13 17:58 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	07/24/13 17:58 / cmm
Chloride	37	mg/L	D	5		E300.0	07/30/13 15:45 / abb
Sulfate	1100	mg/L	D	2		E300.0	07/30/13 15:45 / abb
Fluoride	0.1	mg/L		0.1	4	A4500-F C	08/05/13 15:49 / cmm
NUTRIENTS							
Phosphorus, Orthophosphate as P	12.5	mg/L	D	0.1		E365.1	07/24/13 10:54 / reh
METALS, DISSOLVED							
Aluminum	ND	mg/L		0.03		E200.8	07/24/13 23:16 / raw
Arsenic	0.024	mg/L		0.001		E200.8	07/24/13 23:16 / raw
Barium	0.05	mg/L		0.05		E200.8	07/24/13 23:16 / raw
Beryllium	ND	mg/L		0.001		E200.8	07/24/13 23:16 / raw
Cadmium	ND	mg/L		0.001		E200.8	07/24/13 23:16 / raw
Calcium	926	mg/L		1		E200.8	07/24/13 23:16 / raw
Chromium	ND	mg/L		0.005		E200.8	07/24/13 23:16 / raw
Cobalt	0.006	mg/L		0.005		E200.8	07/29/13 14:55 / dck
Copper	ND	mg/L		0.005		E200.8	07/24/13 23:16 / raw
Iron	0.82	mg/L		0.03		E200.8	07/24/13 23:16 / raw
Lead	ND	mg/L		0.001		E200.8	07/24/13 23:16 / raw
Magnesium	60	mg/L		1		E200.8	07/24/13 23:16 / raw
Manganese	8.88	mg/L	D	0.003		E200.7	07/25/13 15:03 / sld
Nickel	0.009	mg/L		0.005		E200.8	07/24/13 23:16 / raw
Potassium	10	mg/L		1		E200.8	07/24/13 23:16 / raw
Silver	ND	mg/L		0.001		E200.8	07/24/13 23:16 / raw
Sodium	42	mg/L		1		E200.8	07/24/13 23:16 / raw
Thallium	ND	mg/L		0.0005		E200.8	07/24/13 23:16 / raw
Zinc	0.02	mg/L		0.01		E200.8	07/24/13 23:16 / raw

Report Definitions:	RL - Analyte reporting limit.	MCL - Maximum contaminant level.
	QCL - Quality control limit.	ND - Not detected at the reporting limit.
	D - RL increased due to sample matrix.	

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	08/07/13
Project:	Barker Hughsville Pilot	**Collection Date:**	07/23/13 12:00
Lab ID:	H13070431-005	**DateReceived:**	07/24/13
Client Sample ID	13BH-DT-PILOT-BCR1-072313	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1870	mg/L		10		A2540 C	07/24/13 13:59 / glj
INORGANICS							
Acidity, Total as CaCO3	270	mg/L	D	4.0		A2310 B	08/05/13 09:00 / cmm
Alkalinity, Total as CaCO3	93	mg/L		1		A2320 B	07/24/13 18:04 / cmm
Bicarbonate as HCO3	110	mg/L		1		A2320 B	07/24/13 18:04 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	07/24/13 18:04 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	07/24/13 18:04 / cmm
Chloride	2	mg/L		1		E300.0	07/30/13 15:58 / abb
Sulfate	1200	mg/L		1		E300.0	07/31/13 11:37 / jaw
Fluoride	1.3	mg/L	D	0.2	4	A4500-F C	08/05/13 15:51 / cmm
Sulfide	0.94	mg/L		0.04		A4500-S D	07/26/13 14:15 / eli-b22
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.81	mg/L	D	0.01		E365.1	07/24/13 11:44 / reh
METALS, DISSOLVED							
Aluminum	0.09	mg/L		0.03		E200.8	07/24/13 23:58 / raw
Arsenic	0.007	mg/L		0.001		E200.8	07/24/13 23:58 / raw
Barium	0.36	mg/L		0.05		E200.8	07/24/13 23:58 / raw
Beryllium	ND	mg/L		0.001		E200.8	07/24/13 23:58 / raw
Cadmium	ND	mg/L		0.001		E200.8	07/24/13 23:58 / raw
Calcium	301	mg/L		1		E200.8	07/24/13 23:58 / raw
Chromium	ND	mg/L		0.005		E200.8	07/24/13 23:58 / raw
Cobalt	0.028	mg/L		0.005		E200.8	07/25/13 21:43 / dck
Copper	ND	mg/L		0.005		E200.8	07/24/13 23:58 / raw
Iron	104	mg/L		0.03		E200.8	07/24/13 23:58 / raw
Lead	ND	mg/L		0.001		E200.8	07/24/13 23:58 / raw
Magnesium	40	mg/L		1		E200.8	07/24/13 23:58 / raw
Manganese	122	mg/L	D	0.003		E200.7	07/26/13 11:07 / sld
Nickel	0.008	mg/L		0.005		E200.8	07/24/13 23:58 / raw
Potassium	7	mg/L		1		E200.8	07/24/13 23:58 / raw
Silver	ND	mg/L		0.001		E200.8	07/24/13 23:58 / raw
Sodium	5	mg/L		1		E200.8	07/24/13 23:58 / raw
Thallium	ND	mg/L		0.0005		E200.8	07/24/13 23:58 / raw
Zinc	0.06	mg/L		0.01		E200.8	07/24/13 23:58 / raw

Report Definitions:

RL - Analyte reporting limit.

QCL - Quality control limit.

D - RL increased due to sample matrix.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070431-006
Client Sample ID 13BH-DT-PILOT-BDR1-072313

Report Date: 08/07/13
Collection Date: 07/23/13 12:05
DateReceived: 07/24/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1900	mg/L		10		A2540 C	07/24/13 13:59 / glj
INORGANICS							
Acidity, Total as CaCO3	270	mg/L	D	4.0		A2310 B	08/05/13 09:00 / cmm
Alkalinity, Total as CaCO3	99	mg/L		1		A2320 B	07/24/13 18:10 / cmm
Bicarbonate as HCO3	120	mg/L		1		A2320 B	07/24/13 18:10 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	07/24/13 18:10 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	07/24/13 18:10 / cmm
Chloride	2	mg/L		1		E300.0	07/30/13 16:10 / abb
Sulfate	1300	mg/L		1		E300.0	07/25/13 14:58 / cmm
Fluoride	1.3	mg/L	D	0.2	4	A4500-F C	08/05/13 15:52 / cmm
Sulfide	1.2	mg/L	D	0.2		A4500-S D	07/26/13 14:15 / eli-b22
NUTRIENTS							
Phosphorus, Orthophosphate as P	1.43	mg/L	D	0.01		E365.1	07/24/13 11:45 / reh
METALS, DISSOLVED							
Aluminum	0.09	mg/L		0.03		E200.8	07/25/13 00:02 / raw
Arsenic	0.008	mg/L		0.001		E200.8	07/25/13 00:02 / raw
Barium	0.36	mg/L		0.05		E200.8	07/25/13 00:02 / raw
Beryllium	ND	mg/L		0.001		E200.8	07/25/13 00:02 / raw
Cadmium	ND	mg/L		0.001		E200.8	07/25/13 00:02 / raw
Calcium	300	mg/L		1		E200.8	07/25/13 00:02 / raw
Chromium	ND	mg/L		0.005		E200.8	07/25/13 00:02 / raw
Cobalt	0.040	mg/L		0.005		E200.8	07/25/13 21:48 / dck
Copper	ND	mg/L		0.005		E200.8	07/25/13 00:02 / raw
Iron	106	mg/L		0.03		E200.8	07/25/13 00:02 / raw
Lead	ND	mg/L		0.001		E200.8	07/25/13 00:02 / raw
Magnesium	40	mg/L		1		E200.8	07/25/13 00:02 / raw
Manganese	122	mg/L	D	0.003		E200.7	07/26/13 11:10 / sld
Nickel	0.007	mg/L		0.005		E200.8	07/25/13 00:02 / raw
Potassium	8	mg/L		1		E200.8	07/25/13 00:02 / raw
Silver	ND	mg/L		0.001		E200.8	07/25/13 00:02 / raw
Sodium	7	mg/L		1		E200.8	07/25/13 00:02 / raw
Thallium	ND	mg/L		0.0005		E200.8	07/25/13 00:02 / raw
Zinc	0.09	mg/L		0.01		E200.8	07/25/13 00:02 / raw

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13070431-007
Client Sample ID 13BH-DT-PILOT-BCR2-072313

Report Date: 08/07/13
Collection Date: 07/23/13 12:50
DateReceived: 07/24/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1890	mg/L		10		A2540 C	07/24/13 13:59 / glj
INORGANICS							
Acidity, Total as CaCO3	16	mg/L	D	4.0		A2310 B	08/05/13 09:00 / cmm
Alkalinity, Total as CaCO3	200	mg/L		1		A2320 B	07/24/13 18:16 / cmm
Bicarbonate as HCO3	250	mg/L		1		A2320 B	07/24/13 18:16 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	07/24/13 18:16 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	07/24/13 18:16 / cmm
Chloride	3	mg/L		1		E300.0	07/25/13 15:11 / cmm
Sulfate	1200	mg/L		1		E300.0	07/25/13 15:11 / cmm
Fluoride	0.8	mg/L	D	0.2	4	A4500-F C	08/05/13 15:52 / cmm
Sulfide	2.4	mg/L	D	0.2		A4500-S D	07/26/13 14:15 / eli-b22
AGGREGATE ORGANICS							
Oxygen Demand, Biochemical (BOD)	75	mg/L		30		A5210 B	07/24/13 15:22 / kjw
NUTRIENTS							
Nitrogen, Ammonia as N	3.2	mg/L	D	0.1		E350.1	07/29/13 11:51 / reh
Phosphorus, Orthophosphate as P	4.77	mg/L	D	0.02		E365.1	07/24/13 11:46 / reh
METALS, DISSOLVED							
Aluminum	ND	mg/L		0.03		E200.8	07/25/13 00:07 / raw
Arsenic	0.002	mg/L		0.001		E200.8	07/25/13 00:07 / raw
Barium	0.42	mg/L		0.05		E200.8	07/25/13 00:07 / raw
Beryllium	ND	mg/L		0.001		E200.8	07/25/13 00:07 / raw
Cadmium	ND	mg/L		0.001		E200.8	07/25/13 00:07 / raw
Calcium	349	mg/L		1		E200.8	07/25/13 00:07 / raw
Chromium	ND	mg/L		0.005		E200.8	07/25/13 00:07 / raw
Cobalt	0.007	mg/L		0.005		E200.8	07/25/13 21:52 / dck
Copper	ND	mg/L		0.005		E200.8	07/25/13 00:07 / raw
Iron	33.3	mg/L		0.03		E200.8	07/25/13 00:07 / raw
Lead	ND	mg/L		0.001		E200.8	07/25/13 00:07 / raw
Magnesium	48	mg/L		1		E200.8	07/25/13 00:07 / raw
Manganese	102	mg/L	D	0.003		E200.7	07/26/13 11:14 / sld
Nickel	ND	mg/L		0.005		E200.8	07/25/13 00:07 / raw
Potassium	13	mg/L		1		E200.8	07/25/13 00:07 / raw
Silver	ND	mg/L		0.001		E200.8	07/25/13 00:07 / raw
Sodium	7	mg/L		1		E200.8	07/25/13 00:07 / raw
Thallium	ND	mg/L		0.0005		E200.8	07/25/13 00:07 / raw
Zinc	0.02	mg/L		0.01		E200.8	07/25/13 00:07 / raw

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	08/07/13
Project:	Barker Hughsville Pilot	**Collection Date:**	07/23/13 13:45
Lab ID:	H13070431-008	**DateReceived:**	07/24/13
Client Sample ID	13BH-DT-PILOT-BCR3-072313	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	4490	mg/L		10		A2540 C	07/24/13 13:59 / glj
INORGANICS							
Acidity, Total as CaCO3	ND	mg/L	D	4.0		A2310 B	08/05/13 09:00 / cmm
Alkalinity, Total as CaCO3	2600	mg/L		1		A2320 B	07/24/13 18:32 / cmm
Bicarbonate as HCO3	3200	mg/L		1		A2320 B	07/24/13 18:32 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	07/24/13 18:32 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	07/24/13 18:32 / cmm
Chloride	96	mg/L	D	5		E300.0	07/25/13 16:14 / cmm
Sulfate	970	mg/L	D	2		E300.0	07/25/13 16:14 / cmm
Fluoride	0.1	mg/L		0.1	4	A4500-F C	08/05/13 15:53 / cmm
Sulfide	23	mg/L		1		A4500-S F	07/26/13 14:00 / eli-b22
NUTRIENTS							
Phosphorus, Orthophosphate as P	15.3	mg/L	D	0.05		E365.1	07/24/13 11:53 / reh
METALS, DISSOLVED							
Aluminum	ND	mg/L		0.03		E200.8	07/25/13 00:11 / raw
Arsenic	0.041	mg/L		0.001		E200.8	07/25/13 00:11 / raw
Barium	0.53	mg/L		0.05		E200.8	07/25/13 00:11 / raw
Beryllium	ND	mg/L		0.001		E200.8	07/25/13 00:11 / raw
Cadmium	ND	mg/L		0.001		E200.8	07/25/13 00:11 / raw
Calcium	824	mg/L		1		E200.8	07/25/13 00:11 / raw
Chromium	ND	mg/L		0.005		E200.8	07/25/13 00:11 / raw
Cobalt	ND	mg/L		0.005		E200.8	07/25/13 22:15 / dck
Copper	ND	mg/L		0.005		E200.8	07/25/13 00:11 / raw
Iron	0.14	mg/L		0.03		E200.8	07/29/13 15:17 / dck
Lead	ND	mg/L		0.001		E200.8	07/25/13 00:11 / raw
Magnesium	113	mg/L		1		E200.8	07/25/13 00:11 / raw
Manganese	1.72	mg/L	D	0.003		E200.7	07/25/13 15:38 / sld
Nickel	0.011	mg/L		0.005		E200.8	07/25/13 00:11 / raw
Potassium	39	mg/L		1		E200.8	07/25/13 00:11 / raw
Silver	ND	mg/L		0.001		E200.8	07/25/13 00:11 / raw
Sodium	60	mg/L		1		E200.8	07/25/13 00:11 / raw
Thallium	ND	mg/L		0.0005		E200.8	07/25/13 00:11 / raw
Zinc	0.02	mg/L		0.01		E200.8	07/25/13 00:11 / raw

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	08/07/13
Project:	Barker Hughsville Pilot	**Collection Date:**	07/23/13 14:15
Lab ID:	H13070431-009	**DateReceived:**	07/24/13
Client Sample ID	13BH-DT-PILOT-BCR4-072313	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1860	mg/L		10		A2540 C	07/24/13 13:59 / glj
INORGANICS							
Acidity, Total as CaCO3	ND	mg/L	D	4.0		A2310 B	08/05/13 09:00 / cmm
Alkalinity, Total as CaCO3	200	mg/L		1		A2320 B	07/24/13 18:39 / cmm
Bicarbonate as HCO3	240	mg/L		1		A2320 B	07/24/13 18:39 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	07/24/13 18:39 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	07/24/13 18:39 / cmm
Chloride	4	mg/L		1		E300.0	07/30/13 17:39 / abb
Sulfate	1100	mg/L		1		E300.0	07/25/13 16:26 / cmm
Fluoride	1.2	mg/L	D	0.2	4	A4500-F C	08/05/13 15:54 / cmm
Sulfide	6.6	mg/L	D	0.2		A4500-S D	07/26/13 14:15 / eli-b22
NUTRIENTS							
Phosphorus, Orthophosphate as P	5.66	mg/L	D	0.02		E365.1	07/24/13 11:54 / reh
METALS, DISSOLVED							
Aluminum	ND	mg/L		0.03		E200.8	07/25/13 00:16 / raw
Arsenic	0.002	mg/L		0.001		E200.8	07/25/13 00:16 / raw
Barium	0.34	mg/L		0.05		E200.8	07/25/13 00:16 / raw
Beryllium	ND	mg/L		0.001		E200.8	07/25/13 00:16 / raw
Cadmium	ND	mg/L		0.001		E200.8	07/25/13 00:16 / raw
Calcium	219	mg/L		1		E200.8	07/25/13 00:16 / raw
Chromium	ND	mg/L		0.005		E200.8	07/25/13 00:16 / raw
Cobalt	ND	mg/L		0.005		E200.8	07/25/13 22:20 / dck
Copper	ND	mg/L		0.005		E200.8	07/25/13 00:16 / raw
Iron	1.50	mg/L		0.03		E200.8	07/25/13 00:16 / raw
Lead	ND	mg/L		0.001		E200.8	07/25/13 00:16 / raw
Magnesium	150	mg/L		1		E200.8	07/25/13 00:16 / raw
Manganese	61.1	mg/L		0.001		E200.7	07/25/13 15:42 / sld
Nickel	ND	mg/L		0.005		E200.8	07/25/13 00:16 / raw
Potassium	9	mg/L		1		E200.8	07/25/13 00:16 / raw
Silver	ND	mg/L		0.001		E200.8	07/25/13 00:16 / raw
Sodium	9	mg/L		1		E200.8	07/25/13 00:16 / raw
Thallium	ND	mg/L		0.0005		E200.8	07/25/13 00:16 / raw
Zinc	0.02	mg/L		0.01		E200.8	07/29/13 15:22 / dck

Report Definitions:	RL - Analyte reporting limit.	MCL - Maximum contaminant level.
	QCL - Quality control limit.	ND - Not detected at the reporting limit.
	D - RL increased due to sample matrix.	

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	08/07/13
Project:	Barker Hughsville Pilot	**Collection Date:**	07/23/13 14:45
Lab ID:	H13070431-010	**DateReceived:**	07/24/13
Client Sample ID	13BH-DT-PILOT-BCR2-POST	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
INORGANICS							
Sulfide	0.47	mg/L		0.04		A4500-S D	07/26/13 14:15 / eli-b22
AGGREGATE ORGANICS							
Oxygen Demand, Biochemical (BOD)	94	mg/L		30		A5210 B	07/24/13 15:23 / kjw
NUTRIENTS							
Nitrogen, Ammonia as N	5.0	mg/L	D	0.2		E350.1	07/29/13 12:16 / reh

Report Definitions:

RL - Analyte reporting limit.

QCL - Quality control limit.

D - RL increased due to sample matrix.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 08/07/13
Project: Barker Hughsville Pilot
Work Order: H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2310 B										Batch: H13070399-018A
Sample ID: H13070431-009ADUP		Sample Duplicate				Run: MISC WC_130805A				08/05/13 09:00
Acidity, Total as CaCO3		ND	mg/L	4.0					20	
Sample ID: LCS1308050900		Laboratory Control Sample				Run: MISC WC_130805A				08/05/13 09:00
Acidity, Total as CaCO3		720	mg/L	4.0	92	90	110			
Sample ID: MBLK1308050900		Method Blank				Run: MISC WC_130805A				08/05/13 09:00
Acidity, Total as CaCO3		ND	mg/L	3						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 08/07/13
Work Order: H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2320 B										Batch: R89957
Sample ID: MBLK		Method Blank				Run: MAN-TECH_130724C				07/24/13 16:48
Alkalinity, Total as CaCO3		ND	mg/L	2						
Sample ID: LCS-07222013		Laboratory Control Sample				Run: MAN-TECH_130724C				07/24/13 16:57
Alkalinity, Total as CaCO3		630	mg/L	4.0	105	90	110			
Sample ID: H13070395-001ADUP	3	Sample Duplicate				Run: MAN-TECH_130724C				07/24/13 17:12
Alkalinity, Total as CaCO3		260	mg/L	4.0				0.2	10	
Bicarbonate as HCO3		310	mg/L	4.0				0.2	10	
Carbonate as CO3		ND	mg/L	4.0					10	
Sample ID: H13070399-002AMS		Sample Matrix Spike				Run: MAN-TECH_130724C				07/24/13 17:27
Alkalinity, Total as CaCO3		680	mg/L	4.0	102	80	120			
Sample ID: H13070431-009ADUP	3	Sample Duplicate				Run: MAN-TECH_130724C				07/24/13 18:46
Alkalinity, Total as CaCO3		190	mg/L	4.0				0.9	10	
Bicarbonate as HCO3		240	mg/L	4.0				0.9	10	
Carbonate as CO3		ND	mg/L	4.0					10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 08/07/13
Work Order: H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2540 C									Batch: TDS130724A	
Sample ID: MB-1_130724A		Method Blank				Run: ACCU-124 (14410200)_130724			07/24/13 13:57	
Solids, Total Dissolved TDS @ 180 C		ND	mg/L	1						
Sample ID: LCS-2_130724A		Laboratory Control Sample				Run: ACCU-124 (14410200)_130724			07/24/13 13:58	
Solids, Total Dissolved TDS @ 180 C		1960	mg/L	10	98	90	110			
Sample ID: H13070419-001B DUP		Sample Duplicate				Run: ACCU-124 (14410200)_130724			07/24/13 13:58	
Solids, Total Dissolved TDS @ 180 C		748	mg/L	10				1.1	5	
Sample ID: H13070431-001A MS		Sample Matrix Spike				Run: ACCU-124 (14410200)_130724			07/24/13 13:58	
Solids, Total Dissolved TDS @ 180 C		3660	mg/L	10	90	80	120			
Sample ID: H13070442-001ADUP		Sample Duplicate				Run: ACCU-124 (14410200)_130724			07/24/13 15:07	
Solids, Total Dissolved TDS @ 180 C		72.0	mg/L	10					5	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 08/07/13
Project: Barker Hughsville Pilot
Work Order: H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-F C										Analytical Run: PH_130805A
Sample ID: ICV1_130805A		Initial Calibration Verification Standard								08/05/13 15:20
Fluoride		0.7	mg/L	0.1	96	90	110			
Method: A4500-F C										Batch: 130805A-F-ISE-W
Sample ID: MBLK1_130805A		Method Blank				Run: PH_130805A				08/05/13 15:19
Fluoride		0.008	mg/L	0.005						
Sample ID: LFB1_130805A		Laboratory Fortified Blank				Run: PH_130805A				08/05/13 15:21
Fluoride		0.5	mg/L	0.1	99	90	110			
Sample ID: H13070414-001AMS		Sample Matrix Spike				Run: PH_130805A				08/05/13 15:33
Fluoride		4.8	mg/L	0.5	88	85	115			
Sample ID: H13070414-001AMSD		Sample Matrix Spike Duplicate				Run: PH_130805A				08/05/13 15:34
Fluoride		4.7	mg/L	0.5	87	85	115	0.3	10	
Sample ID: H13070442-001AMS		Sample Matrix Spike				Run: PH_130805A				08/05/13 16:04
Fluoride		0.6	mg/L	0.1	98	85	115			
Sample ID: H13070442-001AMSD		Sample Matrix Spike Duplicate				Run: PH_130805A				08/05/13 16:05
Fluoride		0.6	mg/L	0.1	99	85	115	0.9	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 08/07/13
Work Order: H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-S D										Batch: B_R208956
Sample ID: MB-R208956		Method Blank				Run: SUB-B208956				07/26/13 14:15
Sulfide		ND	mg/L	0.002						
Sample ID: LCS-R208956		Laboratory Control Sample				Run: SUB-B208956				07/26/13 14:15
Sulfide		0.268	mg/L	0.040	112	70	130			
Sample ID: B13072242-002DMS		Sample Matrix Spike				Run: SUB-B208956				07/26/13 14:15
Sulfide		0.332	mg/L	0.040	121	70	130			
Sample ID: B13072242-002DMSD		Sample Matrix Spike Duplicate				Run: SUB-B208956				07/26/13 14:15
Sulfide		0.316	mg/L	0.040	114	70	130	5.1	20	
Sample ID: B13072211-001DMS		Sample Matrix Spike				Run: SUB-B208956				07/26/13 14:15
Sulfide		0.264	mg/L	0.040	100	70	130			
Sample ID: B13072211-001DMSD		Sample Matrix Spike Duplicate				Run: SUB-B208956				07/26/13 14:15
Sulfide		0.272	mg/L	0.040	104	70	130	3.1	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 08/07/13
Work Order: H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-S F										Batch: B_R208958
Sample ID: MB-R208958		Method Blank				Run: SUB-B208958				07/26/13 14:00
Sulfide		ND	mg/L	0.5						
Sample ID: LCS-R208958		Laboratory Control Sample				Run: SUB-B208958				07/26/13 14:00
Sulfide		25.6	mg/L	1.0	99	70	130			
Sample ID: B13072117-001BMS		Sample Matrix Spike				Run: SUB-B208958				07/26/13 14:00
Sulfide		25.8	mg/L	1.0	100	80	120			
Sample ID: B13072117-001BMSD		Sample Matrix Spike Duplicate				Run: SUB-B208958				07/26/13 14:00
Sulfide		25.9	mg/L	1.0	101	80	120	0.3	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 08/07/13

Project: Barker Hughsville Pilot **Work Order:** H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **A5210 B**								Batch: 130724_1_BOD5-W		
Sample ID: **Dil-H201_130724**	Dilution Water Blank					Run: MISC WC_130724A			07/24/13 15:06	
Oxygen Demand, Biochemical (BOD)		0.10	mg/L	2.0		0	0.2			
Sample ID: **GGA1_130724**	Laboratory Control Sample					Run: MISC WC_130724A			07/24/13 15:11	
Oxygen Demand, Biochemical (BOD)		200	mg/L	58	101	85	115			
Sample ID: **H13070435-001BDUP**	Sample Duplicate					Run: MISC WC_130724A			07/24/13 15:25	
Oxygen Demand, Biochemical (BOD)		150	mg/L	120		90	110	0.1	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 08/07/13
Work Order: H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7										Analytical Run: ICP2-HE_130725B
Sample ID: ICV	3	Initial Calibration Verification Standard								07/25/13 12:49
Aluminum		4.02	mg/L	0.10	101	95	105			
Manganese		3.94	mg/L	0.010	99	95	105			
Zinc		0.805	mg/L	0.010	101	95	105			
Sample ID: CCV-1	3	Continuing Calibration Verification Standard								07/25/13 12:53
Aluminum		2.49	mg/L	0.10	100	95	105			
Manganese		2.47	mg/L	0.010	99	95	105			
Zinc		2.50	mg/L	0.010	100	95	105			
Sample ID: ICSA	3	Interference Check Sample A								07/25/13 13:04
Aluminum		521	mg/L	0.10	104	80	120			
Manganese		0.00323	mg/L	0.010		0	0			
Zinc		0.0126	mg/L	0.010		0	0			
Sample ID: ICSAB	3	Interference Check Sample AB								07/25/13 13:08
Aluminum		518	mg/L	0.10	104	80	120			
Manganese		0.487	mg/L	0.010	97	80	120			
Zinc		0.993	mg/L	0.010	99	80	120			
Sample ID: CCV	3	Continuing Calibration Verification Standard								07/25/13 14:22
Aluminum		2.41	mg/L	0.10	96	90	110			
Manganese		2.38	mg/L	0.010	95	90	110			
Zinc		2.37	mg/L	0.010	95	90	110			
Sample ID: CCV	3	Continuing Calibration Verification Standard								07/25/13 15:07
Aluminum		2.43	mg/L	0.10	97	90	110			
Manganese		2.42	mg/L	0.010	97	90	110			
Zinc		2.42	mg/L	0.010	97	90	110			
Method: E200.7										Batch: R89996
Sample ID: ICB	3	Method Blank				Run: ICP2-HE_130725B				07/25/13 13:15
Aluminum		ND	mg/L	0.004						
Manganese		ND	mg/L	0.0005						
Zinc		0.001	mg/L	0.001						
Sample ID: LFB	3	Laboratory Fortified Blank				Run: ICP2-HE_130725B				07/25/13 13:19
Aluminum		4.86	mg/L	0.10	97	85	115			
Manganese		4.79	mg/L	0.010	96	85	115			
Zinc		0.958	mg/L	0.010	96	85	115			
Sample ID: H13070372-050AMS2	3	Sample Matrix Spike				Run: ICP2-HE_130725B				07/25/13 14:29
Aluminum		4.65	mg/L	0.030	93	70	130			
Manganese		4.89	mg/L	0.0010	97	70	130			
Zinc		0.975	mg/L	0.010	96	70	130			
Sample ID: H13070372-050AMSD2	3	Sample Matrix Spike Duplicate				Run: ICP2-HE_130725B				07/25/13 14:33
Aluminum		4.66	mg/L	0.030	93	70	130	0.3	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 08/07/13
Work Order: H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7										Batch: R89996
Sample ID: H13070372-050AMSD2	3	Sample Matrix Spike Duplicate				Run: ICP2-HE_130725B				07/25/13 14:33
Manganese		4.93	mg/L	0.0010	97	70	130	0.8	20	
Zinc		0.973	mg/L	0.010	96	70	130	0.2	20	
Sample ID: H13070431-006BMS2	3	Sample Matrix Spike				Run: ICP2-HE_130725B				07/25/13 15:26
Aluminum		5.17	mg/L	0.030	102	70	130			
Manganese		114	mg/L	0.0010		70	130			A
Zinc		1.03	mg/L	0.010	96	70	130			
Sample ID: H13070431-006BMSD2	3	Sample Matrix Spike Duplicate				Run: ICP2-HE_130725B				07/25/13 15:30
Aluminum		5.12	mg/L	0.030	101	70	130	0.9	20	
Manganese		113	mg/L	0.0010		70	130	0.7	20	A
Zinc		1.00	mg/L	0.010	93	70	130	2.1	20	
Method: E200.7										Analytical Run: ICP2-HE_130726A
Sample ID: ICV		Initial Calibration Verification Standard								07/26/13 10:04
Manganese		3.94	mg/L	0.010	98	95	105			
Sample ID: CCV-1		Continuing Calibration Verification Standard								07/26/13 10:08
Manganese		2.46	mg/L	0.010	98	95	105			
Sample ID: ICSA		Interference Check Sample A								07/26/13 10:19
Manganese		0.00371	mg/L	0.010		0	0			
Sample ID: ICSAB		Interference Check Sample AB								07/26/13 10:23
Manganese		0.483	mg/L	0.010	97	80	120			
Sample ID: CCV		Continuing Calibration Verification Standard								07/26/13 10:52
Manganese		2.52	mg/L	0.010	101	90	110			
Method: E200.7										Batch: R90028
Sample ID: ICB		Method Blank				Run: ICP2-HE_130726A				07/26/13 10:31
Manganese		ND	mg/L	0.0005						
Sample ID: LFB		Laboratory Fortified Blank				Run: ICP2-HE_130726A				07/26/13 10:34
Manganese		4.92	mg/L	0.010	98	85	115			
Sample ID: H13070431-001BMS2		Sample Matrix Spike				Run: ICP2-HE_130726A				07/26/13 10:45
Manganese		154	mg/L	0.0027		70	130			A
Sample ID: H13070431-001BMSD2		Sample Matrix Spike Duplicate				Run: ICP2-HE_130726A				07/26/13 10:49
Manganese		153	mg/L	0.0027		70	130	0.8	20	A

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs | **Report Date:** 08/07/13

Project: Barker Hughsville Pilot | **Work Order:** H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130724A
Sample ID: ICV STD	17	Initial Calibration Verification Standard								07/24/13 12:40
Aluminum		0.289	mg/L	0.10	96	90	110			
Arsenic		0.0612	mg/L	0.0050	102	90	110			
Barium		0.0613	mg/L	0.10	102	90	110			
Beryllium		0.0308	mg/L	0.0010	103	90	110			
Cadmium		0.0326	mg/L	0.0010	109	90	110			
Calcium		3.20	mg/L	0.50	107	90	110			
Chromium		0.0614	mg/L	0.010	102	90	110			
Copper		0.0623	mg/L	0.010	104	90	110			
Iron		0.320	mg/L	0.030	107	90	110			
Lead		0.0627	mg/L	0.010	104	90	110			
Magnesium		3.13	mg/L	0.50	104	90	110			
Nickel		0.0629	mg/L	0.010	105	90	110			
Potassium		3.05	mg/L	0.50	102	90	110			
Silver		0.0309	mg/L	0.0050	103	90	110			
Sodium		3.06	mg/L	0.50	102	90	110			
Thallium		0.0594	mg/L	0.10	99	90	110			
Zinc		0.0636	mg/L	0.010	106	90	110			
Sample ID: ICSA	17	Interference Check Sample A								07/24/13 12:45
Aluminum		35.4	mg/L	0.10	88	70	130			
Arsenic		0.000322	mg/L	0.0050						
Barium		0.000238	mg/L	0.10						
Beryllium		ND	mg/L	0.0010						
Cadmium		0.00103	mg/L	0.0010						
Calcium		108	mg/L	0.50	90	70	130			
Chromium		0.00111	mg/L	0.010						
Copper		0.000338	mg/L	0.010						
Iron		94.3	mg/L	0.030	94	70	130			
Lead		0.000225	mg/L	0.010						
Magnesium		39.5	mg/L	0.50	99	70	130			
Nickel		0.000678	mg/L	0.010						
Potassium		39.0	mg/L	0.50	98	70	130			
Silver		0.000203	mg/L	0.0050						
Sodium		98.0	mg/L	0.50	98	70	130			
Thallium		7.00E-05	mg/L	0.10						
Zinc		0.00123	mg/L	0.010						
Sample ID: ICSAB	17	Interference Check Sample AB								07/24/13 12:49
Aluminum		35.5	mg/L	0.10	89	70	130			
Arsenic		0.0105	mg/L	0.0050	105	70	130			
Barium		7.30E-05	mg/L	0.10		0	0			
Beryllium		1.50E-05	mg/L	0.0010		0	0			
Cadmium		0.0106	mg/L	0.0010	106	70	130			
Calcium		109	mg/L	0.50	91	70	130			
Chromium		0.0219	mg/L	0.010	110	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 08/07/13
Project: Barker Hughsville Pilot **Work Order:** H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**										Analytical Run: ICPMS204-B_130724A
Sample ID: **ICSAB**	17	Interference Check Sample AB								07/24/13 12:49
Copper		0.0200	mg/L	0.010	100	70	130			
Iron		92.5	mg/L	0.030	93	70	130			
Lead		0.000233	mg/L	0.010		0	0			
Magnesium		40.3	mg/L	0.50	101	70	130			
Nickel		0.0209	mg/L	0.010	105	70	130			
Potassium		39.7	mg/L	0.50	99	70	130			
Silver		0.0185	mg/L	0.0050	93	70	130			
Sodium		101	mg/L	0.50	101	70	130			
Thallium		3.50E-05	mg/L	0.10		0	0			
Zinc		0.0107	mg/L	0.010	107	70	130			
Sample ID: **ICV STD**	17	Initial Calibration Verification Standard								07/24/13 22:17
Aluminum		0.296	mg/L	0.10	99	90	110			
Arsenic		0.0611	mg/L	0.0050	102	90	110			
Barium		0.0614	mg/L	0.10	102	90	110			
Beryllium		0.0317	mg/L	0.0010	106	90	110			
Cadmium		0.0331	mg/L	0.0010	110	90	110			
Calcium		3.17	mg/L	0.50	106	90	110			
Chromium		0.0629	mg/L	0.010	105	90	110			
Copper		0.0638	mg/L	0.010	106	90	110			
Iron		0.323	mg/L	0.030	108	90	110			
Lead		0.0631	mg/L	0.010	105	90	110			
Magnesium		3.14	mg/L	0.50	105	90	110			
Nickel		0.0639	mg/L	0.010	106	90	110			
Potassium		3.07	mg/L	0.50	102	90	110			
Silver		0.0302	mg/L	0.0050	101	90	110			
Sodium		3.12	mg/L	0.50	104	90	110			
Thallium		0.0606	mg/L	0.10	101	90	110			
Zinc		0.0643	mg/L	0.010	107	90	110			
Sample ID: **ICSA**	17	Interference Check Sample A								07/24/13 22:22
Aluminum		36.3	mg/L	0.10	91	70	130			
Arsenic		0.000306	mg/L	0.0050						
Barium		0.000248	mg/L	0.10						
Beryllium		1.00E-06	mg/L	0.0010						
Cadmium		0.00102	mg/L	0.0010						
Calcium		112	mg/L	0.50	93	70	130			
Chromium		0.00115	mg/L	0.010						
Copper		0.000314	mg/L	0.010						
Iron		95.8	mg/L	0.030	96	70	130			
Lead		0.000204	mg/L	0.010						
Magnesium		40.1	mg/L	0.50	100	70	130			
Nickel		0.000682	mg/L	0.010						
Potassium		40.2	mg/L	0.50	101	70	130			
Silver		0.000194	mg/L	0.0050						

Qualifiers:

RL - Analyte reporting limit. ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 08/07/13

Work Order: H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130724A
Sample ID: ICSA	17	Interference Check Sample A								07/24/13 22:22
Sodium		100	mg/L	0.50	100	70	130			
Thallium		5.80E-05	mg/L	0.10						
Zinc		0.00133	mg/L	0.010						
Sample ID: ICSAB	17	Interference Check Sample AB								07/24/13 22:26
Aluminum		36.4	mg/L	0.10	91	70	130			
Arsenic		0.0111	mg/L	0.0050	111	70	130			
Barium		6.60E-05	mg/L	0.10		0	0			
Beryllium		1.60E-05	mg/L	0.0010		0	0			
Cadmium		0.0108	mg/L	0.0010	108	70	130			
Calcium		113	mg/L	0.50	94	70	130			
Chromium		0.0224	mg/L	0.010	112	70	130			
Copper		0.0209	mg/L	0.010	105	70	130			
Iron		96.6	mg/L	0.030	97	70	130			
Lead		0.000223	mg/L	0.010		0	0			
Magnesium		40.6	mg/L	0.50	101	70	130			
Nickel		0.0218	mg/L	0.010	109	70	130			
Potassium		40.4	mg/L	0.50	101	70	130			
Silver		0.0188	mg/L	0.0050	94	70	130			
Sodium		100	mg/L	0.50	100	70	130			
Thallium		2.20E-05	mg/L	0.10		0	0			
Zinc		0.0114	mg/L	0.010	114	70	130			
Method: E200.8										Batch: R89985
Sample ID: ICB	17	Method Blank				Run: ICPMS204-B_130724A				07/24/13 13:49
Aluminum		0.0002	mg/L	0.0001						
Arsenic		ND	mg/L	7E-05						
Barium		ND	mg/L	5E-05						
Beryllium		ND	mg/L	2E-05						
Cadmium		ND	mg/L	7E-06						
Calcium		0.02	mg/L	0.006						
Chromium		ND	mg/L	4E-05						
Copper		ND	mg/L	3E-05						
Iron		0.0006	mg/L	0.0002						
Lead		2E-05	mg/L	6E-06						
Magnesium		ND	mg/L	0.0007						
Nickel		ND	mg/L	6E-05						
Potassium		ND	mg/L	0.02						
Silver		ND	mg/L	4E-05						
Sodium		ND	mg/L	0.005						
Thallium		ND	mg/L	1E-05						
Zinc		0.0003	mg/L	0.0003						
Sample ID: LFB	17	Laboratory Fortified Blank				Run: ICPMS204-B_130724A				07/24/13 13:54
Aluminum		0.0514	mg/L	0.10	102	85	115			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 08/07/13

Project: Barker Hughsville Pilot **Work Order:** H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Batch: R89985	
Sample ID: LFB	17	Laboratory Fortified Blank				Run: ICPMS204-B_130724A			07/24/13 13:54	
Arsenic		0.0504	mg/L	0.0050	101	85	115			
Barium		0.0505	mg/L	0.10	101	85	115			
Beryllium		0.0500	mg/L	0.0010	100	85	115			
Cadmium		0.0522	mg/L	0.0010	104	85	115			
Calcium		1.10	mg/L	0.50	108	85	115			
Chromium		0.0501	mg/L	0.010	100	85	115			
Copper		0.0508	mg/L	0.010	102	85	115			
Iron		0.163	mg/L	0.030	108	85	115			
Lead		0.0521	mg/L	0.010	104	85	115			
Magnesium		0.998	mg/L	0.50	100	85	115			
Nickel		0.0510	mg/L	0.010	102	85	115			
Potassium		1.01	mg/L	0.50	101	85	115			
Silver		0.0204	mg/L	0.0050	102	85	115			
Sodium		0.995	mg/L	0.50	100	85	115			
Thallium		0.0537	mg/L	0.10	107	85	115			
Zinc		0.0530	mg/L	0.010	105	85	115			
Sample ID: H13070431-004BMS	17	Sample Matrix Spike				Run: ICPMS204-B_130724A			07/24/13 23:21	
Aluminum		0.258	mg/L	0.030	102	70	130			
Arsenic		0.294	mg/L	0.0010	108	70	130			
Barium		0.313	mg/L	0.050	104	70	130			
Beryllium		0.244	mg/L	0.0010	98	70	130			
Cadmium		0.252	mg/L	0.0010	101	70	130			
Calcium		924	mg/L	1.0		70	130			A
Chromium		0.258	mg/L	0.0050	103	70	130			
Copper		0.257	mg/L	0.0050	102	70	130			
Iron		1.48	mg/L	0.030	88	70	130			
Lead		0.291	mg/L	0.0010	116	70	130			
Magnesium		64.2	mg/L	1.0		70	130			A
Nickel		0.269	mg/L	0.0050	104	70	130			
Potassium		15.2	mg/L	1.0	101	70	130			
Silver		0.0752	mg/L	0.0010	75	70	130			
Sodium		47.1	mg/L	1.0		70	130			A
Thallium		0.299	mg/L	0.00050	120	70	130			
Zinc		0.264	mg/L	0.010	98	70	130			
Sample ID: H13070431-004BMSD	17	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130724A			07/24/13 23:25	
Aluminum		0.252	mg/L	0.030	100	70	130	2.0	20	
Arsenic		0.295	mg/L	0.0010	108	70	130	0.3	20	
Barium		0.313	mg/L	0.050	104	70	130	0.1	20	
Beryllium		0.241	mg/L	0.0010	96	70	130	1.4	20	
Cadmium		0.251	mg/L	0.0010	101	70	130	0.4	20	
Calcium		940	mg/L	1.0		70	130	1.7	20	A
Chromium		0.255	mg/L	0.0050	102	70	130	0.8	20	
Copper		0.254	mg/L	0.0050	101	70	130	1.3	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 08/07/13

Project: Barker Hughsville Pilot **Work Order:** H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Batch: R89985	
Sample ID: H13070431-004BMSD	17	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130724A			07/24/13 23:25	
Iron		1.51	mg/L	0.030	91	70	130	1.7	20	
Lead		0.292	mg/L	0.0010	117	70	130	0.4	20	
Magnesium		63.4	mg/L	1.0		70	130	1.3	20	A
Nickel		0.266	mg/L	0.0050	103	70	130	1.0	20	
Potassium		15.2	mg/L	1.0	103	70	130	0.6	20	
Silver		0.0720	mg/L	0.0010	72	70	130	4.3	20	
Sodium		47.1	mg/L	1.0		70	130	0.1	20	A
Thallium		0.297	mg/L	0.00050	119	70	130	0.9	20	
Zinc		0.259	mg/L	0.010	96	70	130	1.9	20	
Method: E200.8									Analytical Run: ICPMS204-B_130725A	
Sample ID: ICV STD		Initial Calibration Verification Standard							07/25/13 14:46	
Cobalt		0.0619	mg/L	0.010	103	90	110			
Sample ID: ICSA		Interference Check Sample A							07/25/13 14:50	
Cobalt		0.000366	mg/L	0.010						
Sample ID: ICSAB		Interference Check Sample AB							07/25/13 14:55	
Cobalt		0.0209	mg/L	0.010	105	70	130			
Sample ID: ICSA		Interference Check Sample A							07/26/13 05:24	
Cobalt		0.000306	mg/L	0.010						
Sample ID: ICSAB		Interference Check Sample AB							07/26/13 05:28	
Cobalt		0.0197	mg/L	0.010	98	70	130			
Method: E200.8									Batch: R90022	
Sample ID: ICB		Method Blank				Run: ICPMS204-B_130725A			07/25/13 19:01	
Cobalt		ND	mg/L	2E-05						
Sample ID: LFB		Laboratory Fortified Blank				Run: ICPMS204-B_130725A			07/25/13 19:05	
Cobalt		0.0485	mg/L	0.010	97	85	115			
Sample ID: H13070375-002BMS		Sample Matrix Spike				Run: ICPMS204-B_130725A			07/25/13 19:28	
Cobalt		0.467	mg/L	0.0050	93	70	130			
Sample ID: H13070375-002BMSD		Sample Matrix Spike Duplicate				Run: ICPMS204-B_130725A			07/25/13 19:33	
Cobalt		0.469	mg/L	0.0050	94	70	130	0.5	20	
Sample ID: H13070275-003BMS		Sample Matrix Spike				Run: ICPMS204-B_130725A			07/25/13 23:36	
Cobalt		0.986	mg/L	0.0050	98	70	130			
Sample ID: H13070275-003BMSD		Sample Matrix Spike Duplicate				Run: ICPMS204-B_130725A			07/25/13 23:40	
Cobalt		0.971	mg/L	0.0050	97	70	130	1.5	20	

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 08/07/13
Project: Barker Hughsville Pilot
Work Order: H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130729A
Sample ID: ICV STD	3	Initial Calibration Verification Standard								07/29/13 10:44
Cobalt		0.0630	mg/L	0.010	105	90	110			
Iron		0.313	mg/L	0.030	104	90	110			
Zinc		0.0632	mg/L	0.010	105	90	110			
Sample ID: ICSA	3	Interference Check Sample A								07/29/13 10:48
Cobalt		0.000440	mg/L	0.010						
Iron		99.3	mg/L	0.030	99	70	130			
Zinc		0.00142	mg/L	0.010						
Sample ID: ICSAB	3	Interference Check Sample AB								07/29/13 10:53
Cobalt		0.0215	mg/L	0.010	108	70	130			
Iron		94.2	mg/L	0.030	94	70	130			
Zinc		0.0112	mg/L	0.010	112	70	130			
Sample ID: ICV STD	3	Initial Calibration Verification Standard								07/29/13 18:57
Cobalt		0.0635	mg/L	0.010	106	90	110			
Iron		0.312	mg/L	0.030	104	90	110			
Zinc		0.0650	mg/L	0.010	108	90	110			
Sample ID: ICSA	3	Interference Check Sample A								07/29/13 19:01
Cobalt		0.000483	mg/L	0.010						
Iron		90.8	mg/L	0.030	91	70	130			
Zinc		0.00102	mg/L	0.010						
Sample ID: ICSAB	3	Interference Check Sample AB								07/29/13 19:06
Cobalt		0.0225	mg/L	0.010	112	70	130			
Iron		91.3	mg/L	0.030	91	70	130			
Zinc		0.0110	mg/L	0.010	110	70	130			
Sample ID: ICV STD	3	Initial Calibration Verification Standard								07/30/13 10:43
Cobalt		0.0620	mg/L	0.010	103	90	110			
Iron		0.317	mg/L	0.030	106	90	110			
Zinc		0.0640	mg/L	0.010	107	90	110			
Sample ID: ICSA	3	Interference Check Sample A								07/30/13 10:47
Cobalt		0.000442	mg/L	0.010						
Iron		91.5	mg/L	0.030	91	70	130			
Zinc		0.00120	mg/L	0.010						
Sample ID: ICSAB	3	Interference Check Sample AB								07/30/13 10:52
Cobalt		0.0218	mg/L	0.010	109	70	130			
Iron		90.4	mg/L	0.030	90	70	130			
Zinc		0.0110	mg/L	0.010	110	70	130			
Sample ID: ICSA	3	Interference Check Sample A								07/30/13 13:23
Cobalt		0.000972	mg/L	0.010						
Iron		93.7	mg/L	0.030	94	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 08/07/13

Project: Barker Hughsville Pilot **Work Order:** H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual	
Method: E200.8											Analytical Run: ICPMS204-B_130729A
Sample ID: ICSA	3	Interference Check Sample A									07/30/13 13:23
Zinc		0.00103	mg/L	0.010							
Sample ID: ICSAB	3	Interference Check Sample AB									07/30/13 13:28
Cobalt		0.0224	mg/L	0.010	112	70	130				
Iron		99.9	mg/L	0.030	100	70	130				
Zinc		0.0106	mg/L	0.010	106	70	130				
Sample ID: ICV STD	3	Initial Calibration Verification Standard									07/30/13 13:51
Cobalt		0.0635	mg/L	0.010	106	90	110				
Iron		0.309	mg/L	0.030	103	90	110				
Zinc		0.0628	mg/L	0.010	105	90	110				
Sample ID: ICV STD	3	Initial Calibration Verification Standard									07/30/13 17:49
Cobalt		0.0633	mg/L	0.010	106	90	110				
Iron		0.325	mg/L	0.030	108	90	110				
Zinc		0.0660	mg/L	0.010	110	90	110				
Sample ID: ICSA	3	Interference Check Sample A									07/30/13 17:53
Cobalt		0.000553	mg/L	0.010							
Iron		98.3	mg/L	0.030	98	70	130				
Zinc		0.00110	mg/L	0.010							
Sample ID: ICSAB	3	Interference Check Sample AB									07/30/13 17:58
Cobalt		0.0224	mg/L	0.010	112	70	130				
Iron		102	mg/L	0.030	102	70	130				
Zinc		0.0107	mg/L	0.010	107	70	130				
Method: E200.8											Batch: R90061
Sample ID: ICB	3	Method Blank				Run: ICPMS204-B_130729A					07/29/13 12:25
Cobalt		ND	mg/L	2E-05							
Iron		0.001	mg/L	0.0002							
Zinc		0.0007	mg/L	0.0003							
Sample ID: LFB	3	Laboratory Fortified Blank				Run: ICPMS204-B_130729A					07/29/13 12:29
Cobalt		0.0540	mg/L	0.010	108	85	115				
Iron		0.170	mg/L	0.030	112	85	115				
Zinc		0.0561	mg/L	0.010	111	85	115				
Sample ID: H13070431-004BMS	3	Sample Matrix Spike				Run: ICPMS204-B_130729A					07/29/13 14:59
Cobalt		1.16	mg/L	0.0050	115	70	130				
Iron		3.69	mg/L	0.030	99	70	130				
Zinc		1.09	mg/L	0.010	106	70	130				
Sample ID: H13070431-004BMSD	3	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130729A					07/29/13 15:04
Cobalt		1.10	mg/L	0.0050	109	70	130	5.4	20		
Iron		3.79	mg/L	0.030	102	70	130	2.8	20		
Zinc		1.06	mg/L	0.010	102	70	130	2.9	20		

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Report Date: 08/07/13
Work Order: H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**									Batch: R90061	
Sample ID: **H13070431-004BMSD**	3	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130729A			07/29/13 15:04	
Sample ID: **ICB**	3	Method Blank				Run: ICPMS204-B_130729A			07/30/13 16:18	
Cobalt		ND	mg/L	0.0050						
Iron		ND	mg/L	0.030						
Zinc		ND	mg/L	0.010						
Sample ID: **LFB**	3	Laboratory Fortified Blank				Run: ICPMS204-B_130729A			07/30/13 16:22	
Cobalt		0.0487	mg/L	0.010	97	85	115			
Iron		0.165	mg/L	0.030	110	85	115			
Zinc		0.0495	mg/L	0.010	99	85	115			
Sample ID: **H13070431-004BMS**	3	Sample Matrix Spike				Run: ICPMS204-B_130729A			07/30/13 16:39	
Cobalt		1.01	mg/L	0.0050	100	70	130			
Iron		3.72	mg/L	0.030	101	70	130			
Zinc		0.940	mg/L	0.010	91	70	130			
Sample ID: **H13070431-004BMSD**	3	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130729A			07/30/13 16:44	
Cobalt		0.914	mg/L	0.0050	91	70	130	9.7	20	
Iron		3.75	mg/L	0.030	102	70	130	0.7	20	
Zinc		0.956	mg/L	0.010	93	70	130	1.7	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 08/07/13

Project: Barker Hughsville Pilot **Work Order:** H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E300.0**										Analytical Run: IC102-H_130725A
Sample ID: **ICV**	2	Initial Calibration Verification Standard								07/25/13 12:02
Chloride		100	mg/L	1.0	100	90	110			
Sulfate		400	mg/L	1.0	100	90	110			
Sample ID: **CCV072513-1**	2	Continuing Calibration Verification Standard								07/25/13 13:05
Chloride		100	mg/L	1.0	103	90	110			
Sulfate		410	mg/L	1.0	103	90	110			
Sample ID: **CCV072513-2**	2	Continuing Calibration Verification Standard								07/25/13 15:48
Chloride		100	mg/L	1.0	103	90	110			
Sulfate		410	mg/L	1.0	103	90	110			
Method: **E300.0**										Batch: R89997
Sample ID: **ICB**	2	Method Blank				Run: IC102-H_130725A				07/25/13 12:39
Chloride		ND	mg/L	1.0						
Sulfate		ND	mg/L	1.0						
Sample ID: **LFB**	2	Laboratory Fortified Blank				Run: IC102-H_130725A				07/25/13 12:52
Chloride		52	mg/L	1.0	104	90	110			
Sulfate		210	mg/L	1.0	104	90	110			
Sample ID: **H13070431-007AMS**	2	Sample Matrix Spike				Run: IC102-H_130725A				07/25/13 15:23
Chloride		260	mg/L	1.4	102	90	110			
Sulfate		2300	mg/L	1.0	110	90	110			
Sample ID: **H13070431-007AMSD**	2	Sample Matrix Spike Duplicate				Run: IC102-H_130725A				07/25/13 15:36
Chloride		260	mg/L	1.4	101	90	110	1.5	20	
Sulfate		2200	mg/L	1.0	105	90	110	2.5	20	
Sample ID: **H13070452-001AMS**	2	Sample Matrix Spike				Run: IC102-H_130725A				07/25/13 17:04
Chloride		56	mg/L	1.0	101	90	110			
Sulfate		420	mg/L	1.0	107	90	110			
Sample ID: **H13070452-001AMSD**	2	Sample Matrix Spike Duplicate				Run: IC102-H_130725A				07/25/13 17:16
Chloride		56	mg/L	1.0	101	90	110	0.1	20	
Sulfate		420	mg/L	1.0	107	90	110	0.1	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 08/07/13
Project: Barker Hughsville Pilot
Work Order: H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E300.0**										Analytical Run: IC102-H_130730A
Sample ID: **ICV**	2	Initial Calibration Verification Standard								07/30/13 12:49
Chloride		98	mg/L	1.0	98	90	110			
Sulfate		390	mg/L	1.0	99	90	110			
Sample ID: **CCV073013-1**	2	Continuing Calibration Verification Standard								07/30/13 13:39
Chloride		100	mg/L	1.0	102	90	110			
Sulfate		410	mg/L	1.0	102	90	110			
Sample ID: **CCV073013-2**	2	Continuing Calibration Verification Standard								07/30/13 16:23
Chloride		100	mg/L	1.0	101	90	110			
Sulfate		410	mg/L	1.0	102	90	110			
Method: **E300.0**										Batch: R90112
Sample ID: **ICB**	2	Method Blank				Run: IC102-H_130730A				07/30/13 13:01
Chloride		ND	mg/L	0.008						
Sulfate		ND	mg/L	0.08						
Sample ID: **LFB**	2	Laboratory Fortified Blank				Run: IC102-H_130730A				07/30/13 13:14
Chloride		50	mg/L	1.0	99	90	110			
Sulfate		200	mg/L	1.0	100	90	110			
Sample ID: **H13070532-001AMS**	2	Sample Matrix Spike				Run: IC102-H_130730A				07/30/13 14:17
Chloride		7400	mg/L	28	97	90	110			
Sulfate		28000	mg/L	11	100	90	110			
Sample ID: **H13070532-001AMSD**	2	Sample Matrix Spike Duplicate				Run: IC102-H_130730A				07/30/13 14:30
Chloride		7400	mg/L	28	98	90	110	0.2	20	
Sulfate		28000	mg/L	11	100	90	110	0.2	20	
Sample ID: **H13070431-007AMS**	2	Sample Matrix Spike				Run: IC102-H_130730A				07/30/13 17:01
Chloride		58	mg/L	1.0	109	90	110			
Sulfate		1500	mg/L	1.0		90	110			A
Sample ID: **H13070431-007AMSD**	2	Sample Matrix Spike Duplicate				Run: IC102-H_130730A				07/30/13 17:13
Chloride		58	mg/L	1.0	109	90	110	0.2	20	
Sulfate		1500	mg/L	1.0		90	110	0.8	20	A

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 08/07/13

Work Order: H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E300.0										Analytical Run: IC102-H_130731A
Sample ID: ICV		Initial Calibration Verification Standard								07/31/13 09:56
Sulfate		390	mg/L	1.0	98	90	110			
Sample ID: CCV073113-1		Continuing Calibration Verification Standard								07/31/13 10:34
Sulfate		400	mg/L	1.0	101	90	110			
Method: E300.0										Batch: R90157
Sample ID: ICB		Method Blank				Run: IC102-H_130731A				07/31/13 10:09
Sulfate		0.1	mg/L	0.08						
Sample ID: LFB		Laboratory Fortified Blank				Run: IC102-H_130731A				07/31/13 10:21
Sulfate		190	mg/L	1.0	97	90	110			
Sample ID: H13070514-002AMS		Sample Matrix Spike				Run: IC102-H_130731A				07/31/13 13:05
Sulfate		1100	mg/L	1.0	99	90	110			
Sample ID: H13070514-002AMSD		Sample Matrix Spike Duplicate				Run: IC102-H_130731A				07/31/13 13:18
Sulfate		1000	mg/L	1.0	97	90	110	1.5	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 08/07/13
Work Order: H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E350.1										Analytical Run: FIA203-HE_130729A
Sample ID: ICV		Initial Calibration Verification Standard								07/29/13 11:28
Nitrogen, Ammonia as N		5.72	mg/L	0.25	101	90	110			
Sample ID: ICB		Initial Calibration Blank, Instrument Blank								07/29/13 11:32
Nitrogen, Ammonia as N		-0.0566	mg/L	0.050		0	0			
Sample ID: CCV		Continuing Calibration Verification Standard								07/29/13 11:50
Nitrogen, Ammonia as N		0.488	mg/L	0.050	98	90	110			
Sample ID: CCV		Continuing Calibration Verification Standard								07/29/13 12:07
Nitrogen, Ammonia as N		0.493	mg/L	0.050	99	90	110			
Method: E350.1										Batch: R90059
Sample ID: LFB		Laboratory Fortified Blank				Run: FIA203-HE_130729A				07/29/13 11:30
Nitrogen, Ammonia as N		1.04	mg/L	0.055	104	90	110			
Sample ID: MBLK		Method Blank				Run: FIA203-HE_130729A				07/29/13 11:33
Nitrogen, Ammonia as N		ND	mg/L	0.01						
Sample ID: H13070447-001AMS		Sample Matrix Spike				Run: FIA203-HE_130729A				07/29/13 11:57
Nitrogen, Ammonia as N		0.978	mg/L	0.055	98	80	120			
Sample ID: H13070447-001AMSD		Sample Matrix Spike Duplicate				Run: FIA203-HE_130729A				07/29/13 11:58
Nitrogen, Ammonia as N		0.986	mg/L	0.055	99	80	120	0.8	10	
Sample ID: H13070505-005AMS		Sample Matrix Spike				Run: FIA203-HE_130729A				07/29/13 12:14
Nitrogen, Ammonia as N		0.906	mg/L	0.055	91	80	120			
Sample ID: H13070505-005AMSD		Sample Matrix Spike Duplicate				Run: FIA203-HE_130729A				07/29/13 12:15
Nitrogen, Ammonia as N		0.921	mg/L	0.055	92	80	120	1.6	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 08/07/13
Project: Barker Hughsville Pilot **Work Order:** H13070431

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E365.1										Analytical Run: FIA202-HE_130724A
Sample ID: ICV		Initial Calibration Verification Standard								07/24/13 10:46
Phosphorus, Orthophosphate as P		0.244	mg/L	0.0050	98	90	110			
Sample ID: ICB		Initial Calibration Blank, Instrument Blank								07/24/13 10:47
Phosphorus, Orthophosphate as P		-0.00722	mg/L	0.0050		0	0			
Sample ID: CCV		Continuing Calibration Verification Standard								07/24/13 10:49
Phosphorus, Orthophosphate as P		0.102	mg/L	0.0050	102	90	110			
Method: E365.1										Batch: R89945
Sample ID: LFB		Laboratory Fortified Blank				Run: FIA202-HE_130724A				07/24/13 10:48
Phosphorus, Orthophosphate as P		0.212	mg/L	0.0050	106	90	110			
Sample ID: MBLK		Method Blank				Run: FIA202-HE_130724A				07/24/13 11:03
Phosphorus, Orthophosphate as P		ND	mg/L	0.0010						
Sample ID: H13070431-005AMS		Sample Matrix Spike				Run: FIA202-HE_130724A				07/24/13 11:06
Phosphorus, Orthophosphate as P		20.9	mg/L	0.10	101	90	110			
Sample ID: H13070431-005AMSD		Sample Matrix Spike Duplicate				Run: FIA202-HE_130724A				07/24/13 11:07
Phosphorus, Orthophosphate as P		22.0	mg/L	0.10	106	90	110	5.0	20	
Method: E365.1										Analytical Run: FIA202-HE_130724B
Sample ID: ICV		Initial Calibration Verification Standard								07/24/13 11:34
Phosphorus, Orthophosphate as P		0.240	mg/L	0.0050	96	90	110			
Sample ID: ICB		Initial Calibration Blank, Instrument Blank								07/24/13 11:35
Phosphorus, Orthophosphate as P		-0.00466	mg/L	0.0050		0	0			
Sample ID: CCV		Continuing Calibration Verification Standard								07/24/13 11:37
Phosphorus, Orthophosphate as P		0.100	mg/L	0.0050	100	90	110			
Sample ID: CCV		Continuing Calibration Verification Standard								07/24/13 11:50
Phosphorus, Orthophosphate as P		0.102	mg/L	0.0050	102	90	110			
Method: E365.1										Batch: R89947
Sample ID: LFB		Laboratory Fortified Blank				Run: FIA202-HE_130724B				07/24/13 11:36
Phosphorus, Orthophosphate as P		0.203	mg/L	0.0050	102	90	110			
Sample ID: H13070431-005AMS		Sample Matrix Spike				Run: FIA202-HE_130724B				07/24/13 11:41
Phosphorus, Orthophosphate as P		21.1	mg/L	0.10	103	90	110			
Sample ID: H13070431-005AMSD		Sample Matrix Spike Duplicate				Run: FIA202-HE_130724B				07/24/13 11:42
Phosphorus, Orthophosphate as P		21.7	mg/L	0.10	106	90	110	2.8	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

Standard Reporting Procedures

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Workorder Receipt Checklist

CDM Federal Programs

H13070431

Login completed by: Tracy L. Lorash
Reviewed by: BL2000\sdull
Reviewed Date: 7/26/2013

Date Received: 7/24/2013
Received by: elm
Carrier name: Hand Del

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☐	No ☑	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Applicable ☐
Container/Temp Blank temperature:	9.5℃ On Ice		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Contact and Corrective Action Comments:

Sample ID on COC is 13BH-DT-PILOT-INFL-072313 - ID on bottles is 13BH-DT-PILOT-INFL-072311. Logged in with ID from COC.
Sample ID on COC is 13BH-DT-PILOT-MGOH-072313 - ID on bottles is 13BH-DT-PILOT-MGOH-072311. Logged in with ID from COC. TI 7/24/13

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

PLEASE PRINT- Provide as much information as possible.

Page 1 of 1

Company Name:
CDM Smith

Project Name, PWS, Permit, Etc.
Barker Hughesville

Sample Origin
State: Montana

EPA/State Compliance:
Yes ☐ No X

Report Mail Address:
50 W 14th Street, Suite 200
Helena, MT 59601

Contact Name:
Angela Frandsen

Phone/Fax:
406-441-1435

Email:
frandsenak@cdmsmith.com

Sampler: (Please Print)
Angela Frandsen

Invoice Address:
Contact Raquel Cisneros 720-264-1148

Invoice Contact & Phone:
Contact Raquel Cisneros 720-264-1148

Purchase Order:

Quote/Bottle Order:

Special Report/Formats – ELI must be notified prior to sample submittal for the following:

☐ DW
☐ GSA
☐ POTW/WWTP
☐ State: ____________
☐ Other: ____________

☐ A2LA
x EDD/EDT(Electronic Data)
~~Format:~~ excel
☐ LEVEL IV
☐ NELAC

Number of Containers
Sample Type: A W S V B O
Air Water Soils/Solids
Vegetation Bioassay Other

ANALYSIS REQUESTED

R U S H

Contact ELI prior to **RUSH** sample submittal for charges and scheduling – See Instruction Page

Comments:
10 day TAT
Pull phosphate from 1 L bottle

Shipped by: Hand

Cooler ID(s): Y

Receipt Temp 9.5 °C TB

On Ice: [✓ Yes] No

Custody Seal Y [✓ N]

Intact Y N

Signature Match Y N

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	Dissolved Metals	~~Total Metals~~	Sulfide	Orthophosphate	Alkalinity and Acidity	SO4, Cl, F, TDS	BOD	Ammonia		SEE ATTACHED	Normal Turnaround (TAT)	LABORATORY USE ONLY
13BH-DT-PILOT-INFL-072313	7/23/13	10:30	2-W	X			X	X	X						
13BH-DT-PILOT-MgOH-072313	7/23/13	10:00	2-W	X			X	X	X						H13070431
13BH-DT-PILOT-SAPS-072313	7/23/13	11:15	2-W	X			X	X	X						
13BH-DT-PILOT-CHIT-072313	7/23/13	11:30	2-W	X			X	X	X						
13BH-DT-PILOT-BCR1-072313	7/23/13	12:00	3-W	X		X	X	X	X						
13BH-DT-PILOT-BDR1-0723B	7/23/13	12:05	3-W	X		X	X	X	X						
13BH-DT-PILOT-BCR2-072313	7/23/13	12:50	5-W	X		X	X	X	X	X	X				
13BH-DT-PILOT-BCR3-072313	7/23/13	13:45	3-W	X		X	X	X	X						
13BH-DT-PILOT-BCR4-072313	7/23/13	14:15	3-W	X		X	X	X	X						
13BH-DT-PILOT-BCR2-POST	7/23/13	14:45	3-W			X				X	X				

Custody Record MUST be Signed

Relinquished by (print): S[illegible] Miller Date/Time: 7/24/13 08:30 Signature:
Received by (print): Date/Time: Signature:

Relinquished by (print): Date/Time: Signature:
Received by (print): Date/Time: Signature:

Sample Disposal: Return to Client: __________ Lab Disposal: __________
Received by Laboratory: Esther Merritt Date/Time: 7-24-13 8:34 Signature: Esther Merritt

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.
Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

ANALYTICAL SUMMARY REPORT

August 21, 2013

CDM Federal Programs
555 17th St Ste 1100
Denver, CO 80202

Workorder No.: H13080161 Quote ID: H823 - Baker-Hughsville Superfund Site

Project Name: Barker Hughsville Pilot

Energy Laboratories Inc Helena MT received the following 10 samples for CDM Federal Programs on 8/8/2013 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H13080161-001	13BH-DT-PILOT-INFL-080713	08/07/13 10:25	08/08/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Conductivity Fluoride Anions by Ion Chromatography Phosphorus, Orthophosphate as P Solids, Total Dissolved
H13080161-002	13BH-DT-PILOT-SAPS-080713	08/07/13 10:45	08/08/13	Aqueous	Same As Above
H13080161-003	13BH-DT-PILOT-CHIT-080713	08/07/13 11:00	08/08/13	Aqueous	Same As Above
H13080161-004	13BH-DT-PILOT-MGOH-080713	08/07/13 11:15	08/08/13	Aqueous	Same As Above
H13080161-005	13BH-DT-PILOT-BCR1-080713	08/07/13 11:40	08/08/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Conductivity Fluoride Anions by Ion Chromatography Phosphorus, Orthophosphate as P Solids, Total Dissolved Sulfide, Methylene Blue Colorimetric
H13080161-006	13BH-DT-PILOT-BCR2-080713	08/07/13 11:55	08/08/13	Aqueous	Same As Above
H13080161-007	13BH-DT-PILOT-BCR3-080713	08/07/13 12:15	08/08/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Biochemical Oxygen Demand, 5 Day Conductivity Fluoride Anions by Ion Chromatography Nitrogen, Ammonia Phosphorus, Orthophosphate as P Solids, Total Dissolved Sulfide, Iodine Titrimetric
H13080161-008	13BH-DT-PILOT-BCR4-080713	08/07/13 12:45	08/08/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Conductivity Fluoride Anions by Ion Chromatography Phosphorus, Orthophosphate as P Solids, Total Dissolved Sulfide, Methylene Blue Colorimetric

ANALYTICAL SUMMARY REPORT

H13080161-009	13BH-DT-PILOT-BDR4-080713	08/07/13 12:50	08/08/13	Aqueous	Same As Above
H13080161-010	13BH-DT-PILOT-BCR3-POST-080713	08/07/13 14:35	08/08/13	Aqueous	Biochemical Oxygen Demand, 5 Day Nitrogen, Ammonia Sulfide, Methylene Blue Colorimetric

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By:

CLIENT: CDM Federal Programs
Project: Barker Hughsville Pilot
Sample Delivery Group: H13080161

Report Date: 08/21/13

CASE NARRATIVE

Tests associated with analyst identified as ELI-B were subcontracted to Energy Laboratories, 1120 S. 27th St., Billings, MT, EPA Number MT00005.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	08/21/13
Project:	Barker Hughsville Pilot	**Collection Date:**	08/07/13 10:25
Lab ID:	H13080161-001	**DateReceived:**	08/08/13
Client Sample ID	13BH-DT-PILOT-INFL-080713	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1750	mg/L		10		A2540 C	08/08/13 12:02 / glj
INORGANICS							
Acidity, Total as CaCO3	700	mg/L	D	4.0		A2310 B	08/12/13 09:30 / cmm
Alkalinity, Total as CaCO3	ND	mg/L		1		A2320 B	08/08/13 18:18 / cmm
Bicarbonate as HCO3	ND	mg/L		1		A2320 B	08/08/13 18:18 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	08/08/13 18:18 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	08/08/13 18:18 / cmm
Chloride	ND	mg/L		1		E300.0	08/13/13 12:26 / cmm
Sulfate	2200	mg/L		1		E300.0	08/13/13 12:26 / cmm
Fluoride	0.7	mg/L	D	0.2	4	A4500-F C	08/13/13 16:18 / cmm
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.478	mg/L		0.005		E365.1	08/08/13 14:01 / reh
METALS, DISSOLVED							
Aluminum	12.8	mg/L		0.03		E200.7	08/08/13 17:19 / sld
Arsenic	0.210	mg/L		0.001		E200.8	08/09/13 06:10 / raw
Barium	ND	mg/L		0.05		E200.8	08/09/13 06:10 / raw
Beryllium	0.006	mg/L		0.001		E200.8	08/09/13 06:10 / raw
Cadmium	0.191	mg/L		0.001		E200.8	08/09/13 06:10 / raw
Calcium	93	mg/L		1		E200.7	08/08/13 17:19 / sld
Chromium	ND	mg/L		0.005		E200.8	08/09/13 06:10 / raw
Cobalt	0.055	mg/L		0.005		E200.8	08/10/13 06:26 / raw
Copper	1.40	mg/L		0.005		E200.7	08/08/13 17:19 / sld
Iron	162	mg/L		0.03		E200.7	08/09/13 11:48 / sld
Lead	0.173	mg/L		0.001		E200.8	08/09/13 06:10 / raw
Magnesium	20	mg/L		1		E200.7	08/08/13 17:19 / sld
Manganese	116	mg/L	D	0.003		E200.7	08/09/13 11:48 / sld
Nickel	0.034	mg/L		0.005		E200.8	08/09/13 06:10 / raw
Potassium	1	mg/L		1		E200.7	08/08/13 17:19 / sld
Silver	ND	mg/L		0.001		E200.8	08/09/13 06:10 / raw
Sodium	7	mg/L		1		E200.7	08/08/13 17:19 / sld
Thallium	0.0021	mg/L		0.0005		E200.8	08/09/13 06:10 / raw
Zinc	53.3	mg/L		0.01		E200.7	08/08/13 17:19 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13080161-002
Client Sample ID 13BH-DT-PILOT-SAPS-080713

Report Date: 08/21/13
Collection Date: 08/07/13 10:45
DateReceived: 08/08/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1870	mg/L		10		A2540 C	08/08/13 12:02 / glj
INORGANICS							
Acidity, Total as CaCO3	450	mg/L	D	4.0		A2310 B	08/12/13 09:30 / cmm
Alkalinity, Total as CaCO3	ND	mg/L		1		A2320 B	08/08/13 18:27 / cmm
Bicarbonate as HCO3	1	mg/L		1		A2320 B	08/08/13 18:27 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	08/08/13 18:27 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	08/08/13 18:27 / cmm
Chloride	ND	mg/L		1		E300.0	08/13/13 12:39 / cmm
Sulfate	1700	mg/L		1		E300.0	08/13/13 12:39 / cmm
Fluoride	1.9	mg/L	D	0.2	4	A4500-F C	08/13/13 16:23 / cmm
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.110	mg/L		0.005		E365.1	08/08/13 14:16 / reh
METALS, DISSOLVED							
Aluminum	2.55	mg/L		0.03		E200.7	08/08/13 17:34 / sld
Arsenic	0.004	mg/L		0.001		E200.8	08/09/13 06:34 / raw
Barium	ND	mg/L		0.05		E200.8	08/09/13 06:34 / raw
Beryllium	0.003	mg/L	D	0.002		E200.8	08/10/13 06:31 / raw
Cadmium	0.071	mg/L		0.001		E200.8	08/09/13 06:34 / raw
Calcium	235	mg/L		1		E200.7	08/09/13 11:51 / sld
Chromium	ND	mg/L		0.005		E200.8	08/09/13 06:34 / raw
Cobalt	0.059	mg/L		0.005		E200.8	08/10/13 06:31 / raw
Copper	0.020	mg/L		0.005		E200.8	08/09/13 06:34 / raw
Iron	111	mg/L		0.03		E200.7	08/09/13 11:51 / sld
Lead	0.002	mg/L		0.001		E200.8	08/09/13 06:34 / raw
Magnesium	21	mg/L		1		E200.7	08/08/13 17:34 / sld
Manganese	120	mg/L	D	0.003		E200.7	08/09/13 11:51 / sld
Nickel	0.042	mg/L		0.005		E200.8	08/09/13 06:34 / raw
Potassium	1	mg/L		1		E200.7	08/08/13 17:34 / sld
Silver	ND	mg/L		0.001		E200.8	08/09/13 06:34 / raw
Sodium	7	mg/L		1		E200.7	08/08/13 17:34 / sld
Thallium	0.0008	mg/L		0.0005		E200.8	08/09/13 06:34 / raw
Zinc	63.2	mg/L		0.01		E200.7	08/08/13 17:34 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	08/21/13
Project:	Barker Hughsville Pilot	**Collection Date:**	08/07/13 11:00
Lab ID:	H13080161-003	**DateReceived:**	08/08/13
Client Sample ID	13BH-DT-PILOT-CHIT-080713	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	6320	mg/L		10		A2540 C	08/08/13 12:02 / glj
INORGANICS							
Acidity, Total as CaCO3	ND	mg/L	D	4.0		A2310 B	08/12/13 09:30 / cmm
Alkalinity, Total as CaCO3	3200	mg/L		1		A2320 B	08/15/13 15:31 / cmm
Bicarbonate as HCO3	3900	mg/L		1		A2320 B	08/15/13 15:31 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	08/15/13 15:31 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	08/15/13 15:31 / cmm
Chloride	190	mg/L	D	10		E300.0	08/15/13 15:21 / cmm
Sulfate	780	mg/L	D	5		E300.0	08/15/13 15:21 / cmm
Fluoride	0.2	mg/L	D	0.2	4	A4500-F C	08/13/13 16:24 / cmm
NUTRIENTS							
Phosphorus, Orthophosphate as P	40.2	mg/L	D	0.1		E365.1	08/08/13 14:03 / reh
METALS, DISSOLVED							
Aluminum	ND	mg/L		0.03		E200.8	08/13/13 03:52 / raw
Arsenic	0.058	mg/L		0.001		E200.8	08/09/13 06:39 / raw
Barium	0.07	mg/L		0.05		E200.8	08/09/13 06:39 / raw
Beryllium	ND	mg/L		0.001		E200.8	08/10/13 06:54 / raw
Cadmium	ND	mg/L		0.001		E200.8	08/09/13 06:39 / raw
Calcium	1060	mg/L		1		E200.7	08/08/13 17:38 / sld
Chromium	ND	mg/L		0.005		E200.8	08/09/13 06:39 / raw
Cobalt	0.009	mg/L		0.005		E200.8	08/10/13 06:54 / raw
Copper	ND	mg/L		0.005		E200.8	08/09/13 06:39 / raw
Iron	1.37	mg/L		0.03		E200.7	08/08/13 17:38 / sld
Lead	ND	mg/L		0.001		E200.8	08/09/13 06:39 / raw
Magnesium	65	mg/L		1		E200.7	08/08/13 17:38 / sld
Manganese	64.3	mg/L	D	0.003		E200.7	08/08/13 17:38 / sld
Nickel	0.019	mg/L		0.005		E200.8	08/09/13 06:39 / raw
Potassium	16	mg/L		1		E200.7	08/08/13 17:38 / sld
Silver	ND	mg/L		0.001		E200.8	08/09/13 06:39 / raw
Sodium	82	mg/L		1		E200.7	08/08/13 17:38 / sld
Thallium	ND	mg/L		0.0005		E200.8	08/09/13 06:39 / raw
Zinc	0.05	mg/L		0.01		E200.8	08/09/13 06:39 / raw

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13080161-004
Client Sample ID 13BH-DT-PILOT-MGOH-080713

Report Date: 08/21/13
Collection Date: 08/07/13 11:15
DateReceived: 08/08/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1800	mg/L		10		A2540 C	08/08/13 12:02 / glj
INORGANICS							
Acidity, Total as CaCO3	700	mg/L	D	4.0		A2310 B	08/12/13 09:30 / cmm
Alkalinity, Total as CaCO3	ND	mg/L		1		A2320 B	08/08/13 18:57 / cmm
Bicarbonate as HCO3	ND	mg/L		1		A2320 B	08/08/13 18:57 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	08/08/13 18:57 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	08/08/13 18:57 / cmm
Chloride	ND	mg/L		1		E300.0	08/12/13 17:40 / cmm
Sulfate	2300	mg/L		1		E300.0	08/15/13 15:34 / cmm
Fluoride	0.8	mg/L	D	0.2	4	A4500-F C	08/13/13 16:25 / cmm
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.343	mg/L		0.005		E365.1	08/08/13 14:04 / reh
METALS, DISSOLVED							
Aluminum	12.8	mg/L		0.03		E200.7	08/08/13 17:42 / sld
Arsenic	0.152	mg/L		0.001		E200.8	08/09/13 06:43 / raw
Barium	ND	mg/L		0.05		E200.8	08/09/13 06:43 / raw
Beryllium	0.007	mg/L	D	0.002		E200.8	08/10/13 06:59 / raw
Cadmium	0.186	mg/L		0.001		E200.8	08/09/13 06:43 / raw
Calcium	107	mg/L		1		E200.7	08/09/13 11:55 / sld
Chromium	ND	mg/L		0.005		E200.8	08/09/13 06:43 / raw
Cobalt	0.051	mg/L		0.005		E200.8	08/10/13 06:59 / raw
Copper	1.57	mg/L		0.005		E200.7	08/08/13 17:42 / sld
Iron	140	mg/L		0.03		E200.7	08/09/13 11:55 / sld
Lead	0.165	mg/L		0.001		E200.8	08/09/13 06:43 / raw
Magnesium	29	mg/L		1		E200.7	08/08/13 17:42 / sld
Manganese	117	mg/L	D	0.003		E200.7	08/09/13 11:55 / sld
Nickel	0.034	mg/L		0.005		E200.8	08/09/13 06:43 / raw
Potassium	1	mg/L		1		E200.7	08/08/13 17:42 / sld
Silver	ND	mg/L		0.001		E200.8	08/09/13 06:43 / raw
Sodium	7	mg/L		1		E200.7	08/08/13 17:42 / sld
Thallium	0.0020	mg/L		0.0005		E200.8	08/09/13 06:43 / raw
Zinc	53.1	mg/L		0.01		E200.7	08/08/13 17:42 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	08/21/13
Project:	Barker Hughsville Pilot	**Collection Date:**	08/07/13 11:40
Lab ID:	H13080161-005	**DateReceived:**	08/08/13
Client Sample ID	13BH-DT-PILOT-BCR1-080713	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1890	mg/L		10		A2540 C	08/08/13 12:02 / glj
INORGANICS							
Acidity, Total as CaCO3	450	mg/L	D	4.0		A2310 B	08/12/13 09:30 / cmm
Alkalinity, Total as CaCO3	76	mg/L		1		A2320 B	08/08/13 19:03 / cmm
Bicarbonate as HCO3	92	mg/L		1		A2320 B	08/08/13 19:03 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	08/08/13 19:03 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	08/08/13 19:03 / cmm
Chloride	ND	mg/L		1		E300.0	08/12/13 17:52 / cmm
Sulfate	1400	mg/L		1		E300.0	08/13/13 13:04 / cmm
Fluoride	2.0	mg/L	D	0.2	4	A4500-F C	08/13/13 16:25 / cmm
Sulfide	0.12	mg/L		0.04		A4500-S D	08/09/13 14:30 / eli-b22
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.083	mg/L		0.005		E365.1	08/08/13 14:17 / reh
METALS, DISSOLVED							
Aluminum	0.29	mg/L		0.03		E200.8	08/09/13 06:48 / raw
Arsenic	0.015	mg/L		0.001		E200.8	08/09/13 06:48 / raw
Barium	0.10	mg/L		0.05		E200.8	08/09/13 06:48 / raw
Beryllium	ND	mg/L		0.001		E200.8	08/20/13 09:58 / dck
Cadmium	ND	mg/L		0.001		E200.8	08/09/13 06:48 / raw
Calcium	233	mg/L		1		E200.7	08/08/13 17:46 / sld
Chromium	ND	mg/L		0.005		E200.8	08/09/13 06:48 / raw
Cobalt	0.055	mg/L		0.005		E200.8	08/10/13 07:04 / raw
Copper	ND	mg/L		0.005		E200.8	08/09/13 06:48 / raw
Iron	138	mg/L		0.03		E200.7	08/08/13 17:46 / sld
Lead	ND	mg/L		0.001		E200.8	08/09/13 06:48 / raw
Magnesium	22	mg/L		1		E200.7	08/08/13 17:46 / sld
Manganese	122	mg/L	D	0.003		E200.7	08/09/13 11:58 / sld
Nickel	0.036	mg/L		0.005		E200.8	08/09/13 06:48 / raw
Potassium	2	mg/L		1		E200.7	08/08/13 17:46 / sld
Silver	ND	mg/L		0.001		E200.8	08/09/13 06:48 / raw
Sodium	6	mg/L		1		E200.7	08/08/13 17:46 / sld
Thallium	ND	mg/L		0.0005		E200.8	08/09/13 06:48 / raw
Zinc	20.7	mg/L		0.01		E200.7	08/08/13 17:46 / sld

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	08/21/13
Project:	Barker Hughsville Pilot	**Collection Date:**	08/07/13 11:55
Lab ID:	H13080161-006	**DateReceived:**	08/08/13
Client Sample ID	13BH-DT-PILOT-BCR2-080713	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1800	mg/L		10		A2540 C	08/08/13 12:02 / glj
INORGANICS							
Acidity, Total as CaCO3	270	mg/L	D	4.0		A2310 B	08/12/13 09:30 / cmm
Alkalinity, Total as CaCO3	110	mg/L		1		A2320 B	08/08/13 19:08 / cmm
Bicarbonate as HCO3	130	mg/L		1		A2320 B	08/08/13 19:08 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	08/08/13 19:08 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	08/08/13 19:08 / cmm
Chloride	ND	mg/L		1		E300.0	08/12/13 18:05 / cmm
Sulfate	1300	mg/L		1		E300.0	08/13/13 13:16 / cmm
Fluoride	1.9	mg/L	D	0.2	4	A4500-F C	08/13/13 16:26 / cmm
Sulfide	0.7	mg/L	D	0.2		A4500-S D	08/09/13 14:30 / eli-b22
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.355	mg/L		0.005		E365.1	08/08/13 14:18 / reh
METALS, DISSOLVED							
Aluminum	0.04	mg/L		0.03		E200.8	08/09/13 06:52 / raw
Arsenic	0.003	mg/L		0.001		E200.8	08/09/13 06:52 / raw
Barium	0.23	mg/L		0.05		E200.8	08/09/13 06:52 / raw
Beryllium	ND	mg/L		0.001		E200.8	08/10/13 07:08 / raw
Cadmium	ND	mg/L		0.001		E200.8	08/09/13 06:52 / raw
Calcium	275	mg/L		1		E200.7	08/08/13 17:50 / sld
Chromium	ND	mg/L		0.005		E200.8	08/09/13 06:52 / raw
Cobalt	0.029	mg/L		0.005		E200.8	08/10/13 07:08 / raw
Copper	ND	mg/L		0.005		E200.8	08/09/13 06:52 / raw
Iron	77.0	mg/L		0.03		E200.7	08/08/13 17:50 / sld
Lead	ND	mg/L		0.001		E200.8	08/09/13 06:52 / raw
Magnesium	22	mg/L		1		E200.7	08/08/13 17:50 / sld
Manganese	127	mg/L	D	0.003		E200.7	08/09/13 12:02 / sld
Nickel	0.014	mg/L		0.005		E200.8	08/09/13 06:52 / raw
Potassium	2	mg/L		1		E200.7	08/08/13 17:50 / sld
Silver	ND	mg/L		0.001		E200.8	08/09/13 06:52 / raw
Sodium	7	mg/L		1		E200.7	08/08/13 17:50 / sld
Thallium	ND	mg/L		0.0005		E200.8	08/09/13 06:52 / raw
Zinc	1.58	mg/L		0.01		E200.7	08/08/13 17:50 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13080161-007
Client Sample ID 13BH-DT-PILOT-BCR3-080713

Report Date: 08/21/13
Collection Date: 08/07/13 12:15
DateReceived: 08/08/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	3970	mg/L		10		A2540 C	08/08/13 12:03 / glj
INORGANICS							
Acidity, Total as CaCO3	ND	mg/L	D	4.0		A2310 B	08/12/13 09:30 / cmm
Alkalinity, Total as CaCO3	2200	mg/L		1		A2320 B	08/08/13 19:23 / cmm
Bicarbonate as HCO3	2700	mg/L		1		A2320 B	08/08/13 19:23 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	08/08/13 19:23 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	08/08/13 19:23 / cmm
Chloride	61	mg/L	D	5		E300.0	08/12/13 18:17 / cmm
Sulfate	640	mg/L	D	2		E300.0	08/12/13 18:17 / cmm
Fluoride	0.1	mg/L		0.1	4	A4500-F C	08/13/13 16:27 / cmm
Sulfide	112	mg/L	D	1		A4500-S F	08/09/13 14:30 / eli-b22
AGGREGATE ORGANICS							
Oxygen Demand, Biochemical (BOD)	1400	mg/L		300		A5210 B	08/08/13 11:04 / cmm
NUTRIENTS							
Nitrogen, Ammonia as N	166	mg/L	D	5		E350.1	08/08/13 11:22 / reh
Phosphorus, Orthophosphate as P	22.0	mg/L	D	0.05		E365.1	08/08/13 14:19 / reh
METALS, DISSOLVED							
Aluminum	ND	mg/L		0.03		E200.8	08/09/13 06:57 / raw
Arsenic	0.029	mg/L		0.001		E200.8	08/09/13 06:57 / raw
Barium	0.26	mg/L		0.05		E200.8	08/09/13 06:57 / raw
Beryllium	ND	mg/L		0.001		E200.8	08/10/13 07:13 / raw
Cadmium	ND	mg/L		0.001		E200.8	08/09/13 06:57 / raw
Calcium	815	mg/L		1		E200.7	08/08/13 18:27 / sld
Chromium	ND	mg/L		0.005		E200.8	08/09/13 06:57 / raw
Cobalt	0.005	mg/L		0.005		E200.8	08/10/13 07:13 / raw
Copper	ND	mg/L		0.005		E200.8	08/09/13 06:57 / raw
Iron	ND	mg/L		0.03		E200.7	08/08/13 18:27 / sld
Lead	ND	mg/L		0.001		E200.8	08/09/13 06:57 / raw
Magnesium	60	mg/L		1		E200.7	08/08/13 18:27 / sld
Manganese	13.1	mg/L	D	0.003		E200.7	08/08/13 18:27 / sld
Nickel	0.008	mg/L		0.005		E200.8	08/09/13 06:57 / raw
Potassium	17	mg/L		1		E200.7	08/08/13 18:27 / sld
Silver	ND	mg/L		0.001		E200.8	08/09/13 06:57 / raw
Sodium	39	mg/L		1		E200.7	08/08/13 18:27 / sld
Thallium	ND	mg/L		0.0005		E200.8	08/09/13 06:57 / raw
Zinc	0.02	mg/L		0.01		E200.8	08/09/13 06:57 / raw

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	08/21/13
Project:	Barker Hughsville Pilot	**Collection Date:**	08/07/13 12:45
Lab ID:	H13080161-008	**DateReceived:**	08/08/13
Client Sample ID	13BH-DT-PILOT-BCR4-080713	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1840	mg/L		10		A2540 C	08/08/13 12:03 / glj
INORGANICS							
Acidity, Total as CaCO3	260	mg/L	D	4.0		A2310 B	08/12/13 09:30 / cmm
Alkalinity, Total as CaCO3	100	mg/L		1		A2320 B	08/08/13 19:29 / cmm
Bicarbonate as HCO3	120	mg/L		1		A2320 B	08/08/13 19:29 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	08/08/13 19:29 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	08/08/13 19:29 / cmm
Chloride	ND	mg/L		1		E300.0	08/12/13 18:30 / cmm
Sulfate	1300	mg/L		1		E300.0	08/13/13 13:29 / cmm
Fluoride	1.9	mg/L	D	0.2	4	A4500-F C	08/13/13 16:28 / cmm
Sulfide	0.7	mg/L	D	0.2		A4500-S D	08/09/13 14:30 / eli-b22
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.085	mg/L		0.005		E365.1	08/08/13 14:20 / reh
METALS, DISSOLVED							
Aluminum	0.05	mg/L		0.03		E200.8	08/09/13 07:02 / raw
Arsenic	0.005	mg/L		0.001		E200.8	08/09/13 07:02 / raw
Barium	0.23	mg/L		0.05		E200.8	08/09/13 07:02 / raw
Beryllium	ND	mg/L		0.001		E200.8	08/14/13 20:19 / dck
Cadmium	ND	mg/L		0.001		E200.8	08/09/13 07:02 / raw
Calcium	252	mg/L		1		E200.7	08/08/13 18:31 / sld
Chromium	ND	mg/L		0.005		E200.8	08/09/13 07:02 / raw
Cobalt	0.042	mg/L		0.005		E200.8	08/10/13 07:18 / raw
Copper	ND	mg/L		0.005		E200.8	08/09/13 07:02 / raw
Iron	65.4	mg/L		0.03		E200.7	08/08/13 18:31 / sld
Lead	ND	mg/L		0.001		E200.8	08/09/13 07:02 / raw
Magnesium	40	mg/L		1		E200.7	08/08/13 18:31 / sld
Manganese	146	mg/L	D	0.003		E200.7	08/09/13 12:13 / sld
Nickel	0.018	mg/L		0.005		E200.8	08/09/13 07:02 / raw
Potassium	1	mg/L		1		E200.7	08/08/13 18:31 / sld
Silver	ND	mg/L		0.001		E200.8	08/09/13 07:02 / raw
Sodium	5	mg/L		1		E200.7	08/08/13 18:31 / sld
Thallium	ND	mg/L		0.0005		E200.8	08/09/13 07:02 / raw
Zinc	7.36	mg/L		0.01		E200.7	08/08/13 18:31 / sld

Report Definitions:

RL - Analyte reporting limit.

QCL - Quality control limit.

D - RL increased due to sample matrix.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13080161-009
Client Sample ID 13BH-DT-PILOT-BDR4-080713

Report Date: 08/21/13
Collection Date: 08/07/13 12:50
DateReceived: 08/08/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1820	mg/L		10		A2540 C	08/08/13 12:03 / glj
INORGANICS							
Acidity, Total as CaCO3	270	mg/L	D	4.0		A2310 B	08/12/13 09:30 / cmm
Alkalinity, Total as CaCO3	100	mg/L		1		A2320 B	08/08/13 19:35 / cmm
Bicarbonate as HCO3	130	mg/L		1		A2320 B	08/08/13 19:35 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	08/08/13 19:35 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	08/08/13 19:35 / cmm
Chloride	ND	mg/L		1		E300.0	08/12/13 18:43 / cmm
Sulfate	1200	mg/L		1		E300.0	08/13/13 13:42 / cmm
Fluoride	1.9	mg/L	D	0.2	4	A4500-F C	08/13/13 16:28 / cmm
Sulfide	0.9	mg/L	D	0.2		A4500-S D	08/09/13 14:30 / eli-b22
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.143	mg/L		0.005		E365.1	08/08/13 14:21 / reh
METALS, DISSOLVED							
Aluminum	0.05	mg/L		0.03		E200.8	08/09/13 07:06 / raw
Arsenic	0.005	mg/L		0.001		E200.8	08/09/13 07:06 / raw
Barium	0.24	mg/L		0.05		E200.8	08/09/13 07:06 / raw
Beryllium	ND	mg/L		0.001		E200.8	08/14/13 20:24 / dck
Cadmium	ND	mg/L		0.001		E200.8	08/09/13 07:06 / raw
Calcium	253	mg/L		1		E200.7	08/08/13 18:35 / sld
Chromium	ND	mg/L		0.005		E200.8	08/09/13 07:06 / raw
Cobalt	0.037	mg/L		0.005		E200.8	08/10/13 07:41 / raw
Copper	ND	mg/L		0.005		E200.8	08/09/13 07:06 / raw
Iron	65.4	mg/L		0.03		E200.7	08/08/13 18:35 / sld
Lead	ND	mg/L		0.001		E200.8	08/09/13 07:06 / raw
Magnesium	41	mg/L		1		E200.7	08/08/13 18:35 / sld
Manganese	147	mg/L	D	0.003		E200.7	08/09/13 12:17 / sld
Nickel	0.018	mg/L		0.005		E200.8	08/09/13 07:06 / raw
Potassium	2	mg/L		1		E200.7	08/08/13 18:35 / sld
Silver	ND	mg/L		0.001		E200.8	08/09/13 07:06 / raw
Sodium	7	mg/L		1		E200.7	08/08/13 18:35 / sld
Thallium	ND	mg/L		0.0005		E200.8	08/09/13 07:06 / raw
Zinc	7.08	mg/L		0.01		E200.7	08/08/13 18:35 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	08/21/13
Project:	Barker Hughsville Pilot	**Collection Date:**	08/07/13 14:35
Lab ID:	H13080161-010	**DateReceived:**	08/08/13
Client Sample ID	13BH-DT-PILOT-BCR3-POST-080713	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
INORGANICS							
Sulfide	1.7	mg/L	D	0.2		A4500-S D	08/09/13 14:30 / eli-b22
AGGREGATE ORGANICS							
Oxygen Demand, Biochemical (BOD)	1700	mg/L		300		A5210 B	08/08/13 11:06 / cmm
NUTRIENTS							
Nitrogen, Ammonia as N	237	mg/L	D	10		E350.1	08/08/13 11:39 / reh

Report Definitions:

RL - Analyte reporting limit.

QCL - Quality control limit.

D - RL increased due to sample matrix.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 08/29/13

Work Order: H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2310 B										Batch: H13080161-001A
Sample ID: H13080161-009ADUP		Sample Duplicate				Run: MISC WC_130812A				08/12/13 09:30
Acidity, Total as CaCO3		280	mg/L	4.0				2.9	20	
Sample ID: LCS1308120930		Laboratory Control Sample				Run: MISC WC_130812A				08/12/13 09:30
Acidity, Total as CaCO3		670	mg/L	4.0	102	90	110			
Sample ID: MBLK1308120930		Method Blank				Run: MISC WC_130812A				08/12/13 09:30
Acidity, Total as CaCO3		10	mg/L	3						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 08/29/13
Work Order: H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2320 B										Batch: R90332
Sample ID: MBLK		Method Blank				Run: MAN-TECH_130808A				08/08/13 13:56
Alkalinity, Total as CaCO3		ND	mg/L	2						
Sample ID: LCS-07222013		Laboratory Control Sample				Run: MAN-TECH_130808A				08/08/13 14:03
Alkalinity, Total as CaCO3		630	mg/L	4.0	105	90	110			
Sample ID: H13080121-002ADUP	3	Sample Duplicate				Run: MAN-TECH_130808A				08/08/13 14:29
Alkalinity, Total as CaCO3		800	mg/L	4.0				0.1	10	
Bicarbonate as HCO3		910	mg/L	4.0				0.4	10	
Carbonate as CO3		32	mg/L	4.0				4.9	10	
Sample ID: H13080158-009ADUP	3	Sample Duplicate				Run: MAN-TECH_130808A				08/08/13 16:54
Alkalinity, Total as CaCO3		450	mg/L	4.0				0.4	10	
Bicarbonate as HCO3		490	mg/L	4.0				0.2	10	
Carbonate as CO3		31	mg/L	4.0				1.8	10	
Sample ID: H13080158-010AMS		Sample Matrix Spike				Run: MAN-TECH_130808A				08/08/13 17:12
Alkalinity, Total as CaCO3		1300	mg/L	4.0	108	80	120			
Sample ID: MBLK		Method Blank				Run: MAN-TECH_130808A				08/08/13 17:19
Alkalinity, Total as CaCO3		ND	mg/L	2						
Sample ID: LCS-0722013		Laboratory Control Sample				Run: MAN-TECH_130808A				08/08/13 17:26
Alkalinity, Total as CaCO3		630	mg/L	4.0	106	90	110			
Sample ID: H13080159-001ADUP	3	Sample Duplicate				Run: MAN-TECH_130808A				08/08/13 17:43
Alkalinity, Total as CaCO3		800	mg/L	4.0				0.1	10	
Bicarbonate as HCO3		970	mg/L	4.0				0.1	10	
Carbonate as CO3		ND	mg/L	4.0					10	
Sample ID: H13080161-001ADUP	3	Sample Duplicate				Run: MAN-TECH_130808A				08/08/13 18:22
Alkalinity, Total as CaCO3		ND	mg/L	4.0					10	
Bicarbonate as HCO3		ND	mg/L	4.0					10	
Carbonate as CO3		ND	mg/L	4.0					10	
Sample ID: H13080161-002AMS		Sample Matrix Spike				Run: MAN-TECH_130808A				08/08/13 18:34
Alkalinity, Total as CaCO3		480	mg/L	4.0	80	80	120			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 08/29/13
Work Order: H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **A2320 B**										Batch: R90533
Sample ID: **MBLK**		Method Blank				Run: MAN-TECH_130815B				08/15/13 15:04
Alkalinity, Total as CaCO3		ND	mg/L	2						
Sample ID: **LCS**		Laboratory Control Sample				Run: MAN-TECH_130815B				08/15/13 15:12
Alkalinity, Total as CaCO3		630	mg/L	4.0	104	90	110			
Sample ID: **H13080192-004ADUP**	3	Sample Duplicate				Run: MAN-TECH_130815B				08/15/13 16:08
Alkalinity, Total as CaCO3		1300	mg/L	4.0				0.2	10	
Bicarbonate as HCO3		1600	mg/L	4.0				0.2	10	
Carbonate as CO3		ND	mg/L	4.0					10	
Sample ID: **H13080283-001AMS**		Sample Matrix Spike				Run: MAN-TECH_130815B				08/15/13 16:31
Alkalinity, Total as CaCO3		2000	mg/L	4.0	96	80	120			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 08/29/13

Work Order: H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2540 C										Batch: TDS130808B
Sample ID: MB-26_130808B		Method Blank				Run: ACCU-124 (14410200)_130808			08/08/13 12:01	
Solids, Total Dissolved TDS @ 180 C		ND	mg/L	1						
Sample ID: LCS-27_130808B		Laboratory Control Sample				Run: ACCU-124 (14410200)_130808			08/08/13 12:01	
Solids, Total Dissolved TDS @ 180 C		2020	mg/L	10	101	90	110			
Sample ID: H13080121-009A DUP		Sample Duplicate				Run: ACCU-124 (14410200)_130808			08/08/13 12:01	
Solids, Total Dissolved TDS @ 180 C		ND	mg/L	10					5	
- RPD greater than method limit. Difference < PQL - RPD not applicable.										
Sample ID: H13080161-001A MS		Sample Matrix Spike				Run: ACCU-124 (14410200)_130808			08/08/13 12:02	
Solids, Total Dissolved TDS @ 180 C		3720	mg/L	10	99	80	120			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 08/29/13
Work Order: H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-F C										Analytical Run: PH_130813A
Sample ID: ICV1_130813A		Initial Calibration Verification Standard								08/13/13 15:05
Fluoride		0.7	mg/L	0.1	97	90	110			
Sample ID: CCV4_130813A		Continuing Calibration Verification Standard								08/13/13 16:18
Fluoride		0.2	mg/L	0.1	99	90	110			
Method: A4500-F C										Batch: 130813A-F-ISE-W
Sample ID: MBLK1_130813A		Method Blank				Run: PH_130813A				08/13/13 15:04
Fluoride		0.01	mg/L	0.005						
Sample ID: LFB1_130813A		Laboratory Fortified Blank				Run: PH_130813A				08/13/13 15:09
Fluoride		0.5	mg/L	0.1	99	90	110			
Sample ID: H13080161-001AMS		Sample Matrix Spike				Run: PH_130813A				08/13/13 16:20
Fluoride		1.1	mg/L	0.2	35	85	115			S
Sample ID: H13080161-001AMSD		Sample Matrix Spike Duplicate				Run: PH_130813A				08/13/13 16:20
Fluoride		1.1	mg/L	0.2	35	85	115	0.4	10	S
Sample ID: H13080192-001AMS		Sample Matrix Spike				Run: PH_130813A				08/13/13 16:34
Fluoride		8.8	mg/L	1.0	91	85	115			
Sample ID: H13080192-001AMSD		Sample Matrix Spike Duplicate				Run: PH_130813A				08/13/13 16:35
Fluoride		8.8	mg/L	1.0	92	85	115	0.3	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Report Date: 08/29/13
Work Order: H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-S D										Batch: B_R209723
Sample ID: MB-R209723	Method Blank					Run: SUB-B209723				08/09/13 14:30
Sulfide		ND	mg/L	0.002						
Sample ID: LCS-R209723	Laboratory Control Sample					Run: SUB-B209723				08/09/13 14:30
Sulfide		0.275	mg/L	0.040	111	70	130			
Sample ID: H13080167-001H	Sample Matrix Spike					Run: SUB-B209723				08/09/13 14:30
Sulfide		0.0959	mg/L	0.040	34	70	130			S
- Matrix spike recoveries outside the acceptance range are considered matrix-related.										
Sample ID: H13080167-001H	Sample Matrix Spike Duplicate					Run: SUB-B209723				08/09/13 14:30
Sulfide		0.104	mg/L	0.040	38	70	130	8.6	20	S
- Matrix spike recoveries outside the acceptance range are considered matrix-related.										

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 08/29/13

Project: Barker Hughsville Pilot **Work Order:** H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-S F										Batch: B_R209724
Sample ID: MB-R209724		Method Blank				Run: SUB-B209724				08/09/13 14:30
Sulfide		ND	mg/L	0.5						
Sample ID: LCS-R209724		Laboratory Control Sample				Run: SUB-B209724				08/09/13 14:30
Sulfide		33.3	mg/L	1.0	101	70	130			
Sample ID: H13080161-005C		Sample Matrix Spike				Run: SUB-B209724				08/09/13 14:30
Sulfide		33.6	mg/L	1.0	97	80	120			
Sample ID: H13080161-005C		Sample Matrix Spike Duplicate				Run: SUB-B209724				08/09/13 14:30
Sulfide		33.2	mg/L	1.0	96	80	120	1.2	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Report Date: 08/29/13

Project: Barker Hughsville Pilot

Work Order: H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A5210 B								Batch: 130808_1_BOD5-W		
Sample ID: Dil-H201_130808		Dilution Water Blank				Run: MISC WC_130808A			08/08/13 10:59	
Oxygen Demand, Biochemical (BOD)		0.27	mg/L	2.0		0	0.2			
Dilution water blank exceeds 0.2 mg/L.										
Sample ID: GGA1_130808		Laboratory Control Sample				Run: MISC WC_130808A			08/08/13 11:01	
Oxygen Demand, Biochemical (BOD)		190	mg/L	53	97	85	115			
Sample ID: H13070399-010ADUP		Sample Duplicate				Run: MISC WC_130808A			08/08/13 11:03	
Oxygen Demand, Biochemical (BOD)		38	mg/L	32		90	110	0.2	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 08/29/13
Work Order: H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7										Analytical Run: ICP2-HE_130808A
Sample ID: ICV	9	Initial Calibration Verification Standard								08/08/13 09:38
Aluminum		4.08	mg/L	0.10	102	95	105			
Calcium		40.7	mg/L	1.0	102	95	105			
Copper		0.805	mg/L	0.010	101	95	105			
Iron		3.99	mg/L	0.030	100	95	105			
Magnesium		40.5	mg/L	1.0	101	95	105			
Manganese		3.98	mg/L	0.010	100	95	105			
Potassium		39.6	mg/L	1.0	99	95	105			
Sodium		39.7	mg/L	1.0	99	95	105			
Zinc		0.785	mg/L	0.010	98	95	105			
Sample ID: CCV-1	9	Continuing Calibration Verification Standard								08/08/13 09:41
Aluminum		2.54	mg/L	0.10	102	95	105			
Calcium		25.5	mg/L	1.0	102	95	105			
Copper		2.52	mg/L	0.010	101	95	105			
Iron		2.51	mg/L	0.030	100	95	105			
Magnesium		25.3	mg/L	1.0	101	95	105			
Manganese		2.51	mg/L	0.010	100	95	105			
Potassium		24.8	mg/L	1.0	99	95	105			
Sodium		24.7	mg/L	1.0	99	95	105			
Zinc		2.52	mg/L	0.010	101	95	105			
Sample ID: ICSA	9	Interference Check Sample A								08/08/13 09:52
Aluminum		531	mg/L	0.10	106	80	120			
Calcium		492	mg/L	1.0	98	80	120			
Copper		0.00219	mg/L	0.010		0	0			
Iron		192	mg/L	0.030	96	80	120			
Magnesium		519	mg/L	1.0	104	80	120			
Manganese		0.00567	mg/L	0.010		0	0			
Potassium		-0.0129	mg/L	1.0		0	0			
Sodium		0.00926	mg/L	1.0		0	0			
Zinc		0.0116	mg/L	0.010		0	0			
Sample ID: ICSAB	9	Interference Check Sample AB								08/08/13 09:56
Aluminum		525	mg/L	0.10	105	80	120			
Calcium		485	mg/L	1.0	97	80	120			
Copper		0.510	mg/L	0.010	102	80	120			
Iron		190	mg/L	0.030	95	80	120			
Magnesium		516	mg/L	1.0	103	80	120			
Manganese		0.494	mg/L	0.010	99	80	120			
Potassium		23.1	mg/L	1.0	115	80	120			
Sodium		23.1	mg/L	1.0	115	80	120			
Zinc		0.976	mg/L	0.010	98	80	120			
Sample ID: CCV	9	Continuing Calibration Verification Standard								08/08/13 17:08
Aluminum		2.38	mg/L	0.10	95	90	110			

Qualifiers:

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ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 08/29/13
Work Order: H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7										Analytical Run: ICP2-HE_130808A
Sample ID: CCV	9	Continuing Calibration Verification Standard								08/08/13 17:08
Calcium		23.4	mg/L	1.0	93	90	110			
Copper		2.36	mg/L	0.010	94	90	110			
Iron		2.33	mg/L	0.030	93	90	110			
Magnesium		22.8	mg/L	1.0	91	90	110			
Manganese		2.36	mg/L	0.010	94	90	110			
Potassium		24.1	mg/L	1.0	97	90	110			
Sodium		24.2	mg/L	1.0	97	90	110			
Zinc		2.39	mg/L	0.010	96	90	110			
Sample ID: CCV	9	Continuing Calibration Verification Standard								08/08/13 18:20
Aluminum		2.50	mg/L	0.10	100	90	110			
Calcium		24.4	mg/L	1.0	98	90	110			
Copper		2.47	mg/L	0.010	99	90	110			
Iron		2.44	mg/L	0.030	98	90	110			
Magnesium		23.6	mg/L	1.0	95	90	110			
Manganese		2.45	mg/L	0.010	98	90	110			
Potassium		23.7	mg/L	1.0	95	90	110			
Sodium		23.9	mg/L	1.0	95	90	110			
Zinc		2.46	mg/L	0.010	99	90	110			
Method: E200.7										Batch: R90335
Sample ID: ICB	9	Method Blank				Run: ICP2-HE_130808A				08/08/13 10:04
Aluminum		ND	mg/L	0.004						
Calcium		0.05	mg/L	0.03						
Copper		ND	mg/L	0.003						
Iron		0.02	mg/L	0.005						
Magnesium		ND	mg/L	0.02						
Manganese		ND	mg/L	0.0005						
Potassium		ND	mg/L	0.03						
Sodium		ND	mg/L	0.03						
Zinc		0.002	mg/L	0.001						
Sample ID: LFB	9	Laboratory Fortified Blank				Run: ICP2-HE_130808A				08/08/13 10:08
Aluminum		5.05	mg/L	0.10	101	85	115			
Calcium		50.5	mg/L	1.0	101	85	115			
Copper		0.988	mg/L	0.010	99	85	115			
Iron		4.94	mg/L	0.030	99	85	115			
Magnesium		50.4	mg/L	1.0	101	85	115			
Manganese		4.95	mg/L	0.010	99	85	115			
Potassium		48.2	mg/L	1.0	96	85	115			
Sodium		48.3	mg/L	1.0	97	85	115			
Zinc		0.979	mg/L	0.010	98	85	115			
Sample ID: H13080161-001BMS2	9	Sample Matrix Spike				Run: ICP2-HE_130808A				08/08/13 17:27
Aluminum		17.5	mg/L	0.030	94	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 08/29/13
Project: Barker Hughsville Pilot
Work Order: H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.7**										Batch: R90335
Sample ID: **H13080161-001BMS2**	9	Sample Matrix Spike				Run: ICP2-HE_130808A				08/08/13 17:27
Calcium		137	mg/L	1.0	87	70	130			
Copper		2.31	mg/L	0.0050	92	70	130			
Iron		151	mg/L	0.030		70	130			A
Magnesium		63.9	mg/L	1.0	88	70	130			
Manganese		109	mg/L	0.0010		70	130			A
Potassium		47.7	mg/L	1.0	93	70	130			
Sodium		53.8	mg/L	1.0	94	70	130			
Zinc		54.0	mg/L	0.010		70	130			A
Sample ID: **H13080161-001BMSD2**	9	Sample Matrix Spike Duplicate				Run: ICP2-HE_130808A				08/08/13 17:31
Aluminum		17.5	mg/L	0.030	94	70	130	0.0	20	
Calcium		138	mg/L	1.0	89	70	130	0.8	20	
Copper		2.30	mg/L	0.0050	90	70	130	0.6	20	
Iron		151	mg/L	0.030		70	130	0.3	20	A
Magnesium		64.4	mg/L	1.0	89	70	130	0.7	20	
Manganese		109	mg/L	0.0010		70	130	0.4	20	A
Potassium		47.9	mg/L	1.0	93	70	130	0.3	20	
Sodium		53.9	mg/L	1.0	94	70	130	0.1	20	
Zinc		52.7	mg/L	0.010		70	130	2.4	20	A
Sample ID: **H13080167-001BMS2**	9	Sample Matrix Spike				Run: ICP2-HE_130808A				08/08/13 18:47
Aluminum		48.6	mg/L	0.042	97	70	130			
Calcium		800	mg/L	1.0	94	70	130			
Copper		9.81	mg/L	0.034	98	70	130			
Iron		48.5	mg/L	0.048	96	70	130			
Magnesium		588	mg/L	1.0	92	70	130			
Manganese		49.9	mg/L	0.0054	96	70	130			
Potassium		501	mg/L	1.0	95	70	130			
Sodium		5430	mg/L	1.0		70	130			A
Zinc		9.65	mg/L	0.014	96	70	130			
Sample ID: **H13080167-001BMSD2**	9	Sample Matrix Spike Duplicate				Run: ICP2-HE_130808A				08/08/13 18:51
Aluminum		48.4	mg/L	0.042	97	70	130	0.3	20	
Calcium		806	mg/L	1.0	95	70	130	0.7	20	
Copper		9.92	mg/L	0.034	99	70	130	1.1	20	
Iron		49.3	mg/L	0.048	98	70	130	1.6	20	
Magnesium		594	mg/L	1.0	93	70	130	0.9	20	
Manganese		50.9	mg/L	0.0054	98	70	130	1.9	20	
Potassium		517	mg/L	1.0	98	70	130	3.2	20	
Sodium		5600	mg/L	1.0		70	130	3.0	20	A
Zinc		9.59	mg/L	0.014	95	70	130	0.7	20	

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 08/29/13

Work Order: H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7							Analytical Run: ICP2-HE_130809A			
Sample ID: ICV	3	Initial Calibration Verification Standard								08/09/13 10:34
Calcium		40.5	mg/L	1.0	101	95	105			
Iron		4.03	mg/L	0.030	101	95	105			
Manganese		3.93	mg/L	0.010	98	95	105			
Sample ID: CCV-1	3	Continuing Calibration Verification Standard								08/09/13 10:37
Calcium		25.3	mg/L	1.0	101	95	105			
Iron		2.51	mg/L	0.030	101	95	105			
Manganese		2.45	mg/L	0.010	98	95	105			
Sample ID: ICSA	3	Interference Check Sample A								08/09/13 10:48
Calcium		473	mg/L	1.0	95	80	120			
Iron		190	mg/L	0.030	95	80	120			
Manganese		0.00389	mg/L	0.010		0	0			
Sample ID: ICSAB	3	Interference Check Sample AB								08/09/13 10:52
Calcium		468	mg/L	1.0	94	80	120			
Iron		188	mg/L	0.030	94	80	120			
Manganese		0.475	mg/L	0.010	95	80	120			
Sample ID: CCV	3	Continuing Calibration Verification Standard								08/09/13 11:22
Calcium		24.9	mg/L	1.0	99	90	110			
Iron		2.48	mg/L	0.030	99	90	110			
Manganese		2.43	mg/L	0.010	97	90	110			
Sample ID: CCV	3	Continuing Calibration Verification Standard								08/09/13 12:06
Calcium		24.4	mg/L	1.0	98	90	110			
Iron		2.44	mg/L	0.030	97	90	110			
Manganese		2.37	mg/L	0.010	95	90	110			
Method: E200.7										Batch: R90370
Sample ID: ICB	3	Method Blank				Run: ICP2-HE_130809A				08/09/13 11:00
Calcium		0.06	mg/L	0.03						
Iron		ND	mg/L	0.005						
Manganese		ND	mg/L	0.0005						
Sample ID: LFB	3	Laboratory Fortified Blank				Run: ICP2-HE_130809A				08/09/13 11:04
Calcium		49.5	mg/L	1.0	99	85	115			
Iron		4.92	mg/L	0.030	98	85	115			
Manganese		4.79	mg/L	0.010	96	85	115			
Sample ID: H13080121-006BMS2	3	Sample Matrix Spike				Run: ICP2-HE_130809A				08/09/13 11:37
Calcium		119	mg/L	1.0	98	70	130			
Iron		5.11	mg/L	0.030	99	70	130			
Manganese		4.91	mg/L	0.0010	98	70	130			
Sample ID: H13080121-006BMSD2	3	Sample Matrix Spike Duplicate				Run: ICP2-HE_130809A				08/09/13 11:40
Calcium		119	mg/L	1.0	100	70	130	0.7	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 08/29/13

Work Order: H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7										Batch: R90370
Sample ID: H13080121-006BMSD2	3	Sample Matrix Spike Duplicate				Run: ICP2-HE_130809A				08/09/13 11:40
Iron		5.15	mg/L	0.030	100	70	130	0.8	20	
Manganese		4.94	mg/L	0.0010	98	70	130	0.8	20	
Sample ID: H13080161-009BMS2	3	Sample Matrix Spike				Run: ICP2-HE_130809A				08/09/13 12:24
Calcium		515	mg/L	1.0	99	70	130			
Iron		92.1	mg/L	0.030	95	70	130			
Manganese		168	mg/L	0.0027		70	130			A
Sample ID: H13080161-009BMSD2	3	Sample Matrix Spike Duplicate				Run: ICP2-HE_130809A				08/09/13 12:27
Calcium		510	mg/L	1.0	97	70	130	1.0	20	
Iron		91.2	mg/L	0.030	92	70	130	0.9	20	
Manganese		168	mg/L	0.0027		70	130	0.0	20	A

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 08/29/13
Project: Barker Hughsville Pilot
Work Order: H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**										Analytical Run: ICPMS204-B_130808C
Sample ID: **ICV STD**	12	Initial Calibration Verification Standard								08/08/13 17:02
Aluminum		0.273	mg/L	0.10	91	90	110			
Arsenic		0.0597	mg/L	0.0050	100	90	110			
Barium		0.0600	mg/L	0.10	100	90	110			
Beryllium		0.0308	mg/L	0.0010	103	90	110			
Cadmium		0.0314	mg/L	0.0010	105	90	110			
Chromium		0.0603	mg/L	0.010	101	90	110			
Copper		0.0608	mg/L	0.010	101	90	110			
Lead		0.0634	mg/L	0.010	106	90	110			
Nickel		0.0617	mg/L	0.010	103	90	110			
Silver		0.0299	mg/L	0.0050	100	90	110			
Thallium		0.0638	mg/L	0.10	106	90	110			
Zinc		0.0600	mg/L	0.010	100	90	110			
Sample ID: **ICSA**	12	Interference Check Sample A								08/08/13 17:06
Aluminum		33.8	mg/L	0.10	84	70	130			
Arsenic		0.000273	mg/L	0.0050						
Barium		0.000100	mg/L	0.10						
Beryllium		2.40E-05	mg/L	0.0010						
Cadmium		0.000944	mg/L	0.0010						
Chromium		0.00110	mg/L	0.010						
Copper		0.000262	mg/L	0.010						
Lead		0.000217	mg/L	0.010						
Nickel		0.000650	mg/L	0.010						
Silver		0.000118	mg/L	0.0050						
Thallium		7.00E-05	mg/L	0.10						
Zinc		0.00103	mg/L	0.010						
Sample ID: **ICSAB**	12	Interference Check Sample AB								08/08/13 17:11
Aluminum		34.2	mg/L	0.10	85	70	130			
Arsenic		0.0102	mg/L	0.0050	102	70	130			
Barium		7.50E-05	mg/L	0.10		0	0			
Beryllium		1.20E-05	mg/L	0.0010		0	0			
Cadmium		0.00995	mg/L	0.0010	99	70	130			
Chromium		0.0206	mg/L	0.010	103	70	130			
Copper		0.0191	mg/L	0.010	95	70	130			
Lead		0.000156	mg/L	0.010		0	0			
Nickel		0.0203	mg/L	0.010	102	70	130			
Silver		0.0186	mg/L	0.0050	93	70	130			
Thallium		2.70E-05	mg/L	0.10		0	0			
Zinc		0.0105	mg/L	0.010	105	70	130			
Sample ID: **ICSA**	12	Interference Check Sample A								08/09/13 07:57
Aluminum		32.6	mg/L	0.10	82	70	130			
Arsenic		0.000476	mg/L	0.0050						
Barium		0.000127	mg/L	0.10						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 08/29/13

Project: Barker Hughsville Pilot **Work Order:** H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130808C
Sample ID: ICSA	12	Interference Check Sample A								08/09/13 07:57
Beryllium		3.00E-05	mg/L	0.0010						
Cadmium		0.00107	mg/L	0.0010						
Chromium		0.00113	mg/L	0.010						
Copper		0.000374	mg/L	0.010						
Lead		0.000347	mg/L	0.010						
Nickel		0.00118	mg/L	0.010						
Silver		0.000398	mg/L	0.0050						
Thallium		2.60E-05	mg/L	0.10						
Zinc		0.00146	mg/L	0.010						
Sample ID: ICSAB	12	Interference Check Sample AB								08/09/13 08:02
Aluminum		33.1	mg/L	0.10	83	70	130			
Arsenic		0.0103	mg/L	0.0050	103	70	130			
Barium		0.000117	mg/L	0.10		0	0			
Beryllium		2.40E-05	mg/L	0.0010		0	0			
Cadmium		0.0101	mg/L	0.0010	101	70	130			
Chromium		0.0213	mg/L	0.010	107	70	130			
Copper		0.0203	mg/L	0.010	101	70	130			
Lead		0.000175	mg/L	0.010		0	0			
Nickel		0.0218	mg/L	0.010	109	70	130			
Silver		0.0174	mg/L	0.0050	87	70	130			
Thallium		2.20E-05	mg/L	0.10		0	0			
Zinc		0.0106	mg/L	0.010	106	70	130			
Sample ID: ICV STD	12	Initial Calibration Verification Standard								08/09/13 11:23
Aluminum		0.283	mg/L	0.10	94	90	110			
Arsenic		0.0605	mg/L	0.0050	101	90	110			
Barium		0.0599	mg/L	0.10	100	90	110			
Beryllium		0.0312	mg/L	0.0010	104	90	110			
Cadmium		0.0324	mg/L	0.0010	108	90	110			
Chromium		0.0613	mg/L	0.010	102	90	110			
Copper		0.0625	mg/L	0.010	104	90	110			
Lead		0.0601	mg/L	0.010	100	90	110			
Nickel		0.0621	mg/L	0.010	104	90	110			
Silver		0.0308	mg/L	0.0050	103	90	110			
Thallium		0.0630	mg/L	0.10	105	90	110			
Zinc		0.0614	mg/L	0.010	102	90	110			
Sample ID: ICSA	12	Interference Check Sample A								08/09/13 11:28
Aluminum		34.4	mg/L	0.10	86	70	130			
Arsenic		0.000185	mg/L	0.0050						
Barium		0.000149	mg/L	0.10						
Beryllium		9.00E-06	mg/L	0.0010						
Cadmium		0.00115	mg/L	0.0010						
Chromium		0.00112	mg/L	0.010						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 08/29/13
Project: Barker Hughsville Pilot
Work Order: H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130808C
Sample ID: ICSA	12	Interference Check Sample A								08/09/13 11:28
Copper		0.000306	mg/L	0.010						
Lead		0.000199	mg/L	0.010						
Nickel		0.000675	mg/L	0.010						
Silver		0.000222	mg/L	0.0050						
Thallium		6.20E-05	mg/L	0.10						
Zinc		0.00112	mg/L	0.010						
Sample ID: ICSAB	12	Interference Check Sample AB								08/09/13 11:32
Aluminum		34.4	mg/L	0.10	86	70	130			
Arsenic		0.0104	mg/L	0.0050	104	70	130			
Barium		0.000147	mg/L	0.10		0	0			
Beryllium		7.00E-06	mg/L	0.0010		0	0			
Cadmium		0.0103	mg/L	0.0010	103	70	130			
Chromium		0.0211	mg/L	0.010	106	70	130			
Copper		0.0198	mg/L	0.010	99	70	130			
Lead		0.000157	mg/L	0.010		0	0			
Nickel		0.0208	mg/L	0.010	104	70	130			
Silver		0.0187	mg/L	0.0050	93	70	130			
Thallium		2.80E-05	mg/L	0.10		0	0			
Zinc		0.0106	mg/L	0.010	106	70	130			
Sample ID: ICV STD	13	Initial Calibration Verification Standard								08/09/13 20:53
Aluminum		0.277	mg/L	0.10	92	90	110			
Arsenic		0.0612	mg/L	0.0050	102	90	110			
Barium		0.0588	mg/L	0.10	98	90	110			
Beryllium		0.0305	mg/L	0.0010	102	90	110			
Cadmium		0.0319	mg/L	0.0010	106	90	110			
Chromium		0.0617	mg/L	0.010	103	90	110			
Cobalt		0.0643	mg/L	0.010	107	90	110			
Copper		0.0625	mg/L	0.010	104	90	110			
Lead		0.0600	mg/L	0.010	100	90	110			
Nickel		0.0622	mg/L	0.010	104	90	110			
Silver		0.0299	mg/L	0.0050	100	90	110			
Thallium		0.0634	mg/L	0.10	106	90	110			
Zinc		0.0633	mg/L	0.010	105	90	110			
Sample ID: ICSA	13	Interference Check Sample A								08/09/13 20:58
Aluminum		34.1	mg/L	0.10	85	70	130			
Arsenic		0.000237	mg/L	0.0050						
Barium		0.000235	mg/L	0.10						
Beryllium		2.10E-05	mg/L	0.0010						
Cadmium		0.00104	mg/L	0.0010						
Chromium		0.00186	mg/L	0.010						
Cobalt		0.000531	mg/L	0.010						
Copper		0.000223	mg/L	0.010						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 08/29/13

Project: Barker Hughsville Pilot **Work Order:** H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130808C
Sample ID: ICSA	13	Interference Check Sample A								08/09/13 20:58
Lead		0.000214	mg/L	0.010						
Nickel		0.000626	mg/L	0.010						
Silver		0.000181	mg/L	0.0050						
Thallium		0.000153	mg/L	0.10						
Zinc		0.00112	mg/L	0.010						
Sample ID: ICSAB	13	Interference Check Sample AB								08/09/13 21:03
Aluminum		34.4	mg/L	0.10	86	70	130			
Arsenic		0.0102	mg/L	0.0050	102	70	130			
Barium		0.000158	mg/L	0.10		0	0			
Beryllium		2.10E-05	mg/L	0.0010		0	0			
Cadmium		0.0101	mg/L	0.0010	101	70	130			
Chromium		0.0215	mg/L	0.010	108	70	130			
Cobalt		0.0209	mg/L	0.010	104	70	130			
Copper		0.0197	mg/L	0.010	99	70	130			
Lead		0.000146	mg/L	0.010		0	0			
Nickel		0.0207	mg/L	0.010	103	70	130			
Silver		0.0183	mg/L	0.0050	92	70	130			
Thallium		7.10E-05	mg/L	0.10		0	0			
Zinc		0.0108	mg/L	0.010	108	70	130			
Sample ID: ICSA	13	Interference Check Sample A								08/10/13 08:10
Aluminum		34.4	mg/L	0.10	86	70	130			
Arsenic		0.000283	mg/L	0.0050						
Barium		0.000177	mg/L	0.10						
Beryllium		3.00E-06	mg/L	0.0010						
Cadmium		0.00104	mg/L	0.0010						
Chromium		0.00104	mg/L	0.010						
Cobalt		0.000517	mg/L	0.010						
Copper		0.000193	mg/L	0.010						
Lead		0.000166	mg/L	0.010						
Nickel		0.000729	mg/L	0.010						
Silver		0.000286	mg/L	0.0050						
Thallium		5.80E-05	mg/L	0.10						
Zinc		0.000983	mg/L	0.010						
Sample ID: ICSAB	13	Interference Check Sample AB								08/10/13 08:14
Aluminum		34.3	mg/L	0.10	86	70	130			
Arsenic		0.0106	mg/L	0.0050	106	70	130			
Barium		9.10E-05	mg/L	0.10		0	0			
Beryllium		-5.00E-06	mg/L	0.0010		0	0			
Cadmium		0.0101	mg/L	0.0010	101	70	130			
Chromium		0.0212	mg/L	0.010	106	70	130			
Cobalt		0.0207	mg/L	0.010	104	70	130			
Copper		0.0195	mg/L	0.010	98	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 08/29/13

Project: Barker Hughsville Pilot **Work Order:** H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130808C
Sample ID: ICSAB	13	Interference Check Sample AB								08/10/13 08:14
Lead		0.000144	mg/L	0.010		0	0			
Nickel		0.0205	mg/L	0.010	103	70	130			
Silver		0.0182	mg/L	0.0050	91	70	130			
Thallium		4.40E-05	mg/L	0.10		0	0			
Zinc		0.0112	mg/L	0.010	112	70	130			
Method: E200.8										Batch: R90353
Sample ID: ICB	13	Method Blank				Run: ICPMS204-B_130808C				08/08/13 17:39
Aluminum		0.0002	mg/L	0.0001						
Arsenic		ND	mg/L	7E-05						
Barium		ND	mg/L	5E-05						
Beryllium		2E-05	mg/L	2E-05						
Cadmium		8E-06	mg/L	7E-06						
Chromium		ND	mg/L	4E-05						
Cobalt		ND	mg/L	2E-05						
Copper		ND	mg/L	3E-05						
Lead		1E-05	mg/L	6E-06						
Nickel		ND	mg/L	6E-05						
Silver		5E-05	mg/L	4E-05						
Thallium		ND	mg/L	1E-05						
Zinc		0.001	mg/L	0.0003						
Sample ID: LFB	13	Laboratory Fortified Blank				Run: ICPMS204-B_130808C				08/08/13 17:44
Aluminum		0.0489	mg/L	0.10	97	85	115			
Arsenic		0.0496	mg/L	0.0050	99	85	115			
Barium		0.0503	mg/L	0.10	101	85	115			
Beryllium		0.0494	mg/L	0.0010	99	85	115			
Cadmium		0.0505	mg/L	0.0010	101	85	115			
Chromium		0.0505	mg/L	0.010	101	85	115			
Cobalt		0.0553	mg/L	0.010	111	85	115			
Copper		0.0520	mg/L	0.010	104	85	115			
Lead		0.0520	mg/L	0.010	104	85	115			
Nickel		0.0524	mg/L	0.010	105	85	115			
Silver		0.0202	mg/L	0.0050	101	85	115			
Thallium		0.0524	mg/L	0.10	105	85	115			
Zinc		0.0525	mg/L	0.010	103	85	115			
Sample ID: H13080158-009BMS	13	Sample Matrix Spike				Run: ICPMS204-B_130808C				08/09/13 05:47
Aluminum		0.127	mg/L	0.030	100	70	130			
Arsenic		0.0629	mg/L	0.0010	124	70	130			
Barium		0.0775	mg/L	0.050	110	70	130			
Beryllium		0.0520	mg/L	0.0010	104	70	130			
Cadmium		0.0517	mg/L	0.0010	103	70	130			
Chromium		0.0557	mg/L	0.0050	106	70	130			
Cobalt		0.0648	mg/L	0.0050	125	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 08/29/13

Project: Barker Hughsville Pilot **Work Order:** H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Batch: R90353
Sample ID: H13080158-009BMS	13	Sample Matrix Spike				Run: ICPMS204-B_130808C				08/09/13 05:47
Copper		0.0549	mg/L	0.0050	108	70	130			
Lead		0.0564	mg/L	0.0010	112	70	130			
Nickel		0.0571	mg/L	0.0050	110	70	130			
Silver		0.0181	mg/L	0.0010	91	70	130			
Thallium		0.0563	mg/L	0.00050	113	70	130			
Zinc		0.0560	mg/L	0.010	106	70	130			
Sample ID: H13080158-009BMSD	13	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130808C				08/09/13 05:52
Aluminum		0.130	mg/L	0.030	107	70	130	2.7	20	
Arsenic		0.0649	mg/L	0.0010	128	70	130	3.1	20	
Barium		0.0785	mg/L	0.050	112	70	130	1.2	20	
Beryllium		0.0512	mg/L	0.0010	102	70	130	1.5	20	
Cadmium		0.0519	mg/L	0.0010	104	70	130	0.4	20	
Chromium		0.0565	mg/L	0.0050	107	70	130	1.5	20	
Cobalt		0.0657	mg/L	0.0050	127	70	130	1.4	20	
Copper		0.0558	mg/L	0.0050	110	70	130	1.5	20	
Lead		0.0571	mg/L	0.0010	114	70	130	1.2	20	
Nickel		0.0580	mg/L	0.0050	111	70	130	1.6	20	
Silver		0.0186	mg/L	0.0010	93	70	130	2.9	20	
Thallium		0.0573	mg/L	0.00050	115	70	130	1.8	20	
Zinc		0.0566	mg/L	0.010	107	70	130	1.0	20	
Sample ID: H13080161-009BMS	13	Sample Matrix Spike				Run: ICPMS204-B_130808C				08/09/13 07:11
Aluminum		0.0928	mg/L	0.030	80	70	130			
Arsenic		0.0625	mg/L	0.0010	115	70	130			
Barium		0.288	mg/L	0.050		70	130			A
Beryllium		0.0410	mg/L	0.0010	82	70	130			
Cadmium		0.0497	mg/L	0.0010	99	70	130			
Chromium		0.0554	mg/L	0.0050	111	70	130			
Cobalt		0.0946	mg/L	0.0050	114	70	130			
Copper		0.0569	mg/L	0.0050	112	70	130			
Lead		0.0558	mg/L	0.0010	111	70	130			
Nickel		0.0751	mg/L	0.0050	115	70	130			
Silver		0.0144	mg/L	0.0010	72	70	130			
Thallium		0.0567	mg/L	0.00050	113	70	130			
Zinc		6.68	mg/L	0.010		70	130			A
Sample ID: H13080161-009BMSD	13	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130808C				08/09/13 07:16
Aluminum		0.0901	mg/L	0.030	74	70	130	3.0	20	
Arsenic		0.0590	mg/L	0.0010	107	70	130	5.8	20	
Barium		0.284	mg/L	0.050		70	130	1.4	20	A
Beryllium		0.0390	mg/L	0.0010	78	70	130	4.8	20	
Cadmium		0.0485	mg/L	0.0010	97	70	130	2.5	20	
Chromium		0.0523	mg/L	0.0050	104	70	130	5.9	20	
Cobalt		0.0958	mg/L	0.0050	116	70	130	1.3	20	

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 08/29/13

Project: Barker Hughsville Pilot
Work Order: H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**										Batch: R90353
Sample ID: **H13080161-009BMSD**	13	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130808C				08/09/13 07:16
Copper		0.0532	mg/L	0.0050	105	70	130	6.7	20	
Lead		0.0548	mg/L	0.0010	109	70	130	1.8	20	
Nickel		0.0706	mg/L	0.0050	106	70	130	6.2	20	
Silver		0.0146	mg/L	0.0010	73	70	130	1.5	20	
Thallium		0.0556	mg/L	0.00050	111	70	130	1.9	20	
Zinc		6.35	mg/L	0.010		70	130	5.0	20	A
Sample ID: **ICB**	13	Method Blank				Run: ICPMS204-B_130808C				08/09/13 21:31
Aluminum		0.001	mg/L	0.0001						
Arsenic		ND	mg/L	7E-05						
Barium		6E-05	mg/L	5E-05						
Beryllium		ND	mg/L	2E-05						
Cadmium		9E-06	mg/L	7E-06						
Chromium		ND	mg/L	4E-05						
Cobalt		ND	mg/L	2E-05						
Copper		4E-05	mg/L	3E-05						
Lead		2E-05	mg/L	6E-06						
Nickel		ND	mg/L	6E-05						
Silver		6E-05	mg/L	4E-05						
Thallium		ND	mg/L	1E-05						
Zinc		0.001	mg/L	0.0003						
Sample ID: **LFB**	13	Laboratory Fortified Blank				Run: ICPMS204-B_130808C				08/09/13 21:35
Aluminum		0.0505	mg/L	0.10	99	85	115			
Arsenic		0.0509	mg/L	0.0050	102	85	115			
Barium		0.0495	mg/L	0.10	99	85	115			
Beryllium		0.0494	mg/L	0.0010	99	85	115			
Cadmium		0.0523	mg/L	0.0010	105	85	115			
Chromium		0.0517	mg/L	0.010	103	85	115			
Cobalt		0.0544	mg/L	0.010	109	85	115			
Copper		0.0529	mg/L	0.010	106	85	115			
Lead		0.0506	mg/L	0.010	101	85	115			
Nickel		0.0529	mg/L	0.010	106	85	115			
Silver		0.0201	mg/L	0.0050	100	85	115			
Thallium		0.0529	mg/L	0.10	106	85	115			
Zinc		0.0545	mg/L	0.010	106	85	115			
Sample ID: **H13080158-008BMS**	13	Sample Matrix Spike				Run: ICPMS204-B_130808C				08/10/13 05:58
Aluminum		0.0530	mg/L	0.030	97	70	130			
Arsenic		0.0565	mg/L	0.0010	113	70	130			
Barium		0.148	mg/L	0.050	98	70	130			
Beryllium		0.0480	mg/L	0.0010	96	70	130			
Cadmium		0.0480	mg/L	0.0010	96	70	130			
Chromium		0.0505	mg/L	0.0050	101	70	130			
Cobalt		0.0540	mg/L	0.0050	104	70	130			

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 08/29/13

Project: Barker Hughsville Pilot **Work Order:** H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**									Batch: R90353	
Sample ID: **H13080158-008BMS**	13	Sample Matrix Spike				Run: ICPMS204-B_130808C			08/10/13 05:58	
Copper		0.0501	mg/L	0.0050	100	70	130			
Lead		0.0507	mg/L	0.0010	101	70	130			
Nickel		0.0510	mg/L	0.0050	101	70	130			
Silver		0.0157	mg/L	0.0010	78	70	130			
Thallium		0.0529	mg/L	0.00050	106	70	130			
Zinc		0.0515	mg/L	0.010	98	70	130			
Sample ID: **H13080158-008BMSD**	13	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130808C			08/10/13 06:03	
Aluminum		0.0535	mg/L	0.030	98	70	130	1.0	20	
Arsenic		0.0564	mg/L	0.0010	112	70	130	0.2	20	
Barium		0.151	mg/L	0.050	104	70	130	1.9	20	
Beryllium		0.0500	mg/L	0.0010	100	70	130	4.1	20	
Cadmium		0.0489	mg/L	0.0010	98	70	130	1.8	20	
Chromium		0.0504	mg/L	0.0050	101	70	130	0.1	20	
Cobalt		0.0549	mg/L	0.0050	106	70	130	1.7	20	
Copper		0.0503	mg/L	0.0050	100	70	130	0.4	20	
Lead		0.0519	mg/L	0.0010	104	70	130	2.3	20	
Nickel		0.0511	mg/L	0.0050	101	70	130	0.1	20	
Silver		0.0165	mg/L	0.0010	83	70	130	5.2	20	
Thallium		0.0544	mg/L	0.00050	109	70	130	2.8	20	
Zinc		0.0521	mg/L	0.010	99	70	130	1.1	20	
Sample ID: **H13080161-008BMS**	13	Sample Matrix Spike				Run: ICPMS204-B_130808C			08/10/13 07:22	
Aluminum		4.71	mg/L	0.030	94	70	130			
Arsenic		4.94	mg/L	0.0065	99	70	130			
Barium		4.99	mg/L	0.050	95	70	130			
Beryllium		4.49	mg/L	0.0017	90	70	130			
Cadmium		4.94	mg/L	0.0010	99	70	130			
Chromium		4.98	mg/L	0.0050	100	70	130			
Cobalt		5.16	mg/L	0.0050	102	70	130			
Copper		5.05	mg/L	0.0050	101	70	130			
Lead		4.76	mg/L	0.0010	95	70	130			
Nickel		5.14	mg/L	0.0063	101	70	130			
Silver		1.28	mg/L	0.0040	64	70	130			S
Thallium		5.03	mg/L	0.0011	101	70	130			
Zinc		13.5	mg/L	0.034	95	70	130			
Sample ID: **H13080161-008BMSD**	13	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130808C			08/10/13 07:27	
Aluminum		4.75	mg/L	0.030	94	70	130	0.8	20	
Arsenic		5.01	mg/L	0.0065	100	70	130	1.4	20	
Barium		5.03	mg/L	0.050	96	70	130	0.7	20	
Beryllium		4.56	mg/L	0.0017	91	70	130	1.5	20	
Cadmium		5.00	mg/L	0.0010	100	70	130	1.1	20	
Chromium		5.10	mg/L	0.0050	102	70	130	2.4	20	
Cobalt		5.12	mg/L	0.0050	102	70	130	0.6	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 08/29/13
Project: Barker Hughsville Pilot
Work Order: H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Batch: R90353
Sample ID: H13080161-008BMSD	13	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130808C				08/10/13 07:27
Copper		5.05	mg/L	0.0050	101	70	130	0.0	20	
Lead		4.83	mg/L	0.0010	96	70	130	1.3	20	
Nickel		5.15	mg/L	0.0063	102	70	130	0.2	20	
Silver		1.39	mg/L	0.0040	70	70	130	8.2	20	
Thallium		5.02	mg/L	0.0011	100	70	130	0.2	20	
Zinc		13.4	mg/L	0.034	91	70	130	1.3	20	
Method: E200.8										Analytical Run: ICPMS204-B_130812A
Sample ID: ICV STD		Initial Calibration Verification Standard								08/12/13 18:18
Aluminum		0.294	mg/L	0.10	98	90	110			
Sample ID: ICSA		Interference Check Sample A								08/12/13 18:22
Aluminum		36.6	mg/L	0.10	92	70	130			
Sample ID: ICSAB		Interference Check Sample AB								08/12/13 18:27
Aluminum		36.5	mg/L	0.10	91	70	130			
Method: E200.8										Batch: R90425
Sample ID: ICB		Method Blank				Run: ICPMS204-B_130812A				08/12/13 21:00
Aluminum		0.001	mg/L	0.0001						
Sample ID: LFB		Laboratory Fortified Blank				Run: ICPMS204-B_130812A				08/12/13 21:05
Aluminum		0.0508	mg/L	0.10	99	85	115			
Sample ID: H13080173-002BMS		Sample Matrix Spike				Run: ICPMS204-B_130812A				08/13/13 00:46
Aluminum		0.0846	mg/L	0.030	104	70	130			
Sample ID: H13080173-002BMSD		Sample Matrix Spike Duplicate				Run: ICPMS204-B_130812A				08/13/13 00:50
Aluminum		0.0795	mg/L	0.030	94	70	130	6.2	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 08/29/13
Project: Barker Hughsville Pilot
Work Order: H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130813A
Sample ID: ICV STD		Initial Calibration Verification Standard								08/13/13 11:30
Beryllium		0.0303	mg/L	0.0010	101	90	110			
Sample ID: ICSA		Interference Check Sample A								08/13/13 11:34
Beryllium		1.00E-05	mg/L	0.0010						
Sample ID: ICSAB		Interference Check Sample AB								08/13/13 11:39
Beryllium		-4.00E-06	mg/L	0.0010		0	0			
Sample ID: ICV STD		Initial Calibration Verification Standard								08/14/13 09:11
Beryllium		0.0318	mg/L	0.0010	106	90	110			
Sample ID: ICSA		Interference Check Sample A								08/14/13 09:17
Beryllium		7.00E-06	mg/L	0.0010						
Sample ID: ICSAB		Interference Check Sample AB								08/14/13 09:38
Beryllium		2.00E-06	mg/L	0.0010		0	0			
Method: E200.8										Batch: R90470
Sample ID: ICB		Method Blank				Run: ICPMS204-B_130813A				08/13/13 12:53
Beryllium		ND	mg/L	2E-05						
Sample ID: LFB		Laboratory Fortified Blank				Run: ICPMS204-B_130813A				08/14/13 01:17
Beryllium		0.0468	mg/L	0.0010	94	85	115			
Sample ID: H13080192-002BMS		Sample Matrix Spike				Run: ICPMS204-B_130813A				08/14/13 05:24
Beryllium		0.225	mg/L	0.0010	90	70	130			
Sample ID: H13080192-002BMSD		Sample Matrix Spike Duplicate				Run: ICPMS204-B_130813A				08/14/13 05:29
Beryllium		0.224	mg/L	0.0010	89	70	130	0.6	20	
Sample ID: ICB		Method Blank				Run: ICPMS204-B_130813A				08/14/13 15:05
Beryllium		ND	mg/L	2E-05						
Sample ID: LFB		Laboratory Fortified Blank				Run: ICPMS204-B_130813A				08/14/13 15:09
Beryllium		0.0481	mg/L	0.0010	96	85	115			
Sample ID: H13080161-002BMS		Sample Matrix Spike				Run: ICPMS204-B_130813A				08/14/13 19:56
Beryllium		2.37	mg/L	0.0010	94	70	130			
Sample ID: H13080161-002BMSD		Sample Matrix Spike Duplicate				Run: ICPMS204-B_130813A				08/14/13 20:01
Beryllium		2.35	mg/L	0.0010	94	70	130	0.8	20	
Sample ID: LFB-21293		Laboratory Fortified Blank				Run: ICPMS204-B_130813A				08/15/13 07:06
Beryllium		49.3	mg/kg	1.0	99	85	115			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Report Date: 08/29/13
Work Order: H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**										Analytical Run: ICPMS204-B_130819A
Sample ID: **ICV STD**		Initial Calibration Verification Standard								08/20/13 03:11
Beryllium		0.0302	mg/L	0.0010	101	90	110			
Sample ID: **ICSA**		Interference Check Sample A								08/20/13 03:16
Beryllium		1.20E-05	mg/L	0.0010						
Sample ID: **ICSAB**		Interference Check Sample AB								08/20/13 03:20
Beryllium		1.10E-05	mg/L	0.0010		0	0			
Method: **E200.8**										Batch: R90581
Sample ID: **ICB**		Method Blank				Run: ICPMS204-B_130819A				08/20/13 08:18
Beryllium		ND	mg/L	2E-05						
Sample ID: **LFB**		Laboratory Fortified Blank				Run: ICPMS204-B_130819A				08/20/13 08:23
Beryllium		0.0491	mg/L	0.0010	98	85	115			
Sample ID: **H13080161-005BMS**		Sample Matrix Spike				Run: ICPMS204-B_130819A				08/20/13 10:03
Beryllium		0.955	mg/L	0.0010	95	70	130			
Sample ID: **H13080161-005BMSD**		Sample Matrix Spike Duplicate				Run: ICPMS204-B_130819A				08/20/13 10:07
Beryllium		0.941	mg/L	0.0010	94	70	130	1.5	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 08/29/13

Project: Barker Hughsville Pilot **Work Order:** H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E300.0**										Analytical Run: IC102-H_130812A
Sample ID: **ICV**	2	Initial Calibration Verification Standard								08/12/13 12:25
Chloride		98	mg/L	1.0	98	90	110			
Sulfate		400	mg/L	1.0	100	90	110			
Sample ID: **CCV081213-3**	2	Continuing Calibration Verification Standard								08/12/13 15:59
Chloride		100	mg/L	1.0	103	90	110			
Sulfate		420	mg/L	1.0	104	90	110			
Method: **E300.0**										Batch: R90424
Sample ID: **ICB**	2	Method Blank				Run: IC102-H_130812A				08/12/13 12:37
Chloride		ND	mg/L	0.008						
Sulfate		0.4	mg/L	0.08						
Sample ID: **LFB**	2	Laboratory Fortified Blank				Run: IC102-H_130812A				08/12/13 12:50
Chloride		50	mg/L	1.0	99	90	110			
Sulfate		210	mg/L	1.0	103	90	110			
Sample ID: **H13080121-002AMS**	2	Sample Matrix Spike				Run: IC102-H_130812A				08/12/13 14:18
Chloride		58	mg/L	1.0	93	90	110			
Sulfate		190	mg/L	1.0	96	90	110			
Sample ID: **H13080121-002AMSD**	2	Sample Matrix Spike Duplicate				Run: IC102-H_130812A				08/12/13 14:31
Chloride		63	mg/L	1.0	102	90	110	7.2	20	
Sulfate		210	mg/L	1.0	105	90	110	9.3	20	
Sample ID: **H13080161-003AMS**	2	Sample Matrix Spike				Run: IC102-H_130812A				08/12/13 17:14
Chloride		2700	mg/L	14	97	90	110			
Sulfate		11000	mg/L	5.7	102	90	110			
Sample ID: **H13080161-003AMSD**	2	Sample Matrix Spike Duplicate				Run: IC102-H_130812A				08/12/13 17:27
Chloride		2700	mg/L	14	98	90	110	0.9	20	
Sulfate		11000	mg/L	5.7	103	90	110	0.4	20	
Sample ID: **H13080192-003AMS**	2	Sample Matrix Spike				Run: IC102-H_130812A				08/12/13 20:11
Chloride		120	mg/L	1.0	96	90	110			
Sulfate		720	mg/L	1.0	106	90	110			
Sample ID: **H13080192-003AMSD**	2	Sample Matrix Spike Duplicate				Run: IC102-H_130812A				08/12/13 20:23
Chloride		120	mg/L	1.0	98	90	110	1.4	20	
Sulfate		730	mg/L	1.0	108	90	110	1.2	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 08/29/13
Work Order: H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E300.0**										Analytical Run: IC102-H_130813A
Sample ID: **ICV**	2	Initial Calibration Verification Standard								08/13/13 10:58
Chloride		97	mg/L	1.0	97	90	110			
Sulfate		400	mg/L	1.0	101	90	110			
Sample ID: **CCV081313-1**	2	Continuing Calibration Verification Standard								08/13/13 11:36
Chloride		100	mg/L	1.0	100	90	110			
Sulfate		420	mg/L	1.0	104	90	110			
Method: **E300.0**										Batch: R90461
Sample ID: **ICB**	2	Method Blank				Run: IC102-H_130813A				08/13/13 11:10
Chloride		0.008	mg/L	0.008						
Sulfate		0.5	mg/L	0.08						
Sample ID: **LFB**	2	Laboratory Fortified Blank				Run: IC102-H_130813A				08/13/13 11:23
Chloride		50	mg/L	1.0	100	90	110			
Sulfate		210	mg/L	1.0	106	90	110			
Sample ID: **H13080197-001AMS**	2	Sample Matrix Spike				Run: IC102-H_130813A				08/13/13 14:07
Chloride		70	mg/L	1.0	99	90	110			
Sulfate		260	mg/L	1.0	108	90	110			
Sample ID: **H13080197-001AMSD**	2	Sample Matrix Spike Duplicate				Run: IC102-H_130813A				08/13/13 14:19
Chloride		70	mg/L	1.0	100	90	110	0.3	20	
Sulfate		260	mg/L	1.0	109	90	110	0.3	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 08/29/13

Project: Barker Hughsville Pilot **Work Order:** H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E300.0										Analytical Run: IC102-H_130815A
Sample ID: ICV	2	Initial Calibration Verification Standard								08/15/13 13:02
Chloride		99	mg/L	1.0	99	90	110			
Sulfate		400	mg/L	1.0	99	90	110			
Sample ID: CCV081513-1	2	Continuing Calibration Verification Standard								08/15/13 13:40
Chloride		100	mg/L	1.0	102	90	110			
Sulfate		410	mg/L	1.0	102	90	110			
Method: E300.0										Batch: R90536
Sample ID: ICB	2	Method Blank				Run: IC102-H_130815A				08/15/13 13:15
Chloride		ND	mg/L	0.008						
Sulfate		0.2	mg/L	0.08						
Sample ID: LFB	2	Laboratory Fortified Blank				Run: IC102-H_130815A				08/15/13 13:28
Chloride		51	mg/L	1.0	103	90	110			
Sulfate		210	mg/L	1.0	103	90	110			
Sample ID: H13080161-004AMS	2	Sample Matrix Spike				Run: IC102-H_130815A				08/15/13 15:46
Chloride		250	mg/L	1.4	98	90	110			
Sulfate		2300	mg/L	1.0	4	90	110			S
Sample matrix interference on Sulfate recovery for the MS was verified by duplicate analysis on a second analytical batch.										
Sample ID: H13080161-004AMSD	2	Sample Matrix Spike Duplicate				Run: IC102-H_130815A				08/15/13 15:59
Chloride		250	mg/L	1.4	99	90	110	0.4	20	
Sulfate		2300	mg/L	1.0		90	110	2.1	20	S
Sample matrix interference on Sulfate recovery for the MSD was verified by duplicate analysis on a second analytical batch.										

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs | **Report Date:** 08/29/13

Project: Barker Hughsville Pilot | **Work Order:** H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E350.1									Analytical Run: FIA203-HE_130808A	
Sample ID: ICV		Initial Calibration Verification Standard							08/08/13 09:54	
Nitrogen, Ammonia as N		5.88	mg/L	0.25	104	90	110			
Sample ID: ICB		Initial Calibration Blank, Instrument Blank							08/08/13 09:58	
Nitrogen, Ammonia as N		-0.0373	mg/L	0.050		0	0			
Sample ID: CCV		Continuing Calibration Verification Standard							08/08/13 11:06	
Nitrogen, Ammonia as N		0.491	mg/L	0.050	98	90	110			
Sample ID: CCV		Continuing Calibration Verification Standard							08/08/13 11:38	
Nitrogen, Ammonia as N		0.491	mg/L	0.050	98	90	110			
Method: E350.1									Batch: R90324	
Sample ID: LFB		Laboratory Fortified Blank				Run: FIA203-HE_130808A			08/08/13 09:56	
Nitrogen, Ammonia as N		0.970	mg/L	0.055	97	90	110			
Sample ID: MBLK		Method Blank				Run: FIA203-HE_130808A			08/08/13 09:59	
Nitrogen, Ammonia as N		ND	mg/L	0.01						
Sample ID: H13080143-002AMS		Sample Matrix Spike				Run: FIA203-HE_130808A			08/08/13 11:10	
Nitrogen, Ammonia as N		1.33	mg/L	0.055	84	80	120			
Sample ID: H13080143-002AMSD		Sample Matrix Spike Duplicate				Run: FIA203-HE_130808A			08/08/13 11:11	
Nitrogen, Ammonia as N		1.33	mg/L	0.055	84	80	120	0.2	10	
Sample ID: H13080161-010BMS		Sample Matrix Spike				Run: FIA203-HE_130808A			08/08/13 11:40	
Nitrogen, Ammonia as N		664	mg/L	25	85	80	120			
Sample ID: H13080161-010BMSD		Sample Matrix Spike Duplicate				Run: FIA203-HE_130808A			08/08/13 11:41	
Nitrogen, Ammonia as N		662	mg/L	25	85	80	120	0.2	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 08/29/13
Work Order: H13080161

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E365.1							Analytical Run: FIA202-HE_130808B			
Sample ID: ICV		Initial Calibration Verification Standard								08/08/13 13:51
Phosphorus, Orthophosphate as P		0.239	mg/L	0.0050	96	90	110			
Sample ID: ICB		Initial Calibration Blank, Instrument Blank								08/08/13 13:52
Phosphorus, Orthophosphate as P		0.000360	mg/L	0.0050		0	0			
Sample ID: CCV		Continuing Calibration Verification Standard								08/08/13 13:54
Phosphorus, Orthophosphate as P		0.0942	mg/L	0.0050	94	90	110			
Sample ID: CCV		Continuing Calibration Verification Standard								08/08/13 14:11
Phosphorus, Orthophosphate as P		0.107	mg/L	0.0050	107	90	110			
Method: E365.1										Batch: R90327
Sample ID: LFB		Laboratory Fortified Blank				Run: FIA202-HE_130808B				08/08/13 13:53
Phosphorus, Orthophosphate as P		0.210	mg/L	0.0050	105	90	110			
Sample ID: H13080148-001CMS		Sample Matrix Spike				Run: FIA202-HE_130808B				08/08/13 13:58
Phosphorus, Orthophosphate as P		0.323	mg/L	0.0050	108	90	110			
Sample ID: H13080148-001CMSD		Sample Matrix Spike Duplicate				Run: FIA202-HE_130808B				08/08/13 14:00
Phosphorus, Orthophosphate as P		0.324	mg/L	0.0050	109	90	110	0.4	20	
Sample ID: H13080167-001AMS		Sample Matrix Spike				Run: FIA202-HE_130808B				08/08/13 14:14
Phosphorus, Orthophosphate as P		0.456	mg/L	0.0050	97	90	110			
Sample ID: H13080167-001AMSD		Sample Matrix Spike Duplicate				Run: FIA202-HE_130808B				08/08/13 14:15
Phosphorus, Orthophosphate as P		0.469	mg/L	0.0050	100	90	110	2.9	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

Standard Reporting Procedures

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Workorder Receipt Checklist

CDM Federal Programs

H13080161

Login completed by: Tracy L. Lorash
Reviewed by: BL2000\jweidemoyer
Reviewed Date: 8/9/2013

Date Received: 8/8/2013
Received by: elm
Carrier name: Hand Del

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Applicable ☐
Container/Temp Blank temperature:	℃ See comments		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☑	Not Applicable ☐

Contact and Corrective Action Comments:

Cooler 1 was received at 3.2℃, Cooler 2 at 3.0℃. Samples were received on wet ice.
CHIT sample for Dissolved Metals was preserved to pH <2 with 2 mL of Nitric acid per 250 mL in the laboratory.
BCR3 and BCR3-POST samples for Nutrients were preserved to pH <2 with 2 mL of sulfuric acid per 250 mL in the laboratory upon receipt. TI 8/8/13

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

Page 1 of 1

PLEASE PRINT- Provide as much information as possible.

Company Name:
CDM Smith

Project Name, PWS, Permit, Etc.
Barker Hughesville

Sample Origin
State: Montana

EPA/State Compliance:
Yes ☐ No X

Report Mail Address:
50 W 14th Street, Suite 200
Helena, MT 59601

Contact Name:
Angela Frandsen

Phone/Fax:
406-441-1435

Email:
frandsenak@cdmsmith.com

Sampler: (Please Print)
Angela Frandsen

Invoice Address:
Contact Raquel Cisneros 720-264-1148

Invoice Contact & Phone:
Contact Raquel Cisneros 720-264-1148

Purchase Order:

Quote/Bottle Order:

Special Report/Formats – ELI must be notified prior to sample submittal for the following:

☐ DW
☐ GSA
☐ POTW/WWTP
☐ State: ____
☐ Other: ____

☐ A2LA
x EDD/EDT(Electronic Data)
Format: excel
☐ LEVEL IV
☐ NELAC

ANALYSIS REQUESTED

Contact ELI prior to **RUSH** sample submittal for charges and scheduling – See Instruction Page

Comments:
10 day TAT
Pull phosphate from 1 L bottle

Shipped by: Hand
Cooler ID(s): 4
Receipt Temp: See comments
On Ice: [✓ Yes] No
Custody Seal Y [✓ N]
Intact Y N
Signature Match Y N

C1

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	Number of Containers Sample Type: A W S V B O Air Water Soils/Solids Vegetation Bioassay Other MATRIX	Dissolved Metals	Total Metals	Sulfide	Orthophosphate	Alkalinity and Acidity	SO4, Cl, F, TDS	BOD	Ammonia		SEE ATTACHED	Normal Turnaround (TAT)	RUSH		LABORATORY USE ONLY
13BH-DT-PILOT-INFL-080713	08/07/13	1025	2 W	X			X	X	X								H13080161
13BH-DT-PILOT-SAPS-080713	08/07/13	1045	2 W	X			X	X	X							TB	
13BH-DT-PILOT-CHIT-080713	08/07/13	1100	2 W	X			X	X	X							C1 → 3.2	
13BH-DT-PILOT-MGOH-080713	08/07/13	1115	2 W	X			X	X	X							C2 → 3.0	
13BH-DT-PILOT-BCR1-080713	08/07/13	1140	3 W	X		X	X	X	X								
13BH-DT-PILOT-BCR2-080713	08/07/13	1155	3 W	X		X	X	X	X								
13BH-DT-PILOT-BCR3-080713	08/07/13	1215	5 W	X		X	X	X	X	X	X						
13BH-DT-PILOT-BCR4-080713	08/09/13	1245	3 W	X		X	X	X	X								
13BH-DT-PILOT-BDR4-080713	08/07/13	1250	3 W	X		X	X	X	X								
13BH-DT-PILOT-BCR3-POST-080713	08/07/13	1435	3 W			X				X	X						

Custody Record MUST be Signed

Relinquished by (print): Lauren Helland Date/Time: 08/08/13 08:27 Signature: Lauren Helland
Received by (print): Date/Time: Signature:
Relinquished by (print): Date/Time: Signature:
Received by (print): Date/Time: Signature:
Received by Laboratory: Esther Merritt Date/Time: 8.8.13 8:27 Signature: Esther Merritt

Sample Disposal: Return to Client: ____ Lab Disposal: ____

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested.
This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.
Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

ANALYTICAL SUMMARY REPORT

August 30, 2013

CDM Federal Programs
555 17th St Ste 1100
Denver, CO 80202

Workorder No.: H13080347 Quote ID: H823 - Baker-Hughsville Superfund Site

Project Name: Barker Hughsville Pilot

Energy Laboratories Inc Helena MT received the following 10 samples for CDM Federal Programs on 8/20/2013 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H13080347-001	13BH-DT-PILOT-INFL-081913	08/19/13 11:30	08/20/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Conductivity Fluoride Anions by Ion Chromatography Phosphorus, Orthophosphate as P Solids, Total Dissolved
H13080347-002	13BH-DT-PILOT-SAPS-081913	08/19/13 12:25	08/20/13	Aqueous	Same As Above
H13080347-003	13BH-DT-PILOT-CHIT-081913	08/19/13 12:45	08/20/13	Aqueous	Same As Above
H13080347-004	13BH-DT-PILOT-MGOH-081913	08/19/13 13:05	08/20/13	Aqueous	Same As Above
H13080347-005	13BH-DT-PILOT-BCR1-081913	08/19/13 13:20	08/20/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Conductivity Fluoride Anions by Ion Chromatography Phosphorus, Orthophosphate as P Solids, Total Dissolved Sulfide, Methylene Blue Colorimetric
H13080347-006	13BH-DT-PILOT-BCR2-081913	08/19/13 13:35	08/20/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Biochemical Oxygen Demand, 5 Day Conductivity Fluoride Anions by Ion Chromatography Nitrogen, Ammonia Phosphorus, Orthophosphate as P Solids, Total Dissolved Sulfide, Methylene Blue Colorimetric
H13080347-007	13BH-DT-PILOT-BCR3-081913	08/19/13 13:55	08/20/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Conductivity Fluoride Anions by Ion Chromatography Phosphorus, Orthophosphate as P Solids, Total Dissolved Sulfide, Iodine Titrimetric
H13080347-008	13BH-DT-PILOT-BDR3-081913	08/19/13 14:00	08/20/13	Aqueous	Same As Above

ANALYTICAL SUMMARY REPORT

H13080347-009	13BH-DT-PILOT-BCR2-POST-081913	08/19/13 14:10	08/20/13	Aqueous	Biochemical Oxygen Demand, 5 Day Nitrogen, Ammonia Sulfide, Methylene Blue Colorimetric
H13080347-010	13BH-DT-PILOT-BCR4-081913	08/19/13 14:30	08/20/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Conductivity Fluoride Anions by Ion Chromatography Phosphorus, Orthophosphate as P Solids, Total Dissolved Sulfide, Methylene Blue Colorimetric

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By:

CLIENT: CDM Federal Programs
Project: Barker Hughsville Pilot
Sample Delivery Group: H13080347

Revised Date: 08/30/13
Report Date: 08/30/13

CASE NARRATIVE

Tests associated with analyst identified as ELI-B were subcontracted to Energy Laboratories, 1120 S. 27th St., Billings, MT, EPA Number MT00005.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13080347-001
Client Sample ID 13BH-DT-PILOT-INFL-081913

Revised Date: 08/30/13
Report Date: 08/30/13
Collection Date: 08/19/13 11:30
DateReceived: 08/20/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1600	mg/L		10		A2540 C	08/20/13 13:55 / cmm
INORGANICS							
Acidity, Total as CaCO3	670	mg/L	D	4.0		A2310 B	08/26/13 10:00 / cmm
Alkalinity, Total as CaCO3	ND	mg/L		1		A2320 B	08/20/13 16:04 / cmm
Bicarbonate as HCO3	ND	mg/L		1		A2320 B	08/20/13 16:04 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	08/20/13 16:04 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	08/20/13 16:04 / cmm
Chloride	ND	mg/L		1		E300.0	08/21/13 18:33 / cmm
Sulfate	1900	mg/L		1		E300.0	08/21/13 18:33 / cmm
Fluoride	0.7	mg/L	D	0.2	4	A4500-F C	08/23/13 11:31 / cmm
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.218	mg/L		0.005		E365.1	08/20/13 13:14 / reh
METALS, DISSOLVED							
Aluminum	12.0	mg/L	D	0.05		E200.7	08/20/13 13:50 / sld
Arsenic	0.168	mg/L		0.001		E200.8	08/21/13 10:32 / dck
Barium	ND	mg/L		0.05		E200.8	08/21/13 10:32 / dck
Beryllium	0.006	mg/L		0.001		E200.8	08/21/13 10:32 / dck
Cadmium	0.228	mg/L		0.001		E200.8	08/22/13 11:54 / dck
Calcium	95	mg/L		1		E200.7	08/20/13 13:50 / sld
Chromium	ND	mg/L		0.005		E200.8	08/21/13 10:32 / dck
Cobalt	0.041	mg/L		0.005		E200.8	08/21/13 10:32 / dck
Copper	1.30	mg/L		0.005		E200.8	08/22/13 11:54 / dck
Iron	145	mg/L		0.03		E200.7	08/20/13 13:50 / sld
Lead	0.151	mg/L		0.001		E200.8	08/21/13 10:32 / dck
Magnesium	21	mg/L		1		E200.7	08/20/13 13:50 / sld
Manganese	106	mg/L	D	0.003		E200.7	08/20/13 13:50 / sld
Nickel	0.029	mg/L		0.005		E200.8	08/21/13 10:32 / dck
Potassium	1	mg/L		1		E200.7	08/20/13 13:50 / sld
Silver	ND	mg/L		0.001		E200.8	08/21/13 10:32 / dck
Sodium	7	mg/L		1		E200.7	08/20/13 13:50 / sld
Thallium	0.0018	mg/L		0.0005		E200.8	08/21/13 10:32 / dck
Zinc	51.3	mg/L		0.01		E200.7	08/21/13 15:06 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Revised Date:**	08/30/13
Project:	Barker Hughsville Pilot	**Report Date:**	08/30/13
Lab ID:	H13080347-002	**Collection Date:**	08/19/13 12:25
Client Sample ID	13BH-DT-PILOT-SAPS-081913	**DateReceived:**	08/20/13
		Matrix:	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1750	mg/L		10		A2540 C	08/20/13 13:56 / cmm
INORGANICS							
Acidity, Total as CaCO3	420	mg/L	D	4.0		A2310 B	08/26/13 10:00 / cmm
Alkalinity, Total as CaCO3	42	mg/L		1		A2320 B	08/20/13 16:12 / cmm
Bicarbonate as HCO3	51	mg/L		1		A2320 B	08/20/13 16:12 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	08/20/13 16:12 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	08/20/13 16:12 / cmm
Chloride	ND	mg/L		1		E300.0	08/21/13 18:45 / cmm
Sulfate	1300	mg/L		1		E300.0	08/21/13 18:45 / cmm
Fluoride	1.6	mg/L	D	0.2	4	A4500-F C	08/23/13 11:34 / cmm
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.125	mg/L		0.005		E365.1	08/20/13 13:15 / reh
METALS, DISSOLVED							
Aluminum	1.92	mg/L		0.03		E200.7	08/20/13 14:37 / sld
Arsenic	0.004	mg/L		0.001		E200.8	08/21/13 10:50 / dck
Barium	ND	mg/L		0.05		E200.8	08/21/13 10:50 / dck
Beryllium	0.002	mg/L		0.001		E200.8	08/21/13 10:50 / dck
Cadmium	0.089	mg/L		0.001		E200.8	08/22/13 12:13 / dck
Calcium	227	mg/L		1		E200.7	08/20/13 14:37 / sld
Chromium	ND	mg/L		0.005		E200.8	08/21/13 10:50 / dck
Cobalt	0.043	mg/L		0.005		E200.8	08/21/13 10:50 / dck
Copper	0.009	mg/L		0.005		E200.8	08/21/13 10:50 / dck
Iron	86.5	mg/L		0.03		E200.7	08/20/13 14:37 / sld
Lead	0.002	mg/L		0.001		E200.8	08/21/13 10:50 / dck
Magnesium	23	mg/L		1		E200.7	08/20/13 14:37 / sld
Manganese	113	mg/L	D	0.003		E200.7	08/20/13 14:37 / sld
Nickel	0.031	mg/L		0.005		E200.8	08/21/13 10:50 / dck
Potassium	1	mg/L		1		E200.7	08/20/13 14:37 / sld
Silver	ND	mg/L		0.001		E200.8	08/21/13 10:50 / dck
Sodium	7	mg/L		1		E200.7	08/20/13 14:37 / sld
Thallium	0.0011	mg/L		0.0005		E200.8	08/21/13 10:50 / dck
Zinc	50.8	mg/L		0.01		E200.7	08/21/13 15:28 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Revised Date:**	08/30/13
Project:	Barker Hughsville Pilot	**Report Date:**	08/30/13
Lab ID:	H13080347-003	**Collection Date:**	08/19/13 12:45
Client Sample ID	13BH-DT-PILOT-CHIT-081913	**DateReceived:**	08/20/13
		Matrix:	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	3830	mg/L		10		A2540 C	08/20/13 13:56 / cmm
INORGANICS							
Acidity, Total as CaCO3	ND	mg/L	D	4.0		A2310 B	08/26/13 10:00 / cmm
Alkalinity, Total as CaCO3	1700	mg/L		1		A2320 B	08/28/13 19:48 / cmm
Bicarbonate as HCO3	2100	mg/L		1		A2320 B	08/28/13 19:48 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	08/28/13 19:48 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	08/28/13 19:48 / cmm
Chloride	31	mg/L	D	5		E300.0	08/27/13 15:54 / cmm
Sulfate	1100	mg/L	D	2		E300.0	08/27/13 15:54 / cmm
Fluoride	0.6	mg/L	D	0.2	4	A4500-F C	08/23/13 11:35 / cmm
NUTRIENTS							
Phosphorus, Orthophosphate as P	45.2	mg/L	D	0.2		E365.1	08/20/13 13:27 / reh
METALS, DISSOLVED							
Aluminum	ND	mg/L		0.03		E200.8	08/21/13 11:19 / dck
Arsenic	0.023	mg/L		0.001		E200.8	08/21/13 11:19 / dck
Barium	0.05	mg/L		0.05		E200.8	08/21/13 11:19 / dck
Beryllium	ND	mg/L		0.001		E200.8	08/21/13 11:19 / dck
Cadmium	ND	mg/L		0.001		E200.8	08/22/13 12:36 / dck
Calcium	852	mg/L		1		E200.7	08/20/13 14:41 / sld
Chromium	ND	mg/L		0.005		E200.8	08/21/13 11:19 / dck
Cobalt	0.012	mg/L		0.005		E200.8	08/21/13 11:19 / dck
Copper	ND	mg/L		0.005		E200.8	08/21/13 11:19 / dck
Iron	32.2	mg/L		0.03		E200.7	08/20/13 14:41 / sld
Lead	ND	mg/L		0.001		E200.8	08/21/13 11:19 / dck
Magnesium	46	mg/L		1		E200.7	08/20/13 14:41 / sld
Manganese	75.0	mg/L	D	0.003		E200.7	08/20/13 14:41 / sld
Nickel	0.008	mg/L		0.005		E200.8	08/21/13 11:19 / dck
Potassium	6	mg/L		1		E200.7	08/20/13 14:41 / sld
Silver	ND	mg/L		0.001		E200.8	08/21/13 11:19 / dck
Sodium	30	mg/L		1		E200.7	08/20/13 14:41 / sld
Thallium	ND	mg/L		0.0005		E200.8	08/21/13 11:19 / dck
Zinc	0.02	mg/L		0.01		E200.8	08/21/13 11:19 / dck

Report Definitions:

RL - Analyte reporting limit.

QCL - Quality control limit.

D - RL increased due to sample matrix.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13080347-004
Client Sample ID 13BH-DT-PILOT-MGOH-081913

Revised Date: 08/30/13
Report Date: 08/30/13
Collection Date: 08/19/13 13:05
DateReceived: 08/20/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1440	mg/L		10		A2540 C	08/20/13 13:56 / cmm
INORGANICS							
Acidity, Total as CaCO3	410	mg/L	D	4.0		A2310 B	08/26/13 10:00 / cmm
Alkalinity, Total as CaCO3	ND	mg/L		1		A2320 B	08/20/13 16:36 / cmm
Bicarbonate as HCO3	ND	mg/L		1		A2320 B	08/20/13 16:36 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	08/20/13 16:36 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	08/20/13 16:36 / cmm
Chloride	2	mg/L		1		E300.0	08/21/13 19:36 / cmm
Sulfate	1400	mg/L		1		E300.0	08/21/13 19:36 / cmm
Fluoride	1.3	mg/L	D	0.2	4	A4500-F C	08/23/13 11:38 / cmm
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.182	mg/L		0.005		E365.1	08/20/13 13:18 / reh
METALS, DISSOLVED							
Aluminum	10.2	mg/L	D	0.05		E200.7	08/20/13 14:45 / sld
Arsenic	0.009	mg/L		0.001		E200.8	08/21/13 11:24 / dck
Barium	ND	mg/L		0.05		E200.8	08/21/13 11:24 / dck
Beryllium	0.005	mg/L		0.001		E200.8	08/21/13 11:24 / dck
Cadmium	0.224	mg/L		0.001		E200.8	08/22/13 12:40 / dck
Calcium	103	mg/L		1		E200.7	08/20/13 14:45 / sld
Chromium	ND	mg/L		0.005		E200.8	08/21/13 11:24 / dck
Cobalt	0.040	mg/L		0.005		E200.8	08/21/13 11:24 / dck
Copper	1.11	mg/L		0.005		E200.8	08/22/13 12:40 / dck
Iron	36.6	mg/L		0.03		E200.7	08/20/13 14:45 / sld
Lead	0.111	mg/L		0.001		E200.8	08/21/13 11:24 / dck
Magnesium	88	mg/L		1		E200.7	08/20/13 14:45 / sld
Manganese	109	mg/L	D	0.003		E200.7	08/20/13 14:45 / sld
Nickel	0.028	mg/L		0.005		E200.8	08/21/13 11:24 / dck
Potassium	ND	mg/L		1		E200.7	08/20/13 14:45 / sld
Silver	ND	mg/L		0.001		E200.8	08/21/13 11:24 / dck
Sodium	8	mg/L		1		E200.7	08/20/13 14:45 / sld
Thallium	0.0018	mg/L		0.0005		E200.8	08/21/13 11:24 / dck
Zinc	51.0	mg/L		0.01		E200.7	08/21/13 15:31 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

		Revised Date:	08/30/13
Client:	CDM Federal Programs	**Report Date:**	08/30/13
Project:	Barker Hughsville Pilot	**Collection Date:**	08/19/13 13:20
Lab ID:	H13080347-005	**DateReceived:**	08/20/13
Client Sample ID	13BH-DT-PILOT-BCR1-081913	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1730	mg/L		10		A2540 C	08/20/13 13:56 / cmm
INORGANICS							
Acidity, Total as CaCO3	350	mg/L	D	4.0		A2310 B	08/26/13 10:00 / cmm
Alkalinity, Total as CaCO3	74	mg/L		1		A2320 B	08/20/13 16:42 / cmm
Bicarbonate as HCO3	91	mg/L		1		A2320 B	08/20/13 16:42 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	08/20/13 16:42 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	08/20/13 16:42 / cmm
Chloride	ND	mg/L		1		E300.0	08/21/13 19:48 / cmm
Sulfate	1200	mg/L		1		E300.0	08/21/13 19:48 / cmm
Fluoride	1.5	mg/L	D	0.2	4	A4500-F C	08/23/13 11:39 / cmm
Sulfide	ND	mg/L		0.04		A4500-S D	08/22/13 15:00 / eli-b22
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.027	mg/L		0.005		E365.1	08/20/13 13:19 / reh
METALS, DISSOLVED							
Aluminum	0.43	mg/L		0.03		E200.8	08/21/13 11:28 / dck
Arsenic	0.013	mg/L		0.001		E200.8	08/21/13 11:28 / dck
Barium	0.07	mg/L		0.05		E200.8	08/21/13 11:28 / dck
Beryllium	ND	mg/L		0.001		E200.8	08/21/13 11:28 / dck
Cadmium	ND	mg/L		0.001		E200.8	08/22/13 12:45 / dck
Calcium	242	mg/L		1		E200.7	08/20/13 14:48 / sld
Chromium	ND	mg/L		0.005		E200.8	08/21/13 11:28 / dck
Cobalt	0.044	mg/L		0.005		E200.8	08/21/13 11:28 / dck
Copper	ND	mg/L		0.005		E200.8	08/21/13 11:28 / dck
Iron	111	mg/L		0.03		E200.7	08/20/13 14:48 / sld
Lead	ND	mg/L		0.001		E200.8	08/21/13 11:28 / dck
Magnesium	23	mg/L		1		E200.7	08/20/13 14:48 / sld
Manganese	111	mg/L	D	0.003		E200.7	08/20/13 14:48 / sld
Nickel	0.033	mg/L		0.005		E200.8	08/21/13 11:28 / dck
Potassium	1	mg/L		1		E200.7	08/20/13 14:48 / sld
Silver	ND	mg/L		0.001		E200.8	08/21/13 11:28 / dck
Sodium	7	mg/L		1		E200.7	08/20/13 14:48 / sld
Thallium	ND	mg/L		0.0005		E200.8	08/21/13 11:28 / dck
Zinc	36.8	mg/L		0.01		E200.7	08/21/13 15:35 / sld

Report Definitions:

RL - Analyte reporting limit.

QCL - Quality control limit.

D - RL increased due to sample matrix.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13080347-006
Client Sample ID 13BH-DT-PILOT-BCR2-081913

Revised Date: 08/30/13
Report Date: 08/30/13
Collection Date: 08/19/13 13:35
DateReceived: 08/20/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1630	mg/L		10		A2540 C	08/20/13 13:56 / cmm
INORGANICS							
Acidity, Total as CaCO3	200	mg/L	D	4.0		A2310 B	08/26/13 10:00 / cmm
Alkalinity, Total as CaCO3	110	mg/L		1		A2320 B	08/20/13 16:48 / cmm
Bicarbonate as HCO3	140	mg/L		1		A2320 B	08/20/13 16:48 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	08/20/13 16:48 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	08/20/13 16:48 / cmm
Chloride	ND	mg/L		1		E300.0	08/21/13 20:01 / cmm
Sulfate	1100	mg/L		1		E300.0	08/21/13 20:01 / cmm
Fluoride	1.6	mg/L	D	0.2	4	A4500-F C	08/23/13 11:39 / cmm
Sulfide	ND	mg/L		0.04		A4500-S D	08/22/13 15:00 / eli-b22
AGGREGATE ORGANICS							
Oxygen Demand, Biochemical (BOD)	<39	mg/L		40		A5210 B	08/20/13 14:29 / cmm
No BOD dilution depleted greater than 2.0 mg/L DO.							
NUTRIENTS							
Nitrogen, Ammonia as N	0.05	mg/L		0.05		E350.1	08/29/13 12:45 / reh
Phosphorus, Orthophosphate as P	0.196	mg/L		0.005		E365.1	08/20/13 13:23 / reh
METALS, DISSOLVED							
Aluminum	0.05	mg/L		0.03		E200.8	08/22/13 12:50 / dck
Arsenic	0.002	mg/L		0.001		E200.8	08/22/13 12:50 / dck
Barium	0.15	mg/L		0.05		E200.8	08/22/13 12:50 / dck
Beryllium	ND	mg/L		0.001		E200.8	08/22/13 12:50 / dck
Cadmium	ND	mg/L		0.001		E200.8	08/22/13 12:50 / dck
Calcium	290	mg/L		1		E200.7	08/20/13 14:52 / sld
Chromium	ND	mg/L		0.005		E200.8	08/22/13 12:50 / dck
Cobalt	0.030	mg/L		0.005		E200.8	08/22/13 12:50 / dck
Copper	ND	mg/L		0.005		E200.8	08/22/13 12:50 / dck
Iron	69.3	mg/L		0.03		E200.7	08/20/13 14:52 / sld
Lead	ND	mg/L		0.001		E200.8	08/23/13 21:41 / dck
Magnesium	23	mg/L		1		E200.7	08/20/13 14:52 / sld
Manganese	113	mg/L	D	0.003		E200.7	08/20/13 14:52 / sld
Nickel	0.016	mg/L		0.005		E200.8	08/22/13 12:50 / dck
Potassium	1	mg/L		1		E200.7	08/20/13 14:52 / sld
Silver	ND	mg/L		0.001		E200.8	08/23/13 21:41 / dck
Sodium	7	mg/L		1		E200.7	08/20/13 14:52 / sld
Thallium	ND	mg/L		0.0005		E200.8	08/22/13 12:50 / dck
Zinc	5.85	mg/L		0.01		E200.7	08/21/13 15:39 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Revised Date: 08/30/13
Report Date: 08/30/13
Collection Date: 08/19/13 13:55
DateReceived: 08/20/13
Matrix: Aqueous

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13080347-007
Client Sample ID 13BH-DT-PILOT-BCR3-081913

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	4310	mg/L		10		A2540 C	08/20/13 13:57 / cmm
INORGANICS							
Acidity, Total as CaCO3	ND	mg/L	D	4.0		A2310 B	08/26/13 10:00 / cmm
Alkalinity, Total as CaCO3	2600	mg/L		1		A2320 B	08/28/13 20:43 / cmm
Bicarbonate as HCO3	3200	mg/L		1		A2320 B	08/28/13 20:43 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	08/28/13 20:43 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	08/28/13 20:43 / cmm
Chloride	63	mg/L	D	5		E300.0	08/21/13 20:13 / cmm
Sulfate	670	mg/L	D	2		E300.0	08/21/13 20:13 / cmm
Fluoride	0.2	mg/L		0.1	4	A4500-F C	08/23/13 11:41 / cmm
Sulfide	62	mg/L		1		A4500-S F	08/22/13 14:45 / eli-b22
NUTRIENTS							
Phosphorus, Orthophosphate as P	30.2	mg/L	D	0.2		E365.1	08/20/13 13:24 / reh
METALS, DISSOLVED							
Aluminum	ND	mg/L		0.03		E200.8	08/21/13 11:38 / dck
Arsenic	0.030	mg/L		0.001		E200.8	08/21/13 11:38 / dck
Barium	0.28	mg/L		0.05		E200.8	08/21/13 11:38 / dck
Beryllium	ND	mg/L		0.001		E200.8	08/21/13 11:38 / dck
Cadmium	ND	mg/L		0.001		E200.8	08/22/13 12:54 / dck
Calcium	1040	mg/L		1		E200.7	08/20/13 14:56 / sld
Chromium	ND	mg/L		0.005		E200.8	08/21/13 11:38 / dck
Cobalt	ND	mg/L		0.005		E200.8	08/21/13 11:38 / dck
Copper	ND	mg/L		0.005		E200.8	08/21/13 11:38 / dck
Iron	0.16	mg/L		0.03		E200.8	08/21/13 11:38 / dck
Lead	ND	mg/L		0.001		E200.8	08/21/13 11:38 / dck
Magnesium	64	mg/L		1		E200.7	08/20/13 14:56 / sld
Manganese	48.6	mg/L	D	0.003		E200.7	08/20/13 14:56 / sld
Nickel	ND	mg/L		0.005		E200.8	08/21/13 11:38 / dck
Potassium	14	mg/L		1		E200.7	08/20/13 14:56 / sld
Silver	ND	mg/L		0.001		E200.8	08/21/13 11:38 / dck
Sodium	49	mg/L		1		E200.7	08/20/13 14:56 / sld
Thallium	ND	mg/L		0.0005		E200.8	08/21/13 11:38 / dck
Zinc	0.02	mg/L		0.01		E200.8	08/21/13 11:38 / dck

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13080347-008
Client Sample ID 13BH-DT-PILOT-BDR3-081913

Revised Date: 08/30/13
Report Date: 08/30/13
Collection Date: 08/19/13 14:00
DateReceived: 08/20/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	4650	mg/L		10		A2540 C	08/20/13 13:57 / cmm
INORGANICS							
Acidity, Total as CaCO3	ND	mg/L	D	4.0		A2310 B	08/26/13 10:00 / cmm
Alkalinity, Total as CaCO3	2600	mg/L		1		A2320 B	08/28/13 21:00 / cmm
Bicarbonate as HCO3	3200	mg/L		1		A2320 B	08/28/13 21:00 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	08/28/13 21:00 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	08/28/13 21:00 / cmm
Chloride	67	mg/L	D	5		E300.0	08/21/13 20:51 / cmm
Sulfate	630	mg/L	D	2		E300.0	08/21/13 20:51 / cmm
Fluoride	0.2	mg/L		0.1	4	A4500-F C	08/23/13 11:43 / cmm
Sulfide	67	mg/L		1		A4500-S F	08/22/13 14:45 / eli-b22
NUTRIENTS							
Phosphorus, Orthophosphate as P	36.5	mg/L	D	0.2		E365.1	08/20/13 13:25 / reh
METALS, DISSOLVED							
Aluminum	ND	mg/L		0.03		E200.8	08/21/13 11:42 / dck
Arsenic	0.032	mg/L		0.001		E200.8	08/21/13 11:42 / dck
Barium	0.29	mg/L		0.05		E200.8	08/21/13 11:42 / dck
Beryllium	ND	mg/L		0.001		E200.8	08/21/13 11:42 / dck
Cadmium	ND	mg/L		0.001		E200.8	08/22/13 12:59 / dck
Calcium	1050	mg/L		1		E200.7	08/20/13 15:00 / sld
Chromium	ND	mg/L		0.005		E200.8	08/21/13 11:42 / dck
Cobalt	ND	mg/L		0.005		E200.8	08/21/13 11:42 / dck
Copper	ND	mg/L		0.005		E200.8	08/21/13 11:42 / dck
Iron	0.12	mg/L		0.03		E200.8	08/21/13 11:42 / dck
Lead	ND	mg/L		0.001		E200.8	08/21/13 11:42 / dck
Magnesium	64	mg/L		1		E200.7	08/20/13 15:00 / sld
Manganese	48.3	mg/L	D	0.003		E200.7	08/20/13 15:00 / sld
Nickel	ND	mg/L		0.005		E200.8	08/21/13 11:42 / dck
Potassium	14	mg/L		1		E200.7	08/20/13 15:00 / sld
Silver	ND	mg/L		0.001		E200.8	08/21/13 11:42 / dck
Sodium	48	mg/L		1		E200.7	08/20/13 15:00 / sld
Thallium	ND	mg/L		0.0005		E200.8	08/21/13 11:42 / dck
Zinc	ND	mg/L		0.01		E200.8	08/22/13 12:59 / dck

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13080347-009
Client Sample ID 13BH-DT-PILOT-BCR2-POST-081913

Revised Date: 08/30/13
Report Date: 08/30/13
Collection Date: 08/19/13 14:10
DateReceived: 08/20/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
INORGANICS							
Sulfide	ND	mg/L		0.04		A4500-S D	08/22/13 15:00 / eli-b22
AGGREGATE ORGANICS							
Oxygen Demand, Biochemical (BOD)	56	mg/L		40		A5210 B	08/20/13 14:31 / cmm
NUTRIENTS							
Nitrogen, Ammonia as N	0.08	mg/L		0.05		E350.1	08/29/13 12:47 / reh

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13080347-010
Client Sample ID 13BH-DT-PILOT-BCR4-081913

Revised Date: 08/30/13
Report Date: 08/30/13
Collection Date: 08/19/13 14:30
DateReceived: 08/20/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1490	mg/L		10		A2540 C	08/20/13 13:57 / cmm
INORGANICS							
Acidity, Total as CaCO3	120	mg/L	D	4.0		A2310 B	08/26/13 10:00 / cmm
Alkalinity, Total as CaCO3	96	mg/L		1		A2320 B	08/20/13 17:28 / cmm
Bicarbonate as HCO3	120	mg/L		1		A2320 B	08/20/13 17:28 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	08/20/13 17:28 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	08/20/13 17:28 / cmm
Chloride	ND	mg/L		1		E300.0	08/21/13 21:04 / cmm
Sulfate	1000	mg/L		1		E300.0	08/21/13 21:04 / cmm
Fluoride	1.4	mg/L	D	0.2	4	A4500-F C	08/23/13 11:44 / cmm
Sulfide	0.11	mg/L		0.04		A4500-S D	08/22/13 15:00 / eli-b22
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.211	mg/L		0.005		E365.1	08/20/13 13:26 / reh
METALS, DISSOLVED							
Aluminum	ND	mg/L		0.03		E200.7	08/20/13 15:11 / sld
Arsenic	0.003	mg/L		0.001		E200.8	08/21/13 11:47 / dck
Barium	0.12	mg/L		0.05		E200.8	08/21/13 11:47 / dck
Beryllium	ND	mg/L		0.001		E200.8	08/21/13 11:47 / dck
Cadmium	ND	mg/L		0.001		E200.8	08/22/13 13:04 / dck
Calcium	167	mg/L		1		E200.7	08/20/13 15:11 / sld
Chromium	ND	mg/L		0.005		E200.8	08/21/13 11:47 / dck
Cobalt	0.010	mg/L		0.005		E200.8	08/21/13 11:47 / dck
Copper	ND	mg/L		0.005		E200.8	08/21/13 11:47 / dck
Iron	14.0	mg/L		0.03		E200.7	08/20/13 15:11 / sld
Lead	ND	mg/L		0.001		E200.8	08/21/13 11:47 / dck
Magnesium	121	mg/L		1		E200.7	08/20/13 15:11 / sld
Manganese	98.1	mg/L	D	0.003		E200.7	08/20/13 15:11 / sld
Nickel	ND	mg/L		0.005		E200.8	08/21/13 11:47 / dck
Potassium	2	mg/L		1		E200.7	08/20/13 15:11 / sld
Silver	ND	mg/L		0.001		E200.8	08/21/13 11:47 / dck
Sodium	8	mg/L		1		E200.7	08/20/13 15:11 / sld
Thallium	ND	mg/L		0.0005		E200.8	08/21/13 11:47 / dck
Zinc	0.90	mg/L		0.01		E200.8	08/22/13 13:04 / dck

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13

Client: CDM Federal Programs

Report Date: 08/30/13

Project: Barker Hughsville Pilot

Work Order: H13080347

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2310 B							Batch: H13080347-001A		
Sample ID: H13080347-001A DUP	Sample Duplicate				Run: MISC WC_130826A			08/26/13 10:00	
Acidity, Total as CaCO3	690	mg/L	4.0				2.9	20	
Sample ID: LCS1308260000	Laboratory Control Sample				Run: MISC WC_130826A			08/26/13 10:00	
Acidity, Total as CaCO3	770	mg/L	4.0	98	90	110			
Sample ID: MBLK1308260000	Method Blank				Run: MISC WC_130826A			08/26/13 10:00	
Acidity, Total as CaCO3	6	mg/L	3						
Method: A2310 B							Batch: H13080347-001A rerun		
Sample ID: H13080347-006ADUP	Sample Duplicate				Run: MISC WC_130828A			08/26/13 10:00	
Acidity, Total as CaCO3	220	mg/L	4.0				13	20	
Sample ID: LCS1308260000	Laboratory Control Sample				Run: MISC WC_130828A			08/26/13 10:00	
Acidity, Total as CaCO3	640	mg/L	4.0	99	90	110			
Sample ID: MBLK1308260000	Method Blank				Run: MISC WC_130828A			08/26/13 10:00	
Acidity, Total as CaCO3	ND	mg/L	3						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13
Report Date: 08/30/13
Work Order: H13080347

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2320 B									Batch: R90654
Sample ID: MBLK	Method Blank				Run: MAN-TECH_130820B				08/20/13 15:53
Alkalinity, Total as CaCO3	ND	mg/L	2						
Sample ID: LCS-07222013	Laboratory Control Sample				Run: MAN-TECH_130820B				08/20/13 16:00
Alkalinity, Total as CaCO3	630	mg/L	4.0	105	90	110			
Sample ID: H13080347-001ADUP	Sample Duplicate				Run: MAN-TECH_130820B				08/20/13 16:07
Alkalinity, Total as CaCO3	ND	mg/L	4.0					10	
Bicarbonate as HCO3	ND	mg/L	4.0					10	
Carbonate as CO3	ND	mg/L	4.0					10	
Sample ID: H13080347-002AMS	Sample Matrix Spike				Run: MAN-TECH_130820B				08/20/13 16:20
Alkalinity, Total as CaCO3	590	mg/L	4.0	91	80	120			
Method: A2320 B									Batch: R90865
Sample ID: MBLK	Method Blank				Run: MAN-TECH_130829A				08/28/13 17:32
Alkalinity, Total as CaCO3	ND	mg/L	2						
Sample ID: H13080453-001ADUP	Sample Duplicate				Run: MAN-TECH_130829A				08/28/13 18:16
Alkalinity, Total as CaCO3	110	mg/L	4.0				0.6	10	
Bicarbonate as HCO3	130	mg/L	4.0				0.6	10	
Carbonate as CO3	ND	mg/L	4.0					10	
Sample ID: H13080347-005ADUP	Sample Duplicate				Run: MAN-TECH_130829A				08/28/13 19:58
Alkalinity, Total as CaCO3	44	mg/L	4.0				35	10	R
Bicarbonate as HCO3	53	mg/L	4.0				35	10	R
Carbonate as CO3	ND	mg/L	4.0					10	
Sample ID: H13080347-006AMS	Sample Matrix Spike				Run: MAN-TECH_130829A				08/28/13 20:10
Alkalinity, Total as CaCO3	610	mg/L	4.0	91	80	120			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

R - RPD exceeds advisory limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13
Report Date: 08/30/13
Work Order: H13080347

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2540 C									Batch: TDS130820A
Sample ID: MB-1_130820A	Method Blank				Run: ACCU-124 (14410200)_130820				08/20/13 13:54
Solids, Total Dissolved TDS @ 180 C	ND	mg/L	1						
Sample ID: LCS-2_130820A	Laboratory Control Sample				Run: ACCU-124 (14410200)_130820				08/20/13 13:54
Solids, Total Dissolved TDS @ 180 C	1870	mg/L	10	93	90	110			
Sample ID: H13080344-001A DUP	Sample Duplicate				Run: ACCU-124 (14410200)_130820				08/20/13 13:55
Solids, Total Dissolved TDS @ 180 C	117	mg/L	10				4.4	5	
Sample ID: H13080346-001B MS	Sample Matrix Spike				Run: ACCU-124 (14410200)_130820				08/20/13 13:55
Solids, Total Dissolved TDS @ 180 C	2420	mg/L	10	95	80	120			
Sample ID: H13080347-010A DUP	Sample Duplicate				Run: ACCU-124 (14410200)_130820				08/20/13 13:57
Solids, Total Dissolved TDS @ 180 C	1490	mg/L	10				0.3	5	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13
Report Date: 08/30/13
Work Order: H13080347

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **A4500-F C**									Analytical Run: PH_130823A
Sample ID: **ICV1_130823A**	Initial Calibration Verification Standard								08/23/13 11:24
Fluoride	0.7	mg/L	0.1	93	90	110			
Sample ID: **CCV2_130823A**	Continuing Calibration Verification Standard								08/23/13 11:40
Fluoride	0.2	mg/L	0.1	94	90	110			
Method: **A4500-F C**									Batch: 130823A-F-ISE-W
Sample ID: **MBLK1_130823A**	Method Blank				Run: PH_130823A				08/23/13 11:23
Fluoride	0.01	mg/L	0.005						
Sample ID: **LFB1_130823A**	Laboratory Fortified Blank				Run: PH_130823A				08/23/13 11:25
Fluoride	0.5	mg/L	0.1	93	90	110			
Sample ID: **H13070399-005AMS**	Sample Matrix Spike				Run: PH_130823A				08/23/13 11:26
Fluoride	1.8	mg/L	0.2	86	85	115			
Sample ID: **H13070399-005AMSD**	Sample Matrix Spike Duplicate				Run: PH_130823A				08/23/13 11:27
Fluoride	1.8	mg/L	0.2	87	85	115	0.4	10	
Sample ID: **H13080347-007AMS**	Sample Matrix Spike				Run: PH_130823A				08/23/13 11:42
Fluoride	0.6	mg/L	0.1	84	85	115			S
Sample ID: **H13080347-007AMSD**	Sample Matrix Spike Duplicate				Run: PH_130823A				08/23/13 11:42
Fluoride	0.6	mg/L	0.1	85	85	115	0.3	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13
Report Date: 08/30/13
Work Order: H13080347

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-S D									Batch: B_R210507
Sample ID: MB-R210507	Method Blank				Run: SUB-B210507				08/22/13 15:00
Sulfide	ND	mg/L	0.002						
Sample ID: LCS-R210507	Laboratory Control Sample				Run: SUB-B210507				08/22/13 15:00
Sulfide	0.281	mg/L	0.040	114	70	130			
Sample ID: B13081719-001BMS	Sample Matrix Spike				Run: SUB-B210507				08/22/13 15:00
Sulfide	0.115	mg/L	0.040	42	70	130			S
- Matrix spike recoveries outside the acceptance range are considered matrix-related.									
Sample ID: B13081719-001BMSD	Sample Matrix Spike Duplicate				Run: SUB-B210507				08/22/13 15:00
Sulfide	0.130	mg/L	0.040	49	70	130	12	20	S
- Matrix spike recoveries outside the acceptance range are considered matrix-related.									
Sample ID: B13081949-001DMS	Sample Matrix Spike				Run: SUB-B210507				08/22/13 15:00
Sulfide	0.287	mg/L	0.040	107	70	130			
Sample ID: B13081949-001DMSD	Sample Matrix Spike Duplicate				Run: SUB-B210507				08/22/13 15:00
Sulfide	0.295	mg/L	0.040	110	70	130	2.6	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13
Report Date: 08/30/13
Work Order: H13080347

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Analyte		Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **A4500-S F**										Batch: B_R210506
Sample ID: **MB-R210506**	Method Blank					Run: SUB-B210506				08/22/13 14:45
Sulfide		ND	mg/L	0.5						
Sample ID: **LCS-R210506**	Laboratory Control Sample					Run: SUB-B210506				08/22/13 14:45
Sulfide		24.6	mg/L	1.0	100	70	130			
Sample ID: **H13080347-007C**	Sample Matrix Spike					Run: SUB-B210506				08/22/13 14:45
Sulfide		117	mg/L	1.0	110	80	120			
Sample ID: **H13080347-007C**	Sample Matrix Spike Duplicate					Run: SUB-B210506				08/22/13 14:45
Sulfide		118	mg/L	1.0	113	80	120	1.2	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13
Report Date: 08/30/13
Work Order: H13080347

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A5210 B								Batch: 130820_1_BOD5-W	
Sample ID: Dil-H201_130820	Dilution Water Blank				Run: MISC WC_130820A			08/20/13 14:19	
Oxygen Demand, Biochemical (BOD)	ND	mg/L	2.0		0	0.2			
Sample ID: GGA1_130820	Laboratory Control Sample				Run: MISC WC_130820A			08/20/13 14:21	
Oxygen Demand, Biochemical (BOD)	180	mg/L	65	89	85	115			
Sample ID: H13080352-002ADUP	Sample Duplicate				Run: MISC WC_130820A			08/20/13 14:34	
Oxygen Demand, Biochemical (BOD)	610	mg/L	200		90	110	5.4	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13
Client: CDM Federal Programs
Report Date: 08/30/13
Project: Barker Hughsville Pilot
Work Order: H13080347

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7									Analytical Run: ICP2-HE_130820A
Sample ID: ICV	Initial Calibration Verification Standard								08/20/13 10:05
Aluminum	4.00	mg/L	0.10	100	95	105			
Calcium	39.6	mg/L	1.0	99	95	105			
Iron	3.95	mg/L	0.030	99	95	105			
Magnesium	39.1	mg/L	1.0	98	95	105			
Manganese	3.93	mg/L	0.010	98	95	105			
Potassium	40.0	mg/L	1.0	100	95	105			
Sodium	40.3	mg/L	1.0	101	95	105			
Sample ID: CCV-1	Continuing Calibration Verification Standard								08/20/13 10:09
Aluminum	2.47	mg/L	0.10	99	95	105			
Calcium	24.6	mg/L	1.0	98	95	105			
Iron	2.45	mg/L	0.030	98	95	105			
Magnesium	24.2	mg/L	1.0	97	95	105			
Manganese	2.44	mg/L	0.010	98	95	105			
Potassium	24.4	mg/L	1.0	97	95	105			
Sodium	24.4	mg/L	1.0	98	95	105			
Sample ID: ICSA	Interference Check Sample A								08/20/13 10:20
Aluminum	513	mg/L	0.10	103	80	120			
Calcium	468	mg/L	1.0	94	80	120			
Iron	188	mg/L	0.030	94	80	120			
Magnesium	497	mg/L	1.0	99	80	120			
Manganese	0.00492	mg/L	0.010		0	0			
Potassium	-0.0822	mg/L	1.0		0	0			
Sodium	0.0383	mg/L	1.0		0	0			
Sample ID: ICSAB	Interference Check Sample AB								08/20/13 10:24
Aluminum	518	mg/L	0.10	104	80	120			
Calcium	478	mg/L	1.0	96	80	120			
Iron	190	mg/L	0.030	95	80	120			
Magnesium	502	mg/L	1.0	100	80	120			
Manganese	0.482	mg/L	0.010	96	80	120			
Potassium	23.1	mg/L	1.0	115	80	120			
Sodium	23.2	mg/L	1.0	116	80	120			
Sample ID: CCV	Continuing Calibration Verification Standard								08/20/13 13:09
Aluminum	2.49	mg/L	0.10	100	90	110			
Calcium	24.3	mg/L	1.0	97	90	110			
Iron	2.44	mg/L	0.030	97	90	110			
Magnesium	24.3	mg/L	1.0	97	90	110			
Manganese	2.40	mg/L	0.010	96	90	110			
Potassium	25.9	mg/L	1.0	104	90	110			
Sodium	26.1	mg/L	1.0	105	90	110			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13
Report Date: 08/30/13
Work Order: H13080347

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.7**									Analytical Run: ICP2-HE_130820A
Sample ID: **CCV**	Continuing Calibration Verification Standard								08/20/13 14:19
Aluminum	2.50	mg/L	0.10	100	90	110			
Calcium	24.7	mg/L	1.0	99	90	110			
Iron	2.46	mg/L	0.030	98	90	110			
Magnesium	24.4	mg/L	1.0	98	90	110			
Manganese	2.43	mg/L	0.010	97	90	110			
Potassium	24.6	mg/L	1.0	99	90	110			
Sodium	24.7	mg/L	1.0	99	90	110			
Sample ID: **CCV**	Continuing Calibration Verification Standard								08/20/13 15:03
Aluminum	2.54	mg/L	0.10	101	90	110			
Calcium	25.2	mg/L	1.0	101	90	110			
Iron	2.48	mg/L	0.030	99	90	110			
Magnesium	25.1	mg/L	1.0	100	90	110			
Manganese	2.47	mg/L	0.010	99	90	110			
Potassium	25.0	mg/L	1.0	100	90	110			
Sodium	25.0	mg/L	1.0	100	90	110			
Method: **E200.7**									Batch: R90651
Sample ID: **ICB**	Method Blank				Run: ICP2-HE_130820A				08/20/13 10:32
Aluminum	ND	mg/L	0.009						
Calcium	0.05	mg/L	0.03						
Iron	ND	mg/L	0.005						
Magnesium	ND	mg/L	0.02						
Manganese	ND	mg/L	0.0005						
Potassium	ND	mg/L	0.03						
Sodium	ND	mg/L	0.03						
Sample ID: **LFB**	Laboratory Fortified Blank				Run: ICP2-HE_130820A				08/20/13 10:36
Aluminum	4.93	mg/L	0.10	99	85	115			
Calcium	48.6	mg/L	1.0	97	85	115			
Iron	4.84	mg/L	0.030	97	85	115			
Magnesium	48.6	mg/L	1.0	97	85	115			
Manganese	4.80	mg/L	0.010	96	85	115			
Potassium	48.9	mg/L	1.0	98	85	115			
Sodium	49.3	mg/L	1.0	99	85	115			
Sample ID: **H13080347-001BMS2**	Sample Matrix Spike				Run: ICP2-HE_130820A				08/20/13 14:30
Aluminum	37.5	mg/L	0.046	102	70	130			
Calcium	351	mg/L	1.0	103	70	130			
Iron	173	mg/L	0.030		70	130			A
Magnesium	274	mg/L	1.0	101	70	130			
Manganese	134	mg/L	0.0027		70	130			A
Potassium	248	mg/L	1.0	99	70	130			

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13
Client: CDM Federal Programs
Report Date: 08/30/13
Project: Barker Hughsville Pilot
Work Order: H13080347

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7									Batch: R90651
Sample ID: H13080347-001BMS2	Sample Matrix Spike				Run: ICP2-HE_130820A				08/20/13 14:30
Sodium	256	mg/L	1.0	99	70	130			
Sample ID: H13080347-001BMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_130820A				08/20/13 14:34
Aluminum	37.5	mg/L	0.046	102	70	130	0.0	20	
Calcium	351	mg/L	1.0	102	70	130	0.2	20	
Iron	173	mg/L	0.030		70	130	0.2	20	A
Magnesium	273	mg/L	1.0	101	70	130	0.4	20	
Manganese	134	mg/L	0.0027		70	130	0.3	20	A
Potassium	249	mg/L	1.0	99	70	130	0.4	20	
Sodium	257	mg/L	1.0	100	70	130	0.5	20	
Sample ID: H13080347-010BMS2	Sample Matrix Spike				Run: ICP2-HE_130820A				08/20/13 15:18
Aluminum	25.5	mg/L	0.046	102	70	130			
Calcium	415	mg/L	1.0	99	70	130			
Iron	38.4	mg/L	0.030	98	70	130			
Magnesium	369	mg/L	1.0	99	70	130			
Manganese	121	mg/L	0.0027	91	70	130			
Potassium	252	mg/L	1.0	100	70	130			
Sodium	260	mg/L	1.0	101	70	130			
Sample ID: H13080347-010BMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_130820A				08/20/13 15:22
Aluminum	25.5	mg/L	0.046	102	70	130	0.1	20	
Calcium	415	mg/L	1.0	99	70	130	0.1	20	
Iron	38.6	mg/L	0.030	98	70	130	0.4	20	
Magnesium	369	mg/L	1.0	99	70	130	0.0	20	
Manganese	121	mg/L	0.0027	92	70	130	0.2	20	
Potassium	248	mg/L	1.0	99	70	130	1.5	20	
Sodium	256	mg/L	1.0	99	70	130	1.4	20	

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Revised Date: 08/30/13
Report Date: 08/30/13
Work Order: H13080347

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7									Analytical Run: ICP2-HE_130821C
Sample ID: ICV	Initial Calibration Verification Standard								08/21/13 14:33
Zinc	0.811	mg/L	0.010	101	95	105			
Sample ID: CCV-1	Continuing Calibration Verification Standard								08/21/13 14:36
Zinc	2.61	mg/L	0.010	104	95	105			
Sample ID: ICSA	Interference Check Sample A								08/21/13 14:47
Zinc	0.00768	mg/L	0.010		0	0			
Sample ID: ICSAB	Interference Check Sample AB								08/21/13 14:51
Zinc	1.01	mg/L	0.010	101	80	120			
Sample ID: CCV	Continuing Calibration Verification Standard								08/21/13 15:20
Zinc	2.54	mg/L	0.010	102	90	110			
Method: E200.7									Batch: R90691
Sample ID: ICB	Method Blank				Run: ICP2-HE_130821C				08/21/13 14:59
Zinc	0.003	mg/L	0.001						
Sample ID: LFB	Laboratory Fortified Blank				Run: ICP2-HE_130821C				08/21/13 15:03
Zinc	0.993	mg/L	0.010	99	85	115			
Sample ID: H13080347-001BMS2	Sample Matrix Spike				Run: ICP2-HE_130821C				08/21/13 15:14
Zinc	55.4	mg/L	0.010		70	130			A
Sample ID: H13080347-001BMSD2	Sample Matrix Spike Duplicate				Run: ICP2-HE_130821C				08/21/13 15:17
Zinc	52.6	mg/L	0.010		70	130	5.3	20	A

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13

Client: CDM Federal Programs **Report Date:** 08/30/13

Project: Barker Hughsville Pilot **Work Order:** H13080347

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**									Analytical Run: ICPMS204-B_130820A
Sample ID: **ICV STD**	Initial Calibration Verification Standard								08/20/13 14:49
Aluminum	0.286	mg/L	0.10	95	90	110			
Arsenic	0.0580	mg/L	0.0050	97	90	110			
Barium	0.0583	mg/L	0.10	97	90	110			
Beryllium	0.0308	mg/L	0.0010	103	90	110			
Cadmium	0.0314	mg/L	0.0010	105	90	110			
Chromium	0.0585	mg/L	0.010	97	90	110			
Cobalt	0.0648	mg/L	0.010	108	90	110			
Copper	0.0590	mg/L	0.010	98	90	110			
Iron	0.300	mg/L	0.030	100	90	110			
Lead	0.0608	mg/L	0.010	101	90	110			
Nickel	0.0585	mg/L	0.010	98	90	110			
Silver	0.0294	mg/L	0.0050	98	90	110			
Thallium	0.0583	mg/L	0.10	97	90	110			
Zinc	0.0599	mg/L	0.010	100	90	110			
Sample ID: **ICSA**	Interference Check Sample A								08/20/13 14:54
Aluminum	36.2	mg/L	0.10	91	70	130			
Arsenic	0.000258	mg/L	0.0050						
Barium	3.20E-05	mg/L	0.10						
Beryllium	6.00E-06	mg/L	0.0010						
Cadmium	0.00122	mg/L	0.0010						
Chromium	0.00108	mg/L	0.010						
Cobalt	0.000324	mg/L	0.010						
Copper	0.000555	mg/L	0.010						
Iron	90.5	mg/L	0.030	91	70	130			
Lead	0.000186	mg/L	0.010						
Nickel	0.000627	mg/L	0.010						
Silver	7.70E-05	mg/L	0.0050						
Thallium	0.000106	mg/L	0.10						
Zinc	0.000983	mg/L	0.010						
Sample ID: **ICSAB**	Interference Check Sample AB								08/20/13 14:58
Aluminum	36.5	mg/L	0.10	91	70	130			
Arsenic	0.00963	mg/L	0.0050	96	70	130			
Barium	3.00E-05	mg/L	0.10		0	0			
Beryllium	ND	mg/L	0.0010		0	0			
Cadmium	0.0103	mg/L	0.0010	103	70	130			
Chromium	0.0208	mg/L	0.010	104	70	130			
Cobalt	0.0202	mg/L	0.010	101	70	130			
Copper	0.0193	mg/L	0.010	97	70	130			
Iron	94.9	mg/L	0.030	95	70	130			
Lead	0.000154	mg/L	0.010		0	0			
Nickel	0.0198	mg/L	0.010	99	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13
Client: CDM Federal Programs
Report Date: 08/30/13
Project: Barker Hughsville Pilot
Work Order: H13080347

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS204-B_130820A
Sample ID: ICSAB	Interference Check Sample AB								08/20/13 14:58
Silver	0.0186	mg/L	0.0050	93	70	130			
Thallium	5.50E-05	mg/L	0.10		0	0			
Zinc	0.0102	mg/L	0.010	102	70	130			
Sample ID: ICV STD	Initial Calibration Verification Standard								08/21/13 04:48
Aluminum	0.291	mg/L	0.10	97	90	110			
Arsenic	0.0610	mg/L	0.0050	102	90	110			
Barium	0.0603	mg/L	0.10	101	90	110			
Beryllium	0.0304	mg/L	0.0010	101	90	110			
Cadmium	0.0322	mg/L	0.0010	107	90	110			
Chromium	0.0608	mg/L	0.010	101	90	110			
Cobalt	0.0657	mg/L	0.010	109	90	110			
Copper	0.0620	mg/L	0.010	103	90	110			
Iron	0.319	mg/L	0.030	106	90	110			
Lead	0.0614	mg/L	0.010	102	90	110			
Nickel	0.0621	mg/L	0.010	104	90	110			
Silver	0.0299	mg/L	0.0050	100	90	110			
Thallium	0.0584	mg/L	0.10	97	90	110			
Zinc	0.0634	mg/L	0.010	106	90	110			
Sample ID: ICSA	Interference Check Sample A								08/21/13 04:52
Aluminum	36.0	mg/L	0.10	90	70	130			
Arsenic	0.000202	mg/L	0.0050						
Barium	7.20E-05	mg/L	0.10						
Beryllium	7.00E-06	mg/L	0.0010						
Cadmium	0.00118	mg/L	0.0010						
Chromium	0.00107	mg/L	0.010						
Cobalt	0.000319	mg/L	0.010						
Copper	0.000517	mg/L	0.010						
Iron	89.0	mg/L	0.030	89	70	130			
Lead	0.000182	mg/L	0.010						
Nickel	0.000615	mg/L	0.010						
Silver	0.000107	mg/L	0.0050						
Thallium	0.000134	mg/L	0.10						
Zinc	0.00113	mg/L	0.010						
Sample ID: ICSAB	Interference Check Sample AB								08/21/13 04:57
Aluminum	36.1	mg/L	0.10	90	70	130			
Arsenic	0.00995	mg/L	0.0050	99	70	130			
Barium	5.40E-05	mg/L	0.10		0	0			
Beryllium	5.00E-06	mg/L	0.0010		0	0			
Cadmium	0.0103	mg/L	0.0010	103	70	130			
Chromium	0.0206	mg/L	0.010	103	70	130			
Cobalt	0.0206	mg/L	0.010	103	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13
Client: CDM Federal Programs
Report Date: 08/30/13
Project: Barker Hughsville Pilot
Work Order: H13080347

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8						Analytical Run: ICPMS204-B_130820A			
Sample ID: ICSAB	Interference Check Sample AB								08/21/13 04:57
Copper	0.0194	mg/L	0.010	97	70	130			
Iron	91.1	mg/L	0.030	91	70	130			
Lead	0.000142	mg/L	0.010		0	0			
Nickel	0.0201	mg/L	0.010	100	70	130			
Silver	0.0188	mg/L	0.0050	94	70	130			
Thallium	8.50E-05	mg/L	0.10		0	0			
Zinc	0.0107	mg/L	0.010	107	70	130			
Sample ID: ICV STD	Initial Calibration Verification Standard								08/22/13 03:10
Aluminum	0.289	mg/L	0.10	96	90	110			
Arsenic	0.0582	mg/L	0.0050	97	90	110			
Barium	0.0584	mg/L	0.10	97	90	110			
Beryllium	0.0297	mg/L	0.0010	99	90	110			
Cadmium	0.0313	mg/L	0.0010	104	90	110			
Chromium	0.0586	mg/L	0.010	98	90	110			
Cobalt	0.0622	mg/L	0.010	104	90	110			
Copper	0.0597	mg/L	0.010	100	90	110			
Iron	0.312	mg/L	0.030	104	90	110			
Lead	0.0594	mg/L	0.010	99	90	110			
Nickel	0.0597	mg/L	0.010	99	90	110			
Silver	0.0295	mg/L	0.0050	98	90	110			
Thallium	0.0588	mg/L	0.10	98	90	110			
Zinc	0.0612	mg/L	0.010	102	90	110			
Sample ID: ICSA	Interference Check Sample A								08/22/13 03:15
Aluminum	35.8	mg/L	0.10	90	70	130			
Arsenic	0.000184	mg/L	0.0050						
Barium	0.000137	mg/L	0.10						
Beryllium	1.30E-05	mg/L	0.0010						
Cadmium	0.00114	mg/L	0.0010						
Chromium	0.00114	mg/L	0.010						
Cobalt	0.000303	mg/L	0.010						
Copper	0.000559	mg/L	0.010						
Iron	92.5	mg/L	0.030	92	70	130			
Lead	0.000172	mg/L	0.010						
Nickel	0.000663	mg/L	0.010						
Silver	0.000191	mg/L	0.0050						
Thallium	0.000145	mg/L	0.10						
Zinc	0.000957	mg/L	0.010						
Sample ID: ICSAB	Interference Check Sample AB								08/22/13 03:19
Aluminum	35.6	mg/L	0.10	89	70	130			
Arsenic	0.0103	mg/L	0.0050	103	70	130			
Barium	0.000158	mg/L	0.10		0	0			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13
Client: CDM Federal Programs
Report Date: 08/30/13
Project: Barker Hughsville Pilot
Work Order: H13080347

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**									Analytical Run: ICPMS204-B_130820A
Sample ID: **ICSAB**	Interference Check Sample AB								08/22/13 03:19
Beryllium	6.00E-06	mg/L	0.0010		0	0			
Cadmium	0.0102	mg/L	0.0010	102	70	130			
Chromium	0.0213	mg/L	0.010	107	70	130			
Cobalt	0.0197	mg/L	0.010	98	70	130			
Copper	0.0202	mg/L	0.010	101	70	130			
Iron	93.6	mg/L	0.030	94	70	130			
Lead	0.000139	mg/L	0.010		0	0			
Nickel	0.0212	mg/L	0.010	106	70	130			
Silver	0.0172	mg/L	0.0050	86	70	130			
Thallium	9.50E-05	mg/L	0.10		0	0			
Zinc	0.0114	mg/L	0.010	114	70	130			
Method: **E200.8**									Batch: R90656
Sample ID: **ICB**	Method Blank				Run: ICPMS204-B_130820A				08/20/13 15:52
Aluminum	0.0005	mg/L	0.0001						
Arsenic	ND	mg/L	7E-05						
Barium	ND	mg/L	5E-05						
Beryllium	ND	mg/L	2E-05						
Cadmium	ND	mg/L	7E-06						
Chromium	ND	mg/L	4E-05						
Cobalt	ND	mg/L	2E-05						
Copper	ND	mg/L	3E-05						
Iron	0.0005	mg/L	0.0002						
Lead	ND	mg/L	6E-06						
Nickel	ND	mg/L	6E-05						
Silver	ND	mg/L	4E-05						
Thallium	ND	mg/L	1E-05						
Zinc	0.0006	mg/L	0.0003						
Sample ID: **LFB**	Laboratory Fortified Blank				Run: ICPMS204-B_130820A				08/20/13 15:57
Aluminum	0.0502	mg/L	0.10	100	85	115			
Arsenic	0.0476	mg/L	0.0050	95	85	115			
Barium	0.0481	mg/L	0.10	96	85	115			
Beryllium	0.0477	mg/L	0.0010	95	85	115			
Cadmium	0.0499	mg/L	0.0010	100	85	115			
Chromium	0.0479	mg/L	0.010	96	85	115			
Cobalt	0.0515	mg/L	0.010	103	85	115			
Copper	0.0481	mg/L	0.010	96	85	115			
Iron	0.164	mg/L	0.030	109	85	115			
Lead	0.0498	mg/L	0.010	100	85	115			
Nickel	0.0490	mg/L	0.010	98	85	115			
Silver	0.0191	mg/L	0.0050	95	85	115			
Thallium	0.0482	mg/L	0.10	97	85	115			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13

Client: CDM Federal Programs

Report Date: 08/30/13

Project: Barker Hughsville Pilot

Work Order: H13080347

Analyte		Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method:	**E200.8**									Batch: R90656
Sample ID:	**LFB**	Laboratory Fortified Blank				Run: ICPMS204-B_130820A				08/20/13 15:57
Zinc		0.0518	mg/L	0.010	102	85	115			
Sample ID:	**H13080347-001BMS**	Sample Matrix Spike				Run: ICPMS204-B_130820A				08/21/13 10:37
Aluminum		9.75	mg/L	0.030		70	130			A
Arsenic		0.213	mg/L	0.0010	91	70	130			
Barium		0.0489	mg/L	0.050	90	70	130			
Beryllium		0.0481	mg/L	0.0010	84	70	130			
Chromium		0.0511	mg/L	0.0050	94	70	130			
Cobalt		0.0894	mg/L	0.0050	96	70	130			
Copper		1.31	mg/L	0.0050		70	130			A
Iron		132	mg/L	0.030		70	130			A
Lead		0.191	mg/L	0.0010	79	70	130			
Nickel		0.0772	mg/L	0.0050	96	70	130			
Silver		0.0162	mg/L	0.0010	81	70	130			
Thallium		0.0530	mg/L	0.00050	102	70	130			
Zinc		47.7	mg/L	0.010		70	130			A
Sample ID:	**H13080347-001BMSD**	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130820A				08/21/13 10:41
Aluminum		9.41	mg/L	0.030		70	130	3.6	20	A
Arsenic		0.215	mg/L	0.0010	93	70	130	0.6	20	
Barium		0.0511	mg/L	0.050	94	70	130		20	
Beryllium		0.0454	mg/L	0.0010	79	70	130	5.6	20	
Chromium		0.0512	mg/L	0.0050	94	70	130	0.3	20	
Cobalt		0.0867	mg/L	0.0050	90	70	130	3.1	20	
Copper		1.30	mg/L	0.0050		70	130	0.8	20	A
Iron		133	mg/L	0.030		70	130	0.3	20	A
Lead		0.190	mg/L	0.0010	77	70	130	0.5	20	
Nickel		0.0772	mg/L	0.0050	96	70	130	0.0	20	
Silver		0.0168	mg/L	0.0010	84	70	130	3.4	20	
Thallium		0.0533	mg/L	0.00050	103	70	130	0.7	20	
Zinc		47.9	mg/L	0.010		70	130	0.5	20	A
Sample ID:	**H13080347-001BMS**	Sample Matrix Spike				Run: ICPMS204-B_130820A				08/22/13 11:59
Aluminum		11.2	mg/L	0.030		70	130			A
Arsenic		0.620	mg/L	0.0010	92	70	130			
Barium		0.462	mg/L	0.050	91	70	130			
Beryllium		0.462	mg/L	0.0010	91	70	130			
Cadmium		0.704	mg/L	0.0010	95	70	130			
Chromium		0.455	mg/L	0.0050	90	70	130			
Cobalt		0.525	mg/L	0.0050	97	70	130			
Copper		1.78	mg/L	0.0050	95	70	130			
Iron		140	mg/L	0.030		70	130			A
Lead		0.622	mg/L	0.0010	95	70	130			
Nickel		0.487	mg/L	0.0050	92	70	130			

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Revised Date: 08/30/13
Report Date: 08/30/13
Work Order: H13080347

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8								Batch: R90656	
Sample ID: H13080347-001BMS	Sample Matrix Spike				Run: ICPMS204-B_130820A			08/22/13 11:59	
Silver	0.175	mg/L	0.0010	87	70	130			
Thallium	0.471	mg/L	0.00050	94	70	130			
Zinc	50.2	mg/L	0.010		70	130			A
Sample ID: H13080347-001BMSD	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130820A			08/22/13 12:03	
Aluminum	11.1	mg/L	0.030		70	130	0.3	20	A
Arsenic	0.612	mg/L	0.0010	91	70	130	1.3	20	
Barium	0.475	mg/L	0.050	94	70	130	2.9	20	
Beryllium	0.468	mg/L	0.0010	92	70	130	1.1	20	
Cadmium	0.708	mg/L	0.0010	96	70	130	0.6	20	
Chromium	0.454	mg/L	0.0050	90	70	130	0.3	20	
Cobalt	0.532	mg/L	0.0050	98	70	130	1.3	20	
Copper	1.76	mg/L	0.0050	91	70	130	1.0	20	
Iron	139	mg/L	0.030		70	130	0.9	20	A
Lead	0.624	mg/L	0.0010	95	70	130	0.4	20	
Nickel	0.485	mg/L	0.0050	91	70	130	0.5	20	
Silver	0.182	mg/L	0.0010	91	70	130	4.1	20	
Thallium	0.473	mg/L	0.00050	94	70	130	0.5	20	
Zinc	50.0	mg/L	0.010		70	130	0.5	20	A

Qualifiers:

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ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13
Client: CDM Federal Programs
Report Date: 08/30/13
Project: Barker Hughsville Pilot
Work Order: H13080347

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**									Analytical Run: ICPMS204-B_130823A
Sample ID: **ICV STD**	Initial Calibration Verification Standard								08/23/13 14:37
Lead	0.0619	mg/L	0.010	103	90	110			
Silver	0.0291	mg/L	0.0050	97	90	110			
Sample ID: **ICSA**	Interference Check Sample A								08/23/13 14:42
Lead	0.000192	mg/L	0.010						
Silver	0.000194	mg/L	0.0050						
Sample ID: **ICSAB**	Interference Check Sample AB								08/23/13 14:46
Lead	0.000154	mg/L	0.010		0	0			
Silver	0.0183	mg/L	0.0050	92	70	130			
Sample ID: **ICV STD**	Initial Calibration Verification Standard								08/24/13 03:12
Lead	0.0575	mg/L	0.010	96	90	110			
Silver	0.0282	mg/L	0.0050	94	90	110			
Sample ID: **ICSA**	Interference Check Sample A								08/24/13 03:17
Lead	0.000177	mg/L	0.010						
Silver	0.000189	mg/L	0.0050						
Sample ID: **ICSAB**	Interference Check Sample AB								08/24/13 03:22
Lead	0.000149	mg/L	0.010		0	0			
Silver	0.0178	mg/L	0.0050	89	70	130			
Sample ID: **ICV STD**	Initial Calibration Verification Standard								08/24/13 13:32
Lead	0.0625	mg/L	0.010	104	90	110			
Silver	0.0294	mg/L	0.0050	98	90	110			
Sample ID: **ICSA**	Interference Check Sample A								08/24/13 13:36
Lead	0.000173	mg/L	0.010						
Silver	0.000199	mg/L	0.0050						
Sample ID: **ICSAB**	Interference Check Sample AB								08/24/13 13:41
Lead	0.000163	mg/L	0.010		0	0			
Silver	0.0184	mg/L	0.0050	92	70	130			
Method: **E200.8**									Batch: R90752
Sample ID: **ICB**	Method Blank				Run: ICPMS204-B_130823A				08/23/13 15:16
Lead	7E-06	mg/L	6E-06						
Silver	9E-05	mg/L	4E-05						
Sample ID: **LFB**	Laboratory Fortified Blank				Run: ICPMS204-B_130823A				08/23/13 15:21
Lead	0.0507	mg/L	0.010	101	85	115			
Silver	0.0186	mg/L	0.0050	92	85	115			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13
Report Date: 08/30/13
Work Order: H13080347

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8								Batch: R90752	
Sample ID: H13080414-002BMS	Sample Matrix Spike				Run: ICPMS204-B_130823A			08/24/13 09:06	
Lead	0.117	mg/L	0.0010	103	70	130			
Silver	0.0318	mg/L	0.0010	79	70	130			
Sample ID: H13080414-002BMSD	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130823A			08/24/13 09:11	
Lead	0.117	mg/L	0.0010	104	70	130	0.5	20	
Silver	0.0322	mg/L	0.0010	81	70	130	1.4	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13
Client: CDM Federal Programs
Report Date: 08/30/13
Project: Barker Hughsville Pilot
Work Order: H13080347

Method: **E300.0** Analytical Run: IC102-H_130821A

Sample ID: **ICV** Initial Calibration Verification Standard 08/21/13 10:31

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Chloride	97	mg/L	1.0	97	90	110			
Sulfate	390	mg/L	1.0	98	90	110			

Sample ID: **CCV082113-2** Continuing Calibration Verification Standard 08/21/13 17:17

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Chloride	100	mg/L	1.0	102	90	110			
Sulfate	410	mg/L	1.0	102	90	110			

Sample ID: **CCV082113-3** Continuing Calibration Verification Standard 08/21/13 20:26

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Chloride	100	mg/L	1.0	102	90	110			
Sulfate	410	mg/L	1.0	103	90	110			

Method: **E300.0** Batch: R90696

Sample ID: **ICB** Method Blank Run: IC102-H_130821A 08/21/13 10:56

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Chloride	ND	mg/L	0.008						
Sulfate	ND	mg/L	0.08						

Sample ID: **LFB** Laboratory Fortified Blank Run: IC102-H_130821A 08/21/13 11:09

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Chloride	49	mg/L	1.0	98	90	110			
Sulfate	200	mg/L	1.0	100	90	110			

Sample ID: **H13080347-003AMS** Sample Matrix Spike Run: IC102-H_130821A 08/21/13 19:10

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Chloride	1100	mg/L	5.7	76	90	110			S
Sulfate	7800	mg/L	2.3	103	90	110			

Sample ID: **H13080347-003AMSD** Sample Matrix Spike Duplicate Run: IC102-H_130821A 08/21/13 19:23

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Chloride	1100	mg/L	5.7	75	90	110	0.7	20	S
Sulfate	8000	mg/L	2.3	109	90	110	2.9	20	

Sample ID: **H13080347-010AMS** Sample Matrix Spike Run: IC102-H_130821A 08/21/13 21:17

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Chloride	250	mg/L	1.4	98	90	110			
Sulfate	2100	mg/L	1.0	108	90	110			

Sample ID: **H13080347-010AMSD** Sample Matrix Spike Duplicate Run: IC102-H_130821A 08/21/13 21:29

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Chloride	250	mg/L	1.4	99	90	110	0.5	20	
Sulfate	2100	mg/L	1.0	105	90	110	1.4	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13
Report Date: 08/30/13
Work Order: H13080347

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E300.0**									Analytical Run: IC102-H_130827A
Sample ID: **ICV**	Initial Calibration Verification Standard								08/27/13 11:05
Chloride	98	mg/L	1.0	98	90	110			
Sulfate	400	mg/L	1.0	100	90	110			
Sample ID: **CCV082713-2**	Continuing Calibration Verification Standard								08/27/13 14:39
Chloride	100	mg/L	1.0	102	90	110			
Sulfate	420	mg/L	1.0	104	90	110			
Method: **E300.0**									Batch: R90831
Sample ID: **ICB**	Method Blank				Run: IC102-H_130827A				08/27/13 11:17
Chloride	ND	mg/L	0.008						
Sulfate	0.2	mg/L	0.08						
Sample ID: **LFB**	Laboratory Fortified Blank				Run: IC102-H_130827A				08/27/13 11:30
Chloride	50	mg/L	1.0	100	90	110			
Sulfate	210	mg/L	1.0	103	90	110			
Sample ID: **H13080347-008AMS**	Sample Matrix Spike				Run: IC102-H_130827A				08/27/13 16:57
Chloride	1100	mg/L	5.7	101	90	110			
Sulfate	4800	mg/L	2.3	98	90	110			
Sample ID: **H13080347-008AMSD**	Sample Matrix Spike Duplicate				Run: IC102-H_130827A				08/27/13 17:10
Chloride	1100	mg/L	5.7	101	90	110	0.1	20	
Sulfate	4800	mg/L	2.3	98	90	110	0.0	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13
Report Date: 08/30/13
Work Order: H13080347

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E350.1						Analytical Run: FIA203-HE_130829B			
Sample ID: ICB	Initial Calibration Blank, Instrument Blank							08/29/13 12:18	
Nitrogen, Ammonia as N	0.00827	mg/L	0.050		0	0			
Sample ID: ICV	Initial Calibration Verification Standard							08/29/13 12:35	
Nitrogen, Ammonia as N	5.42	mg/L	0.50	96	90	110			
Sample ID: CCV	Continuing Calibration Verification Standard							08/29/13 12:37	
Nitrogen, Ammonia as N	0.0951	mg/L	0.050	95	90	110			
Method: E350.1								Batch: R90891	
Sample ID: LFB	Laboratory Fortified Blank				Run: FIA203-HE_130829B			08/29/13 12:15	
Nitrogen, Ammonia as N	0.477	mg/L	0.050	95	90	110			
Sample ID: H13080430-006BMS	Sample Matrix Spike				Run: FIA203-HE_130829B			08/29/13 12:39	
Nitrogen, Ammonia as N	0.405	mg/L	0.050	81	80	120			
Sample ID: H13080430-006BMSD	Sample Matrix Spike Duplicate				Run: FIA203-HE_130829B			08/29/13 12:41	
Nitrogen, Ammonia as N	0.438	mg/L	0.050	88	80	120	7.8	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Revised Date: 08/30/13
Report Date: 08/30/13
Work Order: H13080347

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E365.1									Analytical Run: FIA202-HE_130820A
Sample ID: ICV	Initial Calibration Verification Standard								08/20/13 13:09
Phosphorus, Orthophosphate as P	0.242	mg/L	0.0050	97	90	110			
Sample ID: ICB	Initial Calibration Blank, Instrument Blank								08/20/13 13:10
Phosphorus, Orthophosphate as P	-0.000780	mg/L	0.0050		0	0			
Sample ID: CCV	Continuing Calibration Verification Standard								08/20/13 13:12
Phosphorus, Orthophosphate as P	0.0896	mg/L	0.0050	90	90	110			
Method: E365.1									Batch: R90648
Sample ID: LFB	Laboratory Fortified Blank				Run: FIA202-HE_130820A				08/20/13 13:11
Phosphorus, Orthophosphate as P	0.189	mg/L	0.0050	94	90	110			
Sample ID: H13080347-002AMS	Sample Matrix Spike				Run: FIA202-HE_130820A				08/20/13 13:16
Phosphorus, Orthophosphate as P	0.450	mg/L	0.0050	81	90	110			S
Sample ID: H13080347-002AMSD	Sample Matrix Spike Duplicate				Run: FIA202-HE_130820A				08/20/13 13:17
Phosphorus, Orthophosphate as P	0.467	mg/L	0.0050	85	90	110	3.6	20	S

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

Standard Reporting Procedures

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Workorder Receipt Checklist

CDM Federal Programs

H13080347

Login completed by: Tracy L. Lorash

Reviewed by: BL2000\sdull

Reviewed Date: 8/23/2013

Date Received: 8/20/2013

Received by: elm

Carrier name: Hand Del

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☐	No ☑	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Applicable ☐
Container/Temp Blank temperature:	℃ See comments		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☑	Not Applicable ☐

Contact and Corrective Action Comments:

Sample ID on COC has the date as 081913 - ID on INFL, SAPS, CHIT bottles has date as 08192013. Logged in with ID from COC.
Cooler 1 was received at 0.3℃, Cooler 2 at 0.6℃. Samples were received on wet ice.
BCR3 and BDR3 dissolved metals samples were preserved with 2 mL nitric acid upon receipt to pH <2 in the laboratory. Tl 8/20/13

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

Page 1 of 1

PLEASE PRINT- Provide as much information as possible.

Company Name:
CDM Smith

Project Name, PWS, Permit, Etc.
Barker Hughesville

Sample Origin
State: Montana

EPA/State Compliance:
Yes ☐ No X

Report Mail Address:
50 W 14th Street, Suite 200
Helena, MT 59601

Contact Name:
Angela Frandsen

Phone/Fax:
406-441-1435

Email:
frandsenak@cdmsmith.com

Sampler: (Please Print)
Angela Frandsen

Invoice Address:
Contact Raquel Cisneros 720-264-1148

Invoice Contact & Phone:
Contact Raquel Cisneros 720-264-1148

Purchase Order:

Quote/Bottle Order:

Special Report/Formats – ELI must be notified prior to sample submittal for the following:

☐ DW
☐ GSA
☐ POTW/WWTP
☐ State: __________
☐ Other: __________

☐ A2LA
x EDD/EDT(Electronic Data)
Format: excel
☐ LEVEL IV
☐ NELAC

R U S H

Contact ELI prior to **RUSH** sample submittal for charges and scheduling – See Instruction Page

Comments:

10 day TAT

Pull phosphate from 1 L bottle

Shipped by: Hand

Cooler ID(s): Y

Receipt Temp: See comments

On Ice: [✓ Yes] No

Custody Seal Y [✓ N]
Intact Y N
Signature Match Y N

C1

C2

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	Number of Containers / Sample Type: A W S V B O Air Water Soils/Solids Vegetation Bioassay Other / MATRIX	Dissolved Metals	Total Metals	Sulfide	Orthophosphate	Alkalinity and Acidity	SO4, Cl, F, TDS	BOD	Ammonia		SEE ATTACHED	Normal Turnaround (TAT)	RUSH	Comments	LABORATORY USE ONLY
13BH-DT-PILOT-INFL-081913	08/19/2013	1130	2 W	X			X	X	X								H13080347
13BH-DT-PILOT-SAPS-081913	08/19/2013	1225	2 W	X			X	X	X							TB	
13BH-DT-PILOT-CHIT-081913	08/19/2013	1245	2 W	X			X	X	X							C1→0.3	
13BH-DT-PILOT-MGOH-081913	08/19/2013	1305	2 W	X			X	X	X							C2→0.6	
13BH-DT-PILOT-BCR1-081913	08/19/2013	1320	3 W	X		X	X	X	X								
13BH-DT-PILOT-BCR2-081913	08/19/2013	1335	5 W	X		X	X	X	X	X	X						
13BH-DT-PILOT-BCR3-081913	08/19/2013	1355	3 W	X		X	X	X	X								
13BH-DT-PILOT-BDR3-081913	08/19/2013	1400	3 W	X		X	X	X	X								
13BH-DT-PILOT-BCR2-POST-081913	08/19/2013	1410	3 W			X				X	X						
13BH-DT-PILOT-BCR4-081913	08/19/2013	1430	3 W	X		X	X	X	X								

Custody Record MUST be Signed

Relinquished by (print): Lauren Helland Date/Time: 08/20/2013 08:58 Signature: Lauren Helland

Relinquished by (print): Date/Time: Signature:

Received by (print): Date/Time: Signature:

Received by (print): Date/Time: Signature:

Received by Laboratory: Esther Merritt Date/Time: 8-20-13 8:58 Signature: Esther Merritt

Sample Disposal: Return to Client: ________ Lab Disposal: ________

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.
Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

ANALYTICAL SUMMARY REPORT

September 27, 2013

CDM Federal Programs
555 17th St Ste 1100
Denver, CO 80202

Workorder No.: H13090077 Quote ID: H823 - Baker-Hughsville Superfund Site

Project Name: Barker Hughsville Pilot

Energy Laboratories Inc Helena MT received the following 10 samples for CDM Federal Programs on 9/5/2013 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H13090077-001	13BH-DT-PILOT-BCR3-090413	09/04/13 9:40	09/05/13	Aqueous	Metals by ICP/ICPMS, Dissolved Metals by ICP/ICPMS, Total Acidity, Total as CaCO3 Alkalinity Biochemical Oxygen Demand, 5 Day Conductivity Fluoride Anions by Ion Chromatography Nitrogen, Ammonia Metals Digestion by EPA 200.2 Phosphorus, Orthophosphate as P Solids, Total Dissolved Sulfide, Iodine Titrimetric
H13090077-002	13BH-DT-PILOT-BCR1-090413	09/04/13 10:25	09/05/13	Aqueous	Metals by ICP/ICPMS, Dissolved Metals by ICP/ICPMS, Total Acidity, Total as CaCO3 Alkalinity Conductivity Fluoride Anions by Ion Chromatography Metals Digestion by EPA 200.2 Phosphorus, Orthophosphate as P Solids, Total Dissolved Sulfide, Methylene Blue Colorimetric
H13090077-003	13BH-DT-PILOT-BDR1-090413	09/04/13 10:30	09/05/13	Aqueous	Same As Above
H13090077-004	13BH-DT-PILOT-BCR2-090413	09/04/13 10:55	09/05/13	Aqueous	Same As Above
H13090077-005	13BH-DT-PILOT-BCR4-090413	09/04/13 11:10	09/05/13	Aqueous	Same As Above
H13090077-006	13BH-DT-PILOT-INFL-090413	09/04/13 11:20	09/05/13	Aqueous	Metals by ICP/ICPMS, Dissolved Metals by ICP/ICPMS, Total Acidity, Total as CaCO3 Alkalinity Conductivity Fluoride Anions by Ion Chromatography Metals Digestion by EPA 200.2 Phosphorus, Orthophosphate as P Solids, Total Dissolved
H13090077-007	13BH-DT-PILOT-SAPS-090413	09/04/13 11:35	09/05/13	Aqueous	Same As Above
H13090077-008	13BH-DT-PILOT-MGOH-090413	09/04/13 11:45	09/05/13	Aqueous	Same As Above

ANALYTICAL SUMMARY REPORT

H13090077-009	13BH-DT-PILOT-CHIT-090413	09/04/13 11:55	09/05/13	Aqueous	Same As Above
H13090077-010	13BH-DT-PILOT-BCR3-POST-090413	09/04/13 12:10	09/05/13	Aqueous	Biochemical Oxygen Demand, 5 Day Nitrogen, Ammonia Sulfide, Methylene Blue Colorimetric

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By:

CLIENT: CDM Federal Programs
Project: Barker Hughsville Pilot
Sample Delivery Group: H13090077

Report Date: 09/27/13

CASE NARRATIVE

Tests associated with analyst identified as ELI-B were subcontracted to Energy Laboratories, 1120 S. 27th St., Billings, MT, EPA Number MT00005.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13090077-001
Client Sample ID 13BH-DT-PILOT-BCR3-090413

Report Date: 09/27/13
Collection Date: 09/04/13 09:40
DateReceived: 09/05/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	2630	mg/L		10		A2540 C	09/05/13 12:43 / cmm
INORGANICS							
Acidity, Total as CaCO3	ND	mg/L	D	4.0		A2310 B	09/09/13 11:00 / cmm
Alkalinity, Total as CaCO3	1700	mg/L		1		A2320 B	09/05/13 16:11 / cmm
Bicarbonate as HCO3	2100	mg/L		1		A2320 B	09/05/13 16:11 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	09/05/13 16:11 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	09/05/13 16:11 / cmm
Chloride	31	mg/L	D	5		E300.0	09/09/13 16:01 / cmm
Sulfate	350	mg/L	D	5		E300.0	09/10/13 12:27 / cmm
Fluoride	0.4	mg/L	D	0.2	4	A4500-F C	09/10/13 10:51 / cmm
Sulfide	78	mg/L		1		A4500-S F	09/06/13 14:45 / eli-b22
AGGREGATE ORGANICS							
Oxygen Demand, Biochemical (BOD)	1500	mg/L		400		A5210 B	09/05/13 15:19 / cmm
NUTRIENTS							
Nitrogen, Ammonia as N	179	mg/L	D	5		E350.1	09/05/13 12:17 / reh
Phosphorus, Orthophosphate as P	62.1	mg/L	D	0.2		E365.1	09/05/13 16:12 / reh
METALS, DISSOLVED							
Aluminum	ND	mg/L		0.03		E200.8	09/10/13 23:28 / dck
Arsenic	0.023	mg/L		0.001		E200.8	09/10/13 23:28 / dck
Barium	0.12	mg/L		0.05		E200.8	09/10/13 23:28 / dck
Beryllium	ND	mg/L		0.001		E200.8	09/10/13 23:28 / dck
Cadmium	ND	mg/L		0.001		E200.8	09/10/13 23:28 / dck
Calcium	583	mg/L		1		E200.7	09/06/13 11:16 / sld
Chromium	ND	mg/L		0.005		E200.8	09/10/13 23:28 / dck
Cobalt	ND	mg/L		0.005		E200.8	09/10/13 23:28 / dck
Copper	ND	mg/L		0.005		E200.8	09/10/13 23:28 / dck
Iron	0.09	mg/L		0.03		E200.8	09/10/13 23:28 / dck
Lead	ND	mg/L		0.001		E200.8	09/10/13 23:28 / dck
Magnesium	43	mg/L		1		E200.7	09/06/13 11:16 / sld
Manganese	60.0	mg/L	D	0.003		E200.7	09/06/13 11:16 / sld
Nickel	ND	mg/L		0.005		E200.8	09/10/13 23:28 / dck
Potassium	8	mg/L		1		E200.7	09/06/13 11:16 / sld
Silver	ND	mg/L		0.001		E200.8	09/10/13 23:28 / dck
Sodium	26	mg/L		1		E200.7	09/06/13 11:16 / sld
Thallium	ND	mg/L		0.0005		E200.8	09/10/13 23:28 / dck
Zinc	ND	mg/L		0.01		E200.8	09/10/13 23:28 / dck
METALS, TOTAL							
Aluminum	0.16	mg/L		0.03		E200.8	09/12/13 00:35 / dck
Arsenic	0.029	mg/L		0.001		E200.8	09/12/13 00:35 / dck

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	09/27/13
Project:	Barker Hughsville Pilot	**Collection Date:**	09/04/13 09:40
Lab ID:	H13090077-001	**DateReceived:**	09/05/13
Client Sample ID	13BH-DT-PILOT-BCR3-090413	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS, TOTAL							
Barium	0.13	mg/L		0.05		E200.8	09/12/13 00:35 / dck
Beryllium	ND	mg/L		0.001		E200.8	09/12/13 00:35 / dck
Cadmium	ND	mg/L		0.001		E200.8	09/12/13 00:35 / dck
Calcium	586	mg/L		1		E200.7	09/10/13 14:13 / sld
Chromium	ND	mg/L		0.005		E200.8	09/12/13 00:35 / dck
Cobalt	ND	mg/L		0.005		E200.8	09/12/13 00:35 / dck
Copper	ND	mg/L		0.005		E200.8	09/12/13 00:35 / dck
Iron	0.55	mg/L		0.03		E200.8	09/12/13 00:35 / dck
Lead	0.003	mg/L		0.001		E200.8	09/12/13 00:35 / dck
Magnesium	44	mg/L		1		E200.7	09/10/13 14:13 / sld
Manganese	61.2	mg/L	D	0.003		E200.7	09/10/13 14:13 / sld
Nickel	ND	mg/L		0.005		E200.8	09/12/13 00:35 / dck
Potassium	8	mg/L		1		E200.7	09/10/13 14:13 / sld
Silver	ND	mg/L		0.001		E200.8	09/12/13 00:35 / dck
Sodium	25	mg/L		1		E200.7	09/10/13 14:13 / sld
Thallium	0.0005	mg/L		0.0005		E200.8	09/12/13 00:35 / dck
Zinc	0.03	mg/L		0.01		E200.8	09/12/13 00:35 / dck

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13090077-002
Client Sample ID 13BH-DT-PILOT-BCR1-090413

Report Date: 09/27/13
Collection Date: 09/04/13 10:25
DateReceived: 09/05/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1580	mg/L		10		A2540 C	09/05/13 12:43 / cmm
INORGANICS							
Acidity, Total as CaCO3	230	mg/L	D	4.0		A2310 B	09/09/13 11:00 / cmm
Alkalinity, Total as CaCO3	76	mg/L		1		A2320 B	09/05/13 16:17 / cmm
Bicarbonate as HCO3	93	mg/L		1		A2320 B	09/05/13 16:17 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	09/05/13 16:17 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	09/05/13 16:17 / cmm
Chloride	1	mg/L		1		E300.0	09/09/13 16:14 / cmm
Sulfate	1100	mg/L		1		E300.0	09/10/13 12:40 / cmm
Fluoride	1.3	mg/L	D	0.2	4	A4500-F C	09/10/13 10:54 / cmm
Sulfide	ND	mg/L		0.04		A4500-S D	09/06/13 15:00 / eli-b22
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.029	mg/L		0.005		E365.1	09/05/13 16:13 / reh
METALS, DISSOLVED							
Aluminum	0.84	mg/L		0.03		E200.8	09/10/13 23:46 / dck
Arsenic	0.008	mg/L		0.001		E200.8	09/10/13 23:46 / dck
Barium	0.05	mg/L		0.05		E200.8	09/10/13 23:46 / dck
Beryllium	0.001	mg/L		0.001		E200.8	09/10/13 23:46 / dck
Cadmium	0.001	mg/L		0.001		E200.8	09/10/13 23:46 / dck
Calcium	235	mg/L		1		E200.7	09/06/13 11:27 / sld
Chromium	ND	mg/L		0.005		E200.8	09/10/13 23:46 / dck
Cobalt	0.040	mg/L		0.005		E200.8	09/10/13 23:46 / dck
Copper	ND	mg/L		0.005		E200.8	09/10/13 23:46 / dck
Iron	86.2	mg/L		0.03		E200.7	09/06/13 11:27 / sld
Lead	ND	mg/L		0.001		E200.8	09/10/13 23:46 / dck
Magnesium	23	mg/L		1		E200.7	09/06/13 11:27 / sld
Manganese	105	mg/L	D	0.003		E200.7	09/06/13 11:27 / sld
Nickel	0.029	mg/L		0.005		E200.8	09/10/13 23:46 / dck
Potassium	1	mg/L		1		E200.7	09/06/13 11:27 / sld
Silver	ND	mg/L		0.001		E200.8	09/10/13 23:46 / dck
Sodium	7	mg/L		1		E200.7	09/06/13 11:27 / sld
Thallium	ND	mg/L		0.0005		E200.8	09/10/13 23:46 / dck
Zinc	35.5	mg/L		0.01		E200.7	09/06/13 11:27 / sld
METALS, TOTAL							
Aluminum	0.87	mg/L		0.03		E200.8	09/12/13 00:56 / dck
Arsenic	0.010	mg/L		0.001		E200.8	09/12/13 00:56 / dck
Barium	0.05	mg/L		0.05		E200.8	09/12/13 00:56 / dck
Beryllium	0.001	mg/L		0.001		E200.8	09/12/13 00:56 / dck
Cadmium	0.001	mg/L		0.001		E200.8	09/12/13 00:56 / dck
Calcium	228	mg/L		1		E200.7	09/10/13 14:35 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	09/27/13
Project:	Barker Hughsville Pilot	**Collection Date:**	09/04/13 10:25
Lab ID:	H13090077-002	**DateReceived:**	09/05/13
Client Sample ID	13BH-DT-PILOT-BCR1-090413	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS, TOTAL							
Chromium	ND	mg/L		0.005		E200.8	09/12/13 00:56 / dck
Cobalt	0.039	mg/L		0.005		E200.8	09/12/13 00:56 / dck
Copper	ND	mg/L		0.005		E200.8	09/12/13 00:56 / dck
Iron	83.4	mg/L		0.03		E200.7	09/10/13 14:35 / sld
Lead	0.009	mg/L		0.001		E200.8	09/12/13 00:56 / dck
Magnesium	21	mg/L		1		E200.7	09/10/13 14:35 / sld
Manganese	102	mg/L	D	0.003		E200.7	09/10/13 14:35 / sld
Nickel	0.029	mg/L		0.005		E200.8	09/12/13 00:56 / dck
Potassium	ND	mg/L		1		E200.7	09/10/13 14:35 / sld
Silver	ND	mg/L		0.001		E200.8	09/12/13 00:56 / dck
Sodium	5	mg/L		1		E200.7	09/10/13 14:35 / sld
Thallium	ND	mg/L		0.0005		E200.8	09/12/13 00:56 / dck
Zinc	34.3	mg/L		0.01		E200.7	09/10/13 14:35 / sld

Report Definitions:

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QCL - Quality control limit.
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MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	09/27/13
Project:	Barker Hughsville Pilot	**Collection Date:**	09/04/13 10:30
Lab ID:	H13090077-003	**DateReceived:**	09/05/13
Client Sample ID	13BH-DT-PILOT-BDR1-090413	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1590	mg/L		10		A2540 C	09/05/13 12:43 / cmm
INORGANICS							
Acidity, Total as CaCO3	280	mg/L	D	4.0		A2310 B	09/09/13 11:00 / cmm
Alkalinity, Total as CaCO3	75	mg/L		1		A2320 B	09/05/13 16:22 / cmm
Bicarbonate as HCO3	91	mg/L		1		A2320 B	09/05/13 16:22 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	09/05/13 16:22 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	09/05/13 16:22 / cmm
Chloride	1	mg/L		1		E300.0	09/09/13 16:26 / cmm
Sulfate	1100	mg/L		1		E300.0	09/10/13 12:53 / cmm
Fluoride	1.3	mg/L	D	0.2	4	A4500-F C	09/10/13 10:55 / cmm
Sulfide	ND	mg/L		0.04		A4500-S D	09/06/13 15:00 / eli-b22
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.030	mg/L		0.005		E365.1	09/05/13 16:16 / reh
METALS, DISSOLVED							
Aluminum	1.22	mg/L		0.03		E200.7	09/06/13 11:30 / sld
Arsenic	0.008	mg/L		0.001		E200.8	09/10/13 23:51 / dck
Barium	0.05	mg/L		0.05		E200.8	09/10/13 23:51 / dck
Beryllium	0.001	mg/L		0.001		E200.8	09/10/13 23:51 / dck
Cadmium	0.001	mg/L		0.001		E200.8	09/10/13 23:51 / dck
Calcium	235	mg/L		1		E200.7	09/06/13 11:30 / sld
Chromium	ND	mg/L		0.005		E200.8	09/10/13 23:51 / dck
Cobalt	0.040	mg/L		0.005		E200.8	09/10/13 23:51 / dck
Copper	ND	mg/L		0.005		E200.8	09/10/13 23:51 / dck
Iron	86.1	mg/L		0.03		E200.7	09/06/13 11:30 / sld
Lead	ND	mg/L		0.001		E200.8	09/10/13 23:51 / dck
Magnesium	23	mg/L		1		E200.7	09/06/13 11:30 / sld
Manganese	105	mg/L	D	0.003		E200.7	09/06/13 11:30 / sld
Nickel	0.030	mg/L		0.005		E200.8	09/10/13 23:51 / dck
Potassium	ND	mg/L		1		E200.7	09/06/13 11:30 / sld
Silver	ND	mg/L		0.001		E200.8	09/10/13 23:51 / dck
Sodium	5	mg/L		1		E200.7	09/06/13 11:30 / sld
Thallium	ND	mg/L		0.0005		E200.8	09/10/13 23:51 / dck
Zinc	35.9	mg/L		0.01		E200.7	09/06/13 11:30 / sld
METALS, TOTAL							
Aluminum	1.01	mg/L	D	0.06		E200.7	09/10/13 14:38 / sld
Arsenic	0.010	mg/L		0.001		E200.8	09/12/13 01:01 / dck
Barium	0.05	mg/L		0.05		E200.8	09/12/13 01:01 / dck
Beryllium	0.001	mg/L		0.001		E200.8	09/12/13 01:01 / dck
Cadmium	0.001	mg/L		0.001		E200.8	09/12/13 01:01 / dck
Calcium	233	mg/L		1		E200.7	09/10/13 14:38 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13090077-003
Client Sample ID 13BH-DT-PILOT-BDR1-090413

Report Date: 09/27/13
Collection Date: 09/04/13 10:30
DateReceived: 09/05/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS, TOTAL							
Chromium	ND	mg/L		0.005		E200.8	09/12/13 01:01 / dck
Cobalt	0.039	mg/L		0.005		E200.8	09/12/13 01:01 / dck
Copper	ND	mg/L		0.005		E200.8	09/12/13 01:01 / dck
Iron	84.4	mg/L		0.03		E200.7	09/10/13 14:38 / sld
Lead	0.006	mg/L		0.001		E200.8	09/12/13 01:01 / dck
Magnesium	22	mg/L		1		E200.7	09/10/13 14:38 / sld
Manganese	103	mg/L	D	0.003		E200.7	09/10/13 14:38 / sld
Nickel	0.029	mg/L		0.005		E200.8	09/12/13 01:01 / dck
Potassium	ND	mg/L		1		E200.7	09/10/13 14:38 / sld
Silver	ND	mg/L		0.001		E200.8	09/12/13 01:01 / dck
Sodium	5	mg/L		1		E200.7	09/10/13 14:38 / sld
Thallium	ND	mg/L		0.0005		E200.8	09/12/13 01:01 / dck
Zinc	35.2	mg/L		0.01		E200.7	09/10/13 14:38 / sld

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13090077-004
Client Sample ID 13BH-DT-PILOT-BCR2-090413

Report Date: 09/27/13
Collection Date: 09/04/13 10:55
DateReceived: 09/05/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1510	mg/L		10		A2540 C	09/05/13 12:43 / cmm
INORGANICS							
Acidity, Total as CaCO3	120	mg/L	D	4.0		A2310 B	09/09/13 11:00 / cmm
Alkalinity, Total as CaCO3	100	mg/L		1		A2320 B	09/05/13 16:28 / cmm
Bicarbonate as HCO3	120	mg/L		1		A2320 B	09/05/13 16:28 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	09/05/13 16:28 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	09/05/13 16:28 / cmm
Chloride	1	mg/L		1		E300.0	09/09/13 16:39 / cmm
Sulfate	1000	mg/L		1		E300.0	09/10/13 13:05 / cmm
Fluoride	1.4	mg/L	D	0.2	4	A4500-F C	09/10/13 10:56 / cmm
Sulfide	0.15	mg/L		0.04		A4500-S D	09/06/13 15:00 / eli-b22
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.050	mg/L		0.005		E365.1	09/05/13 16:17 / reh
METALS, DISSOLVED							
Aluminum	0.08	mg/L		0.03		E200.8	09/10/13 23:55 / dck
Arsenic	0.002	mg/L		0.001		E200.8	09/10/13 23:55 / dck
Barium	0.10	mg/L		0.05		E200.8	09/10/13 23:55 / dck
Beryllium	ND	mg/L		0.001		E200.8	09/10/13 23:55 / dck
Cadmium	ND	mg/L		0.001		E200.8	09/10/13 23:55 / dck
Calcium	276	mg/L		1		E200.7	09/06/13 11:34 / sld
Chromium	ND	mg/L		0.005		E200.8	09/10/13 23:55 / dck
Cobalt	0.035	mg/L		0.005		E200.8	09/10/13 23:55 / dck
Copper	ND	mg/L		0.005		E200.8	09/10/13 23:55 / dck
Iron	46.4	mg/L		0.03		E200.7	09/06/13 11:34 / sld
Lead	ND	mg/L		0.001		E200.8	09/10/13 23:55 / dck
Magnesium	22	mg/L		1		E200.7	09/06/13 11:34 / sld
Manganese	104	mg/L	D	0.003		E200.7	09/06/13 11:34 / sld
Nickel	0.024	mg/L		0.005		E200.8	09/10/13 23:55 / dck
Potassium	1	mg/L		1		E200.7	09/06/13 11:34 / sld
Silver	ND	mg/L		0.001		E200.8	09/10/13 23:55 / dck
Sodium	7	mg/L		1		E200.7	09/06/13 11:34 / sld
Thallium	ND	mg/L		0.0005		E200.8	09/10/13 23:55 / dck
Zinc	12.2	mg/L		0.01		E200.7	09/06/13 11:34 / sld
METALS, TOTAL							
Aluminum	0.12	mg/L		0.03		E200.8	09/25/13 10:36 / dck
Arsenic	0.003	mg/L		0.001		E200.8	09/25/13 10:36 / dck
Barium	0.08	mg/L		0.05		E200.8	09/25/13 10:36 / dck
Beryllium	ND	mg/L		0.001		E200.8	09/25/13 10:36 / dck
Cadmium	ND	mg/L		0.001		E200.8	09/25/13 10:36 / dck
Calcium	271	mg/L		1		E200.7	09/10/13 14:42 / sld

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13090077-004
Client Sample ID 13BH-DT-PILOT-BCR2-090413

Report Date: 09/27/13
Collection Date: 09/04/13 10:55
DateReceived: 09/05/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS, TOTAL							
Chromium	ND	mg/L		0.005		E200.8	09/25/13 10:36 / dck
Cobalt	0.037	mg/L		0.005		E200.8	09/25/13 10:36 / dck
Copper	ND	mg/L		0.005		E200.8	09/25/13 10:36 / dck
Iron	45.0	mg/L		0.03		E200.7	09/10/13 14:42 / sld
Lead	0.001	mg/L		0.001		E200.8	09/25/13 10:36 / dck
Magnesium	22	mg/L		1		E200.7	09/10/13 14:42 / sld
Manganese	102	mg/L	D	0.003		E200.7	09/10/13 14:42 / sld
Nickel	0.027	mg/L		0.005		E200.8	09/25/13 10:36 / dck
Potassium	ND	mg/L		1		E200.7	09/10/13 14:42 / sld
Silver	ND	mg/L		0.001		E200.8	09/25/13 10:36 / dck
Sodium	5	mg/L		1		E200.7	09/10/13 14:42 / sld
Thallium	ND	mg/L		0.0005		E200.8	09/25/13 10:36 / dck
Zinc	15.5	mg/L		0.01		E200.7	09/10/13 14:42 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13090077-005
Client Sample ID 13BH-DT-PILOT-BCR4-090413

Report Date: 09/27/13
Collection Date: 09/04/13 11:10
DateReceived: 09/05/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1510	mg/L		10		A2540 C	09/05/13 12:43 / cmm
INORGANICS							
Acidity, Total as CaCO3	170	mg/L	D	4.0		A2310 B	09/09/13 11:00 / cmm
Alkalinity, Total as CaCO3	100	mg/L		1		A2320 B	09/05/13 16:34 / cmm
Bicarbonate as HCO3	120	mg/L		1		A2320 B	09/05/13 16:34 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	09/05/13 16:34 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	09/05/13 16:34 / cmm
Chloride	2	mg/L		1		E300.0	09/09/13 16:51 / cmm
Sulfate	1000	mg/L		1		E300.0	09/10/13 13:18 / cmm
Fluoride	1.8	mg/L	D	0.2	4	A4500-F C	09/10/13 10:57 / cmm
Sulfide	0.34	mg/L		0.04		A4500-S D	09/06/13 15:00 / eli-b22
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.048	mg/L		0.005		E365.1	09/05/13 16:18 / reh
METALS, DISSOLVED							
Aluminum	0.09	mg/L		0.03		E200.8	09/11/13 00:00 / dck
Arsenic	0.006	mg/L		0.001		E200.8	09/11/13 00:00 / dck
Barium	0.11	mg/L		0.05		E200.8	09/11/13 00:00 / dck
Beryllium	ND	mg/L		0.001		E200.8	09/11/13 00:00 / dck
Cadmium	ND	mg/L		0.001		E200.8	09/11/13 00:00 / dck
Calcium	239	mg/L		1		E200.7	09/06/13 11:38 / sld
Chromium	ND	mg/L		0.005		E200.8	09/11/13 00:00 / dck
Cobalt	0.043	mg/L		0.005		E200.8	09/11/13 00:00 / dck
Copper	ND	mg/L		0.005		E200.8	09/11/13 00:00 / dck
Iron	52.2	mg/L		0.03		E200.7	09/06/13 11:38 / sld
Lead	ND	mg/L		0.001		E200.8	09/11/13 00:00 / dck
Magnesium	41	mg/L		1		E200.7	09/06/13 11:38 / sld
Manganese	116	mg/L	D	0.003		E200.7	09/06/13 11:38 / sld
Nickel	0.029	mg/L		0.005		E200.8	09/11/13 00:00 / dck
Potassium	1	mg/L		1		E200.7	09/06/13 11:38 / sld
Silver	ND	mg/L		0.001		E200.8	09/11/13 00:00 / dck
Sodium	7	mg/L		1		E200.7	09/06/13 11:38 / sld
Thallium	ND	mg/L		0.0005		E200.8	09/11/13 00:00 / dck
Zinc	10.4	mg/L		0.01		E200.7	09/06/13 11:38 / sld
METALS, TOTAL							
Aluminum	0.13	mg/L		0.03		E200.8	09/12/13 01:27 / dck
Arsenic	0.006	mg/L		0.001		E200.8	09/12/13 01:27 / dck
Barium	0.10	mg/L		0.05		E200.8	09/12/13 01:27 / dck
Beryllium	ND	mg/L		0.001		E200.8	09/12/13 01:27 / dck
Cadmium	ND	mg/L		0.001		E200.8	09/12/13 01:27 / dck
Calcium	233	mg/L		1		E200.7	09/10/13 14:46 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	09/27/13
Project:	Barker Hughsville Pilot	**Collection Date:**	09/04/13 11:10
Lab ID:	H13090077-005	**DateReceived:**	09/05/13
Client Sample ID	13BH-DT-PILOT-BCR4-090413	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS, TOTAL							
Chromium	ND	mg/L		0.005		E200.8	09/12/13 01:27 / dck
Cobalt	0.044	mg/L		0.005		E200.8	09/12/13 01:27 / dck
Copper	ND	mg/L		0.005		E200.8	09/12/13 01:27 / dck
Iron	51.9	mg/L		0.03		E200.7	09/10/13 14:46 / sld
Lead	ND	mg/L		0.001		E200.8	09/12/13 01:27 / dck
Magnesium	36	mg/L		1		E200.7	09/10/13 14:46 / sld
Manganese	113	mg/L	D	0.003		E200.7	09/10/13 14:46 / sld
Nickel	0.031	mg/L		0.005		E200.8	09/12/13 01:27 / dck
Potassium	ND	mg/L		1		E200.7	09/10/13 14:46 / sld
Silver	ND	mg/L		0.001		E200.8	09/12/13 01:27 / dck
Sodium	5	mg/L		1		E200.7	09/10/13 14:46 / sld
Thallium	ND	mg/L		0.0005		E200.8	09/12/13 01:27 / dck
Zinc	14.6	mg/L		0.01		E200.7	09/10/13 14:46 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	09/27/13
Project:	Barker Hughsville Pilot	**Collection Date:**	09/04/13 11:20
Lab ID:	H13090077-006	**DateReceived:**	09/05/13
Client Sample ID	13BH-DT-PILOT-INFL-090413	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1420	mg/L		10		A2540 C	09/05/13 12:44 / cmm
INORGANICS							
Acidity, Total as CaCO3	510	mg/L	D	4.0		A2310 B	09/09/13 11:00 / cmm
Alkalinity, Total as CaCO3	ND	mg/L		1		A2320 B	09/05/13 16:37 / cmm
Bicarbonate as HCO3	ND	mg/L		1		A2320 B	09/05/13 16:37 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	09/05/13 16:37 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	09/05/13 16:37 / cmm
Chloride	2	mg/L		1		E300.0	09/09/13 17:07 / cmm
Sulfate	2500	mg/L		1		E300.0	09/10/13 13:30 / cmm
Fluoride	0.8	mg/L	D	0.2	4	A4500-F C	09/10/13 10:58 / cmm
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.225	mg/L		0.005		E365.1	09/05/13 17:00 / reh
METALS, DISSOLVED							
Aluminum	10.9	mg/L		0.03		E200.7	09/06/13 11:41 / sld
Arsenic	0.113	mg/L		0.001		E200.8	09/11/13 00:23 / dck
Barium	ND	mg/L		0.05		E200.8	09/11/13 00:23 / dck
Beryllium	0.006	mg/L		0.001		E200.8	09/11/13 00:23 / dck
Cadmium	0.155	mg/L		0.001		E200.8	09/12/13 01:32 / dck
Calcium	97	mg/L		1		E200.7	09/06/13 11:41 / sld
Chromium	ND	mg/L		0.005		E200.8	09/11/13 00:23 / dck
Cobalt	0.038	mg/L		0.005		E200.8	09/11/13 00:23 / dck
Copper	1.12	mg/L		0.005		E200.8	09/12/13 18:32 / dck
Iron	130	mg/L		0.03		E200.7	09/06/13 11:41 / sld
Lead	0.136	mg/L		0.001		E200.8	09/11/13 00:23 / dck
Magnesium	22	mg/L		1		E200.7	09/06/13 11:41 / sld
Manganese	103	mg/L	D	0.003		E200.7	09/06/13 11:41 / sld
Nickel	0.028	mg/L		0.005		E200.8	09/11/13 00:23 / dck
Potassium	ND	mg/L		1		E200.7	09/06/13 11:41 / sld
Silver	ND	mg/L		0.001		E200.8	09/11/13 00:23 / dck
Sodium	7	mg/L		1		E200.7	09/06/13 11:41 / sld
Thallium	0.0022	mg/L		0.0005		E200.8	09/11/13 00:23 / dck
Zinc	47.8	mg/L		0.01		E200.7	09/06/13 11:41 / sld
METALS, TOTAL							
Aluminum	12.6	mg/L	D	0.06		E200.7	09/10/13 14:49 / sld
Arsenic	0.150	mg/L		0.001		E200.8	09/12/13 01:36 / dck
Barium	ND	mg/L		0.05		E200.8	09/12/13 01:36 / dck
Beryllium	0.005	mg/L		0.001		E200.8	09/12/13 01:36 / dck
Cadmium	0.150	mg/L		0.001		E200.8	09/12/13 01:36 / dck
Calcium	98	mg/L		1		E200.7	09/10/13 14:49 / sld
Chromium	ND	mg/L		0.005		E200.8	09/12/13 01:36 / dck

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	09/27/13
Project:	Barker Hughsville Pilot	**Collection Date:**	09/04/13 11:20
Lab ID:	H13090077-006	**DateReceived:**	09/05/13
Client Sample ID	13BH-DT-PILOT-INFL-090413	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS, TOTAL							
Cobalt	0.039	mg/L		0.005		E200.8	09/12/13 01:36 / dck
Copper	1.18	mg/L		0.005		E200.8	09/12/13 18:54 / dck
Iron	129	mg/L		0.03		E200.7	09/10/13 14:49 / sld
Lead	0.258	mg/L		0.001		E200.8	09/12/13 01:36 / dck
Magnesium	22	mg/L		1		E200.7	09/10/13 14:49 / sld
Manganese	101	mg/L	D	0.003		E200.7	09/10/13 14:49 / sld
Nickel	0.029	mg/L		0.005		E200.8	09/12/13 01:36 / dck
Potassium	1	mg/L		1		E200.7	09/10/13 14:49 / sld
Silver	ND	mg/L		0.001		E200.8	09/12/13 01:36 / dck
Sodium	5	mg/L		1		E200.7	09/10/13 14:49 / sld
Thallium	0.0025	mg/L		0.0005		E200.8	09/12/13 01:36 / dck
Zinc	45.7	mg/L		0.01		E200.7	09/10/13 14:49 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13090077-007
Client Sample ID 13BH-DT-PILOT-SAPS-090413

Report Date: 09/27/13
Collection Date: 09/04/13 11:35
DateReceived: 09/05/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1580	mg/L		10		A2540 C	09/05/13 12:44 / cmm
INORGANICS							
Acidity, Total as CaCO3	320	mg/L	D	4.0		A2310 B	09/09/13 11:00 / cmm
Alkalinity, Total as CaCO3	51	mg/L		1		A2320 B	09/05/13 16:43 / cmm
Bicarbonate as HCO3	62	mg/L		1		A2320 B	09/05/13 16:43 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	09/05/13 16:43 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	09/05/13 16:43 / cmm
Chloride	2	mg/L		1		E300.0	09/09/13 17:20 / cmm
Sulfate	1300	mg/L		1		E300.0	09/10/13 13:43 / cmm
Fluoride	1.5	mg/L	D	0.2	4	A4500-F C	09/10/13 11:02 / cmm
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.151	mg/L		0.005		E365.1	09/05/13 17:01 / reh
METALS, DISSOLVED							
Aluminum	0.68	mg/L		0.03		E200.8	09/11/13 00:36 / dck
Arsenic	0.003	mg/L		0.001		E200.8	09/11/13 00:36 / dck
Barium	ND	mg/L		0.05		E200.8	09/11/13 00:36 / dck
Beryllium	0.001	mg/L		0.001		E200.8	09/11/13 00:36 / dck
Cadmium	0.067	mg/L		0.001		E200.8	09/11/13 00:36 / dck
Calcium	238	mg/L		1		E200.7	09/06/13 11:45 / sld
Chromium	ND	mg/L		0.005		E200.8	09/11/13 00:36 / dck
Cobalt	0.040	mg/L		0.005		E200.8	09/11/13 00:36 / dck
Copper	ND	mg/L		0.005		E200.8	09/11/13 00:36 / dck
Iron	79.1	mg/L		0.03		E200.7	09/06/13 11:45 / sld
Lead	0.001	mg/L		0.001		E200.8	09/11/13 00:36 / dck
Magnesium	23	mg/L		1		E200.7	09/06/13 11:45 / sld
Manganese	105	mg/L	D	0.003		E200.7	09/06/13 11:45 / sld
Nickel	0.029	mg/L		0.005		E200.8	09/11/13 00:36 / dck
Potassium	ND	mg/L		1		E200.7	09/06/13 11:45 / sld
Silver	ND	mg/L		0.001		E200.8	09/11/13 00:36 / dck
Sodium	7	mg/L		1		E200.7	09/06/13 11:45 / sld
Thallium	0.0023	mg/L		0.0005		E200.8	09/11/13 00:36 / dck
Zinc	50.1	mg/L		0.01		E200.7	09/06/13 11:45 / sld
METALS, TOTAL							
Aluminum	154	mg/L	D	0.05		E200.7	09/10/13 14:53 / sld
Arsenic	0.746	mg/L		0.001		E200.8	09/12/13 01:41 / dck
Barium	0.05	mg/L		0.05		E200.8	09/12/13 01:41 / dck
Beryllium	0.063	mg/L		0.001		E200.8	09/12/13 01:41 / dck
Cadmium	0.584	mg/L		0.001		E200.8	09/12/13 18:58 / dck
Calcium	210	mg/L		1		E200.7	09/10/13 14:53 / sld
Chromium	0.082	mg/L		0.005		E200.8	09/12/13 01:41 / dck

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	09/27/13
Project:	Barker Hughsville Pilot	**Collection Date:**	09/04/13 11:35
Lab ID:	H13090077-007	**DateReceived:**	09/05/13
Client Sample ID	13BH-DT-PILOT-SAPS-090413	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS, TOTAL							
Cobalt	0.038	mg/L		0.005		E200.8	09/12/13 01:41 / dck
Copper	10.1	mg/L	D	0.009		E200.8	09/12/13 18:58 / dck
Iron	669	mg/L	D	0.1		E200.7	09/11/13 10:50 / sld
Lead	1.95	mg/L		0.001		E200.8	09/12/13 01:41 / dck
Magnesium	20	mg/L		1		E200.7	09/10/13 14:53 / sld
Manganese	96.3	mg/L	D	0.002		E200.7	09/10/13 14:53 / sld
Nickel	0.030	mg/L		0.005		E200.8	09/12/13 01:41 / dck
Potassium	ND	mg/L		1		E200.7	09/10/13 14:53 / sld
Silver	0.001	mg/L		0.001		E200.8	09/12/13 01:41 / dck
Sodium	5	mg/L		1		E200.7	09/10/13 14:53 / sld
Thallium	0.0067	mg/L		0.0005		E200.8	09/12/13 01:41 / dck
Zinc	69.8	mg/L		0.01		E200.7	09/10/13 14:53 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13090077-008
Client Sample ID 13BH-DT-PILOT-MGOH-090413

Report Date: 09/27/13
Collection Date: 09/04/13 11:45
DateReceived: 09/05/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1460	mg/L		10		A2540 C	09/05/13 12:44 / cmm
INORGANICS							
Acidity, Total as CaCO3	220	mg/L	D	4.0		A2310 B	09/09/13 11:00 / cmm
Alkalinity, Total as CaCO3	8	mg/L		1		A2320 B	09/05/13 16:48 / cmm
Bicarbonate as HCO3	9	mg/L		1		A2320 B	09/05/13 16:48 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	09/05/13 16:48 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	09/05/13 16:48 / cmm
Chloride	2	mg/L		1		E300.0	09/09/13 17:32 / cmm
Sulfate	1000	mg/L		1		E300.0	09/10/13 14:46 / cmm
Fluoride	1.0	mg/L	D	0.2	4	A4500-F C	09/10/13 11:03 / cmm
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.185	mg/L		0.005		E365.1	09/05/13 17:04 / reh
METALS, DISSOLVED							
Aluminum	0.21	mg/L		0.03		E200.8	09/11/13 00:41 / dck
Arsenic	ND	mg/L		0.001		E200.8	09/11/13 00:41 / dck
Barium	ND	mg/L		0.05		E200.8	09/11/13 00:41 / dck
Beryllium	ND	mg/L		0.001		E200.8	09/11/13 00:41 / dck
Cadmium	0.176	mg/L		0.001		E200.8	09/11/13 00:41 / dck
Calcium	102	mg/L		1		E200.7	09/06/13 11:49 / sld
Chromium	ND	mg/L		0.005		E200.8	09/11/13 00:41 / dck
Cobalt	0.038	mg/L		0.005		E200.8	09/11/13 00:41 / dck
Copper	0.079	mg/L		0.005		E200.8	09/11/13 00:41 / dck
Iron	4.68	mg/L		0.03		E200.7	09/06/13 11:49 / sld
Lead	ND	mg/L		0.001		E200.8	09/11/13 00:41 / dck
Magnesium	123	mg/L		1		E200.7	09/06/13 11:49 / sld
Manganese	102	mg/L	D	0.003		E200.7	09/06/13 11:49 / sld
Nickel	0.028	mg/L		0.005		E200.8	09/11/13 00:41 / dck
Potassium	ND	mg/L		1		E200.7	09/06/13 11:49 / sld
Silver	ND	mg/L		0.001		E200.8	09/11/13 00:41 / dck
Sodium	8	mg/L		1		E200.7	09/06/13 11:49 / sld
Thallium	0.0021	mg/L		0.0005		E200.8	09/11/13 00:41 / dck
Zinc	42.0	mg/L		0.01		E200.7	09/06/13 11:49 / sld
METALS, TOTAL							
Aluminum	3.41	mg/L	D	0.06		E200.7	09/10/13 14:57 / sld
Arsenic	0.034	mg/L		0.001		E200.8	09/12/13 01:45 / dck
Barium	ND	mg/L		0.05		E200.8	09/12/13 01:45 / dck
Beryllium	0.002	mg/L		0.001		E200.8	09/12/13 01:45 / dck
Cadmium	0.161	mg/L		0.001		E200.8	09/12/13 01:45 / dck
Calcium	98	mg/L		1		E200.7	09/10/13 14:57 / sld
Chromium	ND	mg/L		0.005		E200.8	09/12/13 01:45 / dck

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	09/27/13
Project:	Barker Hughsville Pilot	**Collection Date:**	09/04/13 11:45
Lab ID:	H13090077-008	**DateReceived:**	09/05/13
Client Sample ID	13BH-DT-PILOT-MGOH-090413	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS, TOTAL							
Cobalt	0.038	mg/L		0.005		E200.8	09/12/13 01:45 / dck
Copper	0.362	mg/L		0.005		E200.8	09/12/13 01:45 / dck
Iron	36.3	mg/L		0.03		E200.7	09/10/13 14:57 / sld
Lead	0.058	mg/L		0.001		E200.8	09/12/13 01:45 / dck
Magnesium	120	mg/L		1		E200.7	09/10/13 14:57 / sld
Manganese	98.8	mg/L	D	0.003		E200.7	09/10/13 14:57 / sld
Nickel	0.027	mg/L		0.005		E200.8	09/12/13 01:45 / dck
Potassium	ND	mg/L		1		E200.7	09/10/13 14:57 / sld
Silver	ND	mg/L		0.001		E200.8	09/12/13 01:45 / dck
Sodium	6	mg/L		1		E200.7	09/10/13 14:57 / sld
Thallium	0.0022	mg/L		0.0005		E200.8	09/12/13 01:45 / dck
Zinc	44.4	mg/L		0.01		E200.7	09/10/13 14:57 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13090077-009
Client Sample ID 13BH-DT-PILOT-CHIT-090413

Report Date: 09/27/13
Collection Date: 09/04/13 11:55
DateReceived: 09/05/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	2770	mg/L		10		A2540 C	09/05/13 12:44 / cmm
INORGANICS							
Acidity, Total as CaCO3	ND	mg/L	D	4.0		A2310 B	09/09/13 11:00 / cmm
Alkalinity, Total as CaCO3	1500	mg/L		1		A2320 B	09/12/13 16:51 / cmm
Bicarbonate as HCO3	1800	mg/L		1		A2320 B	09/12/13 16:51 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	09/12/13 16:51 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	09/12/13 16:51 / cmm
Chloride	14	mg/L	D	5		E300.0	09/09/13 18:35 / cmm
Sulfate	520	mg/L	D	2		E300.0	09/09/13 18:35 / cmm
Fluoride	0.6	mg/L	D	0.2	4	A4500-F C	09/10/13 11:06 / cmm
NUTRIENTS							
Phosphorus, Orthophosphate as P	65.8	mg/L	D	0.2		E365.1	09/05/13 17:05 / reh
METALS, DISSOLVED							
Aluminum	ND	mg/L		0.03		E200.8	09/11/13 00:45 / dck
Arsenic	0.033	mg/L		0.001		E200.8	09/11/13 00:45 / dck
Barium	ND	mg/L		0.05		E200.8	09/11/13 00:45 / dck
Beryllium	ND	mg/L		0.001		E200.8	09/11/13 00:45 / dck
Cadmium	ND	mg/L		0.001		E200.8	09/11/13 00:45 / dck
Calcium	575	mg/L		1		E200.7	09/06/13 11:52 / sld
Chromium	ND	mg/L		0.005		E200.8	09/11/13 00:45 / dck
Cobalt	0.005	mg/L		0.005		E200.8	09/11/13 00:45 / dck
Copper	ND	mg/L		0.005		E200.8	09/11/13 00:45 / dck
Iron	39.4	mg/L		0.03		E200.7	09/06/13 11:52 / sld
Lead	ND	mg/L		0.001		E200.8	09/11/13 00:45 / dck
Magnesium	46	mg/L		1		E200.7	09/06/13 11:52 / sld
Manganese	113	mg/L	D	0.003		E200.7	09/06/13 11:52 / sld
Nickel	0.005	mg/L		0.005		E200.8	09/11/13 00:45 / dck
Potassium	6	mg/L		1		E200.7	09/06/13 11:52 / sld
Silver	ND	mg/L		0.001		E200.8	09/11/13 00:45 / dck
Sodium	34	mg/L		1		E200.7	09/06/13 11:52 / sld
Thallium	ND	mg/L		0.0005		E200.8	09/11/13 00:45 / dck
Zinc	0.06	mg/L		0.01		E200.8	09/11/13 00:45 / dck
METALS, TOTAL							
Aluminum	0.11	mg/L		0.03		E200.8	09/12/13 02:12 / dck
Arsenic	0.042	mg/L	D	0.002		E200.8	09/12/13 02:12 / dck
Barium	0.05	mg/L		0.05		E200.8	09/12/13 02:12 / dck
Beryllium	ND	mg/L		0.001		E200.8	09/12/13 02:12 / dck
Cadmium	0.002	mg/L		0.001		E200.8	09/12/13 02:12 / dck
Calcium	546	mg/L		1		E200.7	09/10/13 15:00 / sld
Chromium	ND	mg/L		0.005		E200.8	09/12/13 02:12 / dck

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13090077-009
Client Sample ID 13BH-DT-PILOT-CHIT-090413

Report Date: 09/27/13
Collection Date: 09/04/13 11:55
DateReceived: 09/05/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
METALS, TOTAL							
Cobalt	0.008	mg/L		0.005		E200.8	09/12/13 02:12 / dck
Copper	0.021	mg/L		0.005		E200.8	09/12/13 02:12 / dck
Iron	45.3	mg/L	D	0.05		E200.7	09/10/13 15:00 / sld
Lead	0.002	mg/L		0.001		E200.8	09/12/13 02:12 / dck
Magnesium	43	mg/L		1		E200.7	09/10/13 15:00 / sld
Manganese	109	mg/L	D	0.006		E200.7	09/10/13 15:00 / sld
Nickel	0.008	mg/L		0.005		E200.8	09/12/13 02:12 / dck
Potassium	6	mg/L		1		E200.7	09/10/13 15:00 / sld
Silver	ND	mg/L		0.001		E200.8	09/12/13 02:12 / dck
Sodium	31	mg/L		1		E200.7	09/10/13 15:00 / sld
Thallium	ND	mg/L		0.0005		E200.8	09/12/13 02:12 / dck
Zinc	0.66	mg/L		0.01		E200.8	09/12/13 02:12 / dck

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	09/27/13
Project:	Barker Hughsville Pilot	**Collection Date:**	09/04/13 12:10
Lab ID:	H13090077-010	**DateReceived:**	09/05/13
Client Sample ID	13BH-DT-PILOT-BCR3-POST-090413	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
INORGANICS							
Sulfide	1.3	mg/L	D	0.2		A4500-S D	09/06/13 15:00 / eli-b22
AGGREGATE ORGANICS							
Oxygen Demand, Biochemical (BOD)	1600	mg/L		400		A5210 B	09/05/13 15:21 / cmm
NUTRIENTS							
Nitrogen, Ammonia as N	229	mg/L	D	10		E350.1	09/05/13 12:21 / reh

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 09/27/13
Project: Barker Hughsville Pilot
Work Order: H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2310 B									Batch: H13090077-001A	
Sample ID: H13090077-009ADUP		Sample Duplicate				Run: MISC WC_130909C			09/09/13 11:00	
Acidity, Total as CaCO3		ND	mg/L	4.0					20	
Sample ID: LCS1309091100		Laboratory Control Sample				Run: MISC WC_130909C			09/09/13 11:00	
Acidity, Total as CaCO3		750	mg/L	4.0	97	90	110			
Sample ID: MBLK1309091100		Method Blank				Run: MISC WC_130909C			09/09/13 11:00	
Acidity, Total as CaCO3		ND	mg/L	3						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 09/27/13

Work Order: H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2320 B									Batch: R91062	
Sample ID: MBLK		Method Blank				Run: MAN-TECH_130905B			09/05/13 15:04	
Alkalinity, Total as CaCO3		ND	mg/L	2						
Sample ID: LCS-08282013		Laboratory Control Sample				Run: MAN-TECH_130905B			09/05/13 15:12	
Alkalinity, Total as CaCO3		620	mg/L	4.0	104	90	110			
Sample ID: H13080533-002ADUP	3	Sample Duplicate				Run: MAN-TECH_130905B			09/05/13 15:41	
Alkalinity, Total as CaCO3		240	mg/L	4.0				2.8	10	
Bicarbonate as HCO3		290	mg/L	4.0				2.8	10	
Carbonate as CO3		ND	mg/L	4.0					10	
Sample ID: H13080555-001AMS		Sample Matrix Spike				Run: MAN-TECH_130905B			09/05/13 15:59	
Alkalinity, Total as CaCO3		1100	mg/L	4.0	105	80	120			
Sample ID: H13090077-009ADUP	3	Sample Duplicate				Run: MAN-TECH_130905B			09/05/13 17:12	
Alkalinity, Total as CaCO3		1600	mg/L	4.0				0.4	10	
Bicarbonate as HCO3		1900	mg/L	4.0				0.4	10	
Carbonate as CO3		ND	mg/L	4.0					10	
Method: A2320 B									Batch: R91272	
Sample ID: MBLK		Method Blank				Run: MAN-TECH_130912A			09/12/13 16:31	
Alkalinity, Total as CaCO3		ND	mg/L	2						
Sample ID: LCS-08282013		Laboratory Control Sample				Run: MAN-TECH_130912A			09/12/13 16:40	
Alkalinity, Total as CaCO3		620	mg/L	4.0	103	90	110			
Sample ID: H13090192-006ADUP	3	Sample Duplicate				Run: MAN-TECH_130912A			09/12/13 17:45	
Alkalinity, Total as CaCO3		110	mg/L	4.0				0.4	10	
Bicarbonate as HCO3		130	mg/L	4.0				0.4	10	
Carbonate as CO3		ND	mg/L	4.0					10	
Sample ID: H13090192-007AMS		Sample Matrix Spike				Run: MAN-TECH_130912A			09/12/13 18:01	
Alkalinity, Total as CaCO3		740	mg/L	4.0	105	80	120			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 09/27/13

Work Order: H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2540 C										Batch: TDS130905A
Sample ID: MB-1_130905A	Method Blank					Run: ACCU-124 (14410200)_130905			09/05/13 12:42	
Solids, Total Dissolved TDS @ 180 C		10	mg/L	1						
Sample ID: LCS-2_130905A	Laboratory Control Sample					Run: ACCU-124 (14410200)_130905			09/05/13 12:42	
Solids, Total Dissolved TDS @ 180 C		1910	mg/L	10	95	90	110			
Sample ID: H13090066-001A DUP	Sample Duplicate					Run: ACCU-124 (14410200)_130905			09/05/13 12:42	
Solids, Total Dissolved TDS @ 180 C		5930	mg/L	10				2.7	5	
Sample ID: H13090077-001A MS	Sample Matrix Spike					Run: ACCU-124 (14410200)_130905			09/05/13 12:43	
Solids, Total Dissolved TDS @ 180 C		6520	mg/L	10	97	80	120			
Sample ID: H13090083-001A DUP	Sample Duplicate					Run: ACCU-124 (14410200)_130905			09/05/13 14:59	
Solids, Total Dissolved TDS @ 180 C		193	mg/L	10				2.1	5	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 09/27/13

Work Order: H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-F C										Analytical Run: PH_130910A
Sample ID: ICV1_130910A		Initial Calibration Verification Standard								09/10/13 10:41
Fluoride		0.7	mg/L	0.1	90	90	110			
Sample ID: CCV2_130910A		Continuing Calibration Verification Standard								09/10/13 11:05
Fluoride		0.2	mg/L	0.1	90	90	110			
Method: A4500-F C										Batch: 130910A-F-ISE-W
Sample ID: MBLK1_130910A		Method Blank				Run: PH_130910A				09/10/13 10:40
Fluoride		0.010	mg/L	0.005						
Sample ID: LFB1_130910A		Laboratory Fortified Blank				Run: PH_130910A				09/10/13 10:41
Fluoride		0.5	mg/L	0.1	90	90	110			
Sample ID: H13090077-008AMS		Sample Matrix Spike				Run: PH_130910A				09/10/13 11:03
Fluoride		1.9	mg/L	0.2	91	85	115			
Sample ID: H13090077-008AMSD		Sample Matrix Spike Duplicate				Run: PH_130910A				09/10/13 11:04
Fluoride		1.9	mg/L	0.2	90	85	115	0.5	10	
Sample ID: H13090077-009AMS		Sample Matrix Spike				Run: PH_130910A				09/10/13 11:06
Fluoride		1.5	mg/L	0.2	90	85	115			
Sample ID: H13090077-009AMSD		Sample Matrix Spike Duplicate				Run: PH_130910A				09/10/13 11:07
Fluoride		1.4	mg/L	0.2	88	85	115	1.2	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 09/27/13
Work Order: H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **A4500-S D**									Batch: B_R211270	
Sample ID: **MB-R211270**		Method Blank				Run: SUB-B211270			09/06/13 15:00	
Sulfide		ND	mg/L	0.002						
Sample ID: **LCS-R211270**		Laboratory Control Sample				Run: SUB-B211270			09/06/13 15:00	
Sulfide		0.237	mg/L	0.040	111	70	130			
Sample ID: **B13090433-002GMS**		Sample Matrix Spike				Run: SUB-B211270			09/06/13 15:00	
Sulfide		0.225	mg/L	0.040	105	70	130			
Sample ID: **B13090433-002GMSD**		Sample Matrix Spike Duplicate				Run: SUB-B211270			09/06/13 15:00	
Sulfide		0.225	mg/L	0.040	105	70	130	0.1	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 09/27/13
Project: Barker Hughsville Pilot
Work Order: H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-S F										Batch: B_R211271
Sample ID: MB-R211271		Method Blank				Run: SUB-B211271				09/06/13 14:45
Sulfide		ND	mg/L	0.5						
Sample ID: LCS-R211271		Laboratory Control Sample				Run: SUB-B211271				09/06/13 14:45
Sulfide		24.5	mg/L	1.0	101	70	130			
Sample ID: B13090499-001FMS		Sample Matrix Spike				Run: SUB-B211271				09/06/13 14:45
Sulfide		24.7	mg/L	1.0	102	80	120			
Sample ID: B13090499-001FMSD		Sample Matrix Spike Duplicate				Run: SUB-B211271				09/06/13 14:45
Sulfide		24.6	mg/L	1.0	102	80	120	0.3	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 09/27/13

Project: Barker Hughsville Pilot **Work Order:** H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A5210 B									Batch: 130905_1_BOD5-W	
Sample ID: Dil-H201_130905		Dilution Water Blank				Run: MISC WC_130905A			09/05/13 15:08	
Oxygen Demand, Biochemical (BOD)		0.10	mg/L	2.0		0	0.2			
Sample ID: GGA1_130905		Laboratory Control Sample				Run: MISC WC_130905A			09/05/13 15:12	
Oxygen Demand, Biochemical (BOD)		190	mg/L	61	96	85	115			
Sample ID: H13090081-001ADUP		Sample Duplicate				Run: MISC WC_130905A			09/05/13 15:26	
Oxygen Demand, Biochemical (BOD)		610	mg/L	180		90	110	3.0	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs | **Report Date:** 09/27/13

Project: Barker Hughsville Pilot | **Work Order:** H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7										Analytical Run: ICP2-HE_130906B
Sample ID: ICV	8	Initial Calibration Verification Standard								09/06/13 09:46
Aluminum		4.05	mg/L	0.10	101	95	105			
Calcium		40.4	mg/L	1.0	101	95	105			
Iron		4.03	mg/L	0.030	101	95	105			
Magnesium		40.8	mg/L	1.0	102	95	105			
Manganese		3.96	mg/L	0.010	99	95	105			
Potassium		40.3	mg/L	1.0	101	95	105			
Sodium		40.3	mg/L	1.0	101	95	105			
Zinc		0.798	mg/L	0.010	100	95	105			
Sample ID: CCV-1	8	Continuing Calibration Verification Standard								09/06/13 09:50
Aluminum		2.53	mg/L	0.10	101	95	105			
Calcium		25.5	mg/L	1.0	102	95	105			
Iron		2.54	mg/L	0.030	101	95	105			
Magnesium		25.4	mg/L	1.0	102	95	105			
Manganese		2.49	mg/L	0.010	100	95	105			
Potassium		25.2	mg/L	1.0	101	95	105			
Sodium		25.2	mg/L	1.0	101	95	105			
Zinc		2.54	mg/L	0.010	102	95	105			
Sample ID: ICSA	8	Interference Check Sample A								09/06/13 10:01
Aluminum		521	mg/L	0.10	104	80	120			
Calcium		480	mg/L	1.0	96	80	120			
Iron		192	mg/L	0.030	96	80	120			
Magnesium		518	mg/L	1.0	104	80	120			
Manganese		0.00616	mg/L	0.010		0	0			
Potassium		-0.0709	mg/L	1.0		0	0			
Sodium		0.0490	mg/L	1.0		0	0			
Zinc		0.00710	mg/L	0.010		0	0			
Sample ID: ICSAB	8	Interference Check Sample AB								09/06/13 10:05
Aluminum		525	mg/L	0.10	105	80	120			
Calcium		478	mg/L	1.0	96	80	120			
Iron		192	mg/L	0.030	96	80	120			
Magnesium		521	mg/L	1.0	104	80	120			
Manganese		0.489	mg/L	0.010	98	80	120			
Potassium		22.2	mg/L	1.0	111	80	120			
Sodium		22.1	mg/L	1.0	111	80	120			
Zinc		1.01	mg/L	0.010	101	80	120			
Sample ID: CCV	8	Continuing Calibration Verification Standard								09/06/13 10:35
Aluminum		2.55	mg/L	0.10	102	90	110			
Calcium		25.2	mg/L	1.0	101	90	110			
Iron		2.53	mg/L	0.030	101	90	110			
Magnesium		25.3	mg/L	1.0	101	90	110			
Manganese		2.46	mg/L	0.010	99	90	110			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 09/27/13
Project: Barker Hughsville Pilot
Work Order: H13090077

Method: **E200.7** Analytical Run: ICP2-HE_130906B

Sample ID: **CCV** 8 Continuing Calibration Verification Standard 09/06/13 10:35

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Potassium		25.4	mg/L	1.0	102	90	110			
Sodium		25.2	mg/L	1.0	101	90	110			
Zinc		2.48	mg/L	0.010	99	90	110			

Sample ID: **CCV** 8 Continuing Calibration Verification Standard 09/06/13 11:19

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Aluminum		2.53	mg/L	0.10	101	90	110			
Calcium		25.2	mg/L	1.0	101	90	110			
Iron		2.50	mg/L	0.030	100	90	110			
Magnesium		25.4	mg/L	1.0	102	90	110			
Manganese		2.46	mg/L	0.010	98	90	110			
Potassium		25.1	mg/L	1.0	101	90	110			
Sodium		25.0	mg/L	1.0	100	90	110			
Zinc		2.66	mg/L	0.010	106	90	110			

Method: **E200.7** Batch: R91111

Sample ID: **ICB** 8 Method Blank Run: ICP2-HE_130906B 09/06/13 10:13

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Aluminum		ND	mg/L	0.009						
Calcium		0.04	mg/L	0.03						
Iron		ND	mg/L	0.005						
Magnesium		ND	mg/L	0.02						
Manganese		ND	mg/L	0.0005						
Potassium		ND	mg/L	0.03						
Sodium		ND	mg/L	0.03						
Zinc		0.002	mg/L	0.001						

Sample ID: **LFB** 8 Laboratory Fortified Blank Run: ICP2-HE_130906B 09/06/13 10:17

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Aluminum		5.05	mg/L	0.10	101	85	115			
Calcium		49.6	mg/L	1.0	99	85	115			
Iron		4.98	mg/L	0.030	100	85	115			
Magnesium		50.2	mg/L	1.0	100	85	115			
Manganese		4.89	mg/L	0.010	98	85	115			
Potassium		49.6	mg/L	1.0	99	85	115			
Sodium		49.5	mg/L	1.0	99	85	115			
Zinc		1.00	mg/L	0.010	100	85	115			

Sample ID: **H13080497-002BMS2** 8 Sample Matrix Spike Run: ICP2-HE_130906B 09/06/13 11:04

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Aluminum		51.2	mg/L	0.093	102	70	130			
Calcium		821	mg/L	1.0	98	70	130			
Iron		50.3	mg/L	0.048	101	70	130			
Magnesium		756	mg/L	1.0	101	70	130			
Manganese		49.5	mg/L	0.0054	98	70	130			
Potassium		518	mg/L	1.0	103	70	130			
Sodium		4870	mg/L	1.0		70	130			A
Zinc		10.2	mg/L	0.014	102	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Report Date: 09/27/13
Work Order: H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7										Batch: R91111
Sample ID: H13080497-002BMSD2	8	Sample Matrix Spike Duplicate				Run: ICP2-HE_130906B				09/06/13 11:08
Aluminum		51.8	mg/L	0.093	103	70	130	1.2	20	
Calcium		829	mg/L	1.0	100	70	130	1.0	20	
Iron		50.7	mg/L	0.048	101	70	130	0.9	20	
Magnesium		765	mg/L	1.0	102	70	130	1.2	20	
Manganese		49.9	mg/L	0.0054	99	70	130	1.0	20	
Potassium		509	mg/L	1.0	102	70	130	1.7	20	
Sodium		4890	mg/L	1.0		70	130	0.4	20	A
Zinc		10.2	mg/L	0.014	102	70	130	0.5	20	
Sample ID: H13090077-009BMS2	8	Sample Matrix Spike				Run: ICP2-HE_130906B				09/06/13 12:00
Aluminum		26.1	mg/L	0.046	104	70	130			
Calcium		795	mg/L	1.0	88	70	130			
Iron		62.5	mg/L	0.030	93	70	130			
Magnesium		297	mg/L	1.0	100	70	130			
Manganese		132	mg/L	0.0027		70	130			A
Potassium		253	mg/L	1.0	99	70	130			
Sodium		278	mg/L	1.0	98	70	130			
Zinc		5.07	mg/L	0.010	101	70	130			
Sample ID: H13090077-009BMSD2	8	Sample Matrix Spike Duplicate				Run: ICP2-HE_130906B				09/06/13 12:10
Aluminum		26.2	mg/L	0.046	105	70	130	0.4	20	
Calcium		806	mg/L	1.0	93	70	130	1.4	20	
Iron		63.2	mg/L	0.030	95	70	130	1.0	20	
Magnesium		299	mg/L	1.0	101	70	130	0.8	20	
Manganese		134	mg/L	0.0027		70	130	1.3	20	A
Potassium		263	mg/L	1.0	103	70	130	3.9	20	
Sodium		290	mg/L	1.0	102	70	130	4.0	20	
Zinc		5.20	mg/L	0.010	103	70	130	2.5	20	

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 09/27/13
Project: Barker Hughsville Pilot **Work Order:** H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.7**										Analytical Run: ICP2-HE_130910C
Sample ID: **ICV**	8	Initial Calibration Verification Standard								09/10/13 13:32
Aluminum		4.05	mg/L	0.10	101	95	105			
Calcium		39.9	mg/L	1.0	100	95	105			
Iron		3.98	mg/L	0.030	99	95	105			
Magnesium		40.3	mg/L	1.0	101	95	105			
Manganese		3.95	mg/L	0.010	99	95	105			
Potassium		39.6	mg/L	1.0	99	95	105			
Sodium		39.8	mg/L	1.0	99	95	105			
Zinc		0.803	mg/L	0.010	100	95	105			
Sample ID: **CCV-1**	8	Continuing Calibration Verification Standard								09/10/13 13:35
Aluminum		2.51	mg/L	0.10	100	95	105			
Calcium		25.2	mg/L	1.0	101	95	105			
Iron		2.51	mg/L	0.030	100	95	105			
Magnesium		24.9	mg/L	1.0	100	95	105			
Manganese		2.47	mg/L	0.010	99	95	105			
Potassium		24.3	mg/L	1.0	97	95	105			
Sodium		24.4	mg/L	1.0	98	95	105			
Zinc		2.57	mg/L	0.010	103	95	105			
Sample ID: **ICSA**	8	Interference Check Sample A								09/10/13 13:46
Aluminum		515	mg/L	0.10	103	80	120			
Calcium		474	mg/L	1.0	95	80	120			
Iron		188	mg/L	0.030	94	80	120			
Magnesium		508	mg/L	1.0	102	80	120			
Manganese		0.00528	mg/L	0.010		0	0			
Potassium		-0.0813	mg/L	1.0		0	0			
Sodium		0.0226	mg/L	1.0		0	0			
Zinc		0.00693	mg/L	0.010		0	0			
Sample ID: **ICSAB**	8	Interference Check Sample AB								09/10/13 13:50
Aluminum		513	mg/L	0.10	103	80	120			
Calcium		468	mg/L	1.0	94	80	120			
Iron		187	mg/L	0.030	94	80	120			
Magnesium		505	mg/L	1.0	101	80	120			
Manganese		0.484	mg/L	0.010	97	80	120			
Potassium		21.9	mg/L	1.0	109	80	120			
Sodium		22.0	mg/L	1.0	110	80	120			
Zinc		1.01	mg/L	0.010	101	80	120			
Sample ID: **CCV**	8	Continuing Calibration Verification Standard								09/10/13 14:20
Aluminum		2.44	mg/L	0.10	98	90	110			
Calcium		24.4	mg/L	1.0	98	90	110			
Iron		2.45	mg/L	0.030	98	90	110			
Magnesium		24.4	mg/L	1.0	98	90	110			
Manganese		2.39	mg/L	0.010	96	90	110			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 09/27/13

Project: Barker Hughsville Pilot **Work Order:** H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.7**										Analytical Run: ICP2-HE_130910C
Sample ID: **CCV**	8	Continuing Calibration Verification Standard								09/10/13 14:20
Potassium		25.1	mg/L	1.0	100	90	110			
Sodium		25.1	mg/L	1.0	100	90	110			
Zinc		2.38	mg/L	0.010	95	90	110			
Method: **E200.7**										Batch: 21587
Sample ID: **MB-21587**	8	Method Blank				Run: ICP2-HE_130910C				09/10/13 14:05
Aluminum		0.02	mg/L	0.01						
Calcium		0.3	mg/L	0.06						
Iron		0.009	mg/L	0.005						
Magnesium		ND	mg/L	0.006						
Manganese		ND	mg/L	0.0006						
Potassium		ND	mg/L	0.03						
Sodium		ND	mg/L	0.03						
Zinc		0.002	mg/L	0.001						
Sample ID: **LCS-21587**	8	Laboratory Control Sample				Run: ICP2-HE_130910C				09/10/13 14:09
Aluminum		2.59	mg/L	0.030	103	85	115			
Calcium		25.2	mg/L	1.0	100	85	115			
Iron		2.49	mg/L	0.030	99	85	115			
Magnesium		25.3	mg/L	1.0	101	85	115			
Manganese		2.46	mg/L	0.0010	98	85	115			
Potassium		25.4	mg/L	1.0	102	85	115			
Sodium		25.3	mg/L	1.0	101	85	115			
Zinc		0.505	mg/L	0.010	101	85	115			
Sample ID: **H13090077-001CMS3**	8	Sample Matrix Spike				Run: ICP2-HE_130910C				09/10/13 14:28
Aluminum		12.9	mg/L	0.058	102	70	130			
Calcium		693	mg/L	1.0		70	130			A
Iron		12.9	mg/L	0.030	99	70	130			
Magnesium		167	mg/L	1.0	98	70	130			
Manganese		72.2	mg/L	0.0031		70	130			A
Potassium		133	mg/L	1.0	101	70	130			
Sodium		151	mg/L	1.0	101	70	130			
Zinc		2.57	mg/L	0.010	102	70	130			
Sample ID: **H13090077-001CMSD3**	8	Sample Matrix Spike Duplicate				Run: ICP2-HE_130910C				09/10/13 14:31
Aluminum		12.7	mg/L	0.058	100	70	130	1.5	20	
Calcium		683	mg/L	1.0		70	130	1.3	20	A
Iron		13.0	mg/L	0.030	100	70	130	0.7	20	
Magnesium		165	mg/L	1.0	97	70	130	1.2	20	
Manganese		71.0	mg/L	0.0031		70	130	1.6	20	A
Potassium		134	mg/L	1.0	101	70	130	0.7	20	
Sodium		151	mg/L	1.0	101	70	130	0.3	20	
Zinc		2.67	mg/L	0.010	106	70	130	3.9	20	

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 09/27/13
Work Order: H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7										Batch: 21587
Sample ID: H13090086-001CMS3	8	Sample Matrix Spike				Run: ICP2-HE_130910C				09/10/13 15:23
Aluminum		2.65	mg/L	0.030	104	70	130			
Calcium		57.6	mg/L	1.0	96	70	130			
Iron		2.66	mg/L	0.030	96	70	130			
Magnesium		33.2	mg/L	1.0	98	70	130			
Manganese		2.57	mg/L	0.0010	95	70	130			
Potassium		26.9	mg/L	1.0	100	70	130			
Sodium		31.0	mg/L	1.0	100	70	130			
Zinc		0.772	mg/L	0.010	102	70	130			
Sample ID: H13090086-001CMSD3	8	Sample Matrix Spike Duplicate				Run: ICP2-HE_130910C				09/10/13 15:26
Aluminum		2.55	mg/L	0.030	100	70	130	3.9	20	
Calcium		57.3	mg/L	1.0	95	70	130	0.5	20	
Iron		2.69	mg/L	0.030	97	70	130	0.9	20	
Magnesium		32.9	mg/L	1.0	97	70	130	0.6	20	
Manganese		2.59	mg/L	0.0010	96	70	130	0.6	20	
Potassium		27.0	mg/L	1.0	100	70	130	0.3	20	
Sodium		31.1	mg/L	1.0	100	70	130	0.3	20	
Zinc		0.743	mg/L	0.010	96	70	130	3.9	20	
Method: E200.7										Analytical Run: ICP2-HE_130911A
Sample ID: ICV		Initial Calibration Verification Standard								09/11/13 09:50
Iron		4.04	mg/L	0.030	101	95	105			
Sample ID: CCV-1		Continuing Calibration Verification Standard								09/11/13 09:54
Iron		2.54	mg/L	0.030	102	95	105			
Sample ID: ICSA		Interference Check Sample A								09/11/13 10:05
Iron		193	mg/L	0.030	97	80	120			
Sample ID: ICSAB		Interference Check Sample AB								09/11/13 10:09
Iron		193	mg/L	0.030	96	80	120			
Sample ID: CCV		Continuing Calibration Verification Standard								09/11/13 10:39
Iron		2.54	mg/L	0.030	101	90	110			
Method: E200.7										Batch: 21587
Sample ID: MB-21587	8	Method Blank				Run: ICP2-HE_130911A				09/11/13 10:46
Aluminum		ND	mg/L	0.01						
Calcium		0.07	mg/L	0.06						
Iron		ND	mg/L	0.005						
Magnesium		ND	mg/L	0.006						
Manganese		ND	mg/L	0.0006						
Potassium		ND	mg/L	0.03						
Sodium		0.08	mg/L	0.03						
Zinc		0.003	mg/L	0.001						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 09/27/13
Project: Barker Hughsville Pilot
Work Order: H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130910B
Sample ID: ICV STD	14	Initial Calibration Verification Standard								09/10/13 13:30
Aluminum		0.305	mg/L	0.10	102	90	110			
Arsenic		0.0607	mg/L	0.0050	101	90	110			
Barium		0.0610	mg/L	0.10	102	90	110			
Beryllium		0.0314	mg/L	0.0010	105	90	110			
Cadmium		0.0326	mg/L	0.0010	109	90	110			
Chromium		0.0620	mg/L	0.010	103	90	110			
Cobalt		0.0623	mg/L	0.010	104	90	110			
Copper		0.0622	mg/L	0.010	104	90	110			
Iron		0.321	mg/L	0.030	107	90	110			
Lead		0.0623	mg/L	0.010	104	90	110			
Nickel		0.0624	mg/L	0.010	104	90	110			
Silver		0.0313	mg/L	0.0050	104	90	110			
Thallium		0.0601	mg/L	0.10	100	90	110			
Zinc		0.0631	mg/L	0.010	105	90	110			
Sample ID: ICSA	14	Interference Check Sample A								09/10/13 13:34
Aluminum		39.6	mg/L	0.10	99	70	130			
Arsenic		0.000214	mg/L	0.0050						
Barium		0.000129	mg/L	0.10						
Beryllium		1.20E-05	mg/L	0.0010						
Cadmium		0.00165	mg/L	0.0010						
Chromium		0.00118	mg/L	0.010						
Cobalt		0.000406	mg/L	0.010						
Copper		0.000306	mg/L	0.010						
Iron		94.1	mg/L	0.030	94	70	130			
Lead		0.000262	mg/L	0.010						
Nickel		0.000704	mg/L	0.010						
Silver		0.000101	mg/L	0.0050						
Thallium		9.80E-05	mg/L	0.10						
Zinc		0.00111	mg/L	0.010						
Sample ID: ICSAB	14	Interference Check Sample AB								09/10/13 13:39
Aluminum		40.6	mg/L	0.10	102	70	130			
Arsenic		0.0107	mg/L	0.0050	107	70	130			
Barium		0.000136	mg/L	0.10		0	0			
Beryllium		2.00E-06	mg/L	0.0010		0	0			
Cadmium		0.0115	mg/L	0.0010	115	70	130			
Chromium		0.0225	mg/L	0.010	113	70	130			
Cobalt		0.0211	mg/L	0.010	106	70	130			
Copper		0.0206	mg/L	0.010	103	70	130			
Iron		97.3	mg/L	0.030	97	70	130			
Lead		0.000187	mg/L	0.010		0	0			
Nickel		0.0216	mg/L	0.010	108	70	130			
Silver		0.0200	mg/L	0.0050	100	70	130			
Thallium		4.90E-05	mg/L	0.10		0	0			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 09/27/13

Work Order: H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130910B
Sample ID: ICSAB	14	Interference Check Sample AB								09/10/13 13:39
Zinc		0.0113	mg/L	0.010	113	70	130			
Sample ID: ICV STD	14	Initial Calibration Verification Standard								09/11/13 22:52
Aluminum		0.294	mg/L	0.10	98	90	110			
Arsenic		0.0618	mg/L	0.0050	103	90	110			
Barium		0.0615	mg/L	0.10	102	90	110			
Beryllium		0.0312	mg/L	0.0010	104	90	110			
Cadmium		0.0328	mg/L	0.0010	109	90	110			
Chromium		0.0623	mg/L	0.010	104	90	110			
Cobalt		0.0620	mg/L	0.010	103	90	110			
Copper		0.0633	mg/L	0.010	106	90	110			
Iron		0.320	mg/L	0.030	107	90	110			
Lead		0.0636	mg/L	0.010	106	90	110			
Nickel		0.0628	mg/L	0.010	105	90	110			
Silver		0.0308	mg/L	0.0050	103	90	110			
Thallium		0.0615	mg/L	0.10	102	90	110			
Zinc		0.0641	mg/L	0.010	107	90	110			
Sample ID: ICSA	14	Interference Check Sample A								09/11/13 22:56
Aluminum		37.0	mg/L	0.10	93	70	130			
Arsenic		0.000209	mg/L	0.0050						
Barium		0.000155	mg/L	0.10						
Beryllium		1.00E-05	mg/L	0.0010						
Cadmium		0.00175	mg/L	0.0010						
Chromium		0.00132	mg/L	0.010						
Cobalt		0.000494	mg/L	0.010						
Copper		0.000235	mg/L	0.010						
Iron		95.1	mg/L	0.030	95	70	130			
Lead		0.000215	mg/L	0.010						
Nickel		0.000739	mg/L	0.010						
Silver		0.000264	mg/L	0.0050						
Thallium		0.000101	mg/L	0.10						
Zinc		0.00120	mg/L	0.010						
Sample ID: ICSAB	14	Interference Check Sample AB								09/11/13 23:01
Aluminum		36.7	mg/L	0.10	92	70	130			
Arsenic		0.0103	mg/L	0.0050	103	70	130			
Barium		0.000118	mg/L	0.10		0	0			
Beryllium		5.00E-06	mg/L	0.0010		0	0			
Cadmium		0.0115	mg/L	0.0010	115	70	130			
Chromium		0.0217	mg/L	0.010	109	70	130			
Cobalt		0.0206	mg/L	0.010	103	70	130			
Copper		0.0202	mg/L	0.010	101	70	130			
Iron		97.1	mg/L	0.030	97	70	130			
Lead		0.000171	mg/L	0.010		0	0			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 09/27/13
Project: Barker Hughsville Pilot
Work Order: H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**										Analytical Run: ICPMS204-B_130910B
Sample ID: **ICSAB**	14	Interference Check Sample AB								09/11/13 23:01
Nickel		0.0209	mg/L	0.010	105	70	130			
Silver		0.0184	mg/L	0.0050	92	70	130			
Thallium		5.90E-05	mg/L	0.10		0	0			
Zinc		0.0109	mg/L	0.010	109	70	130			
Sample ID: **ICV STD**	14	Initial Calibration Verification Standard								09/12/13 17:42
Aluminum		0.298	mg/L	0.10	99	90	110			
Arsenic		0.0619	mg/L	0.0050	103	90	110			
Barium		0.0617	mg/L	0.10	103	90	110			
Beryllium		0.0316	mg/L	0.0010	105	90	110			
Cadmium		0.0317	mg/L	0.0010	106	90	110			
Chromium		0.0617	mg/L	0.010	103	90	110			
Cobalt		0.0633	mg/L	0.010	105	90	110			
Copper		0.0632	mg/L	0.010	105	90	110			
Iron		0.318	mg/L	0.030	106	90	110			
Lead		0.0641	mg/L	0.010	107	90	110			
Nickel		0.0626	mg/L	0.010	104	90	110			
Silver		0.0309	mg/L	0.0050	103	90	110			
Thallium		0.0609	mg/L	0.10	102	90	110			
Zinc		0.0640	mg/L	0.010	107	90	110			
Sample ID: **ICSA**	14	Interference Check Sample A								09/12/13 17:47
Aluminum		38.0	mg/L	0.10	95	70	130			
Arsenic		0.000198	mg/L	0.0050						
Barium		0.000215	mg/L	0.10						
Beryllium		1.00E-05	mg/L	0.0010						
Cadmium		0.00122	mg/L	0.0010						
Chromium		0.00128	mg/L	0.010						
Cobalt		0.000481	mg/L	0.010						
Copper		0.000217	mg/L	0.010						
Iron		100	mg/L	0.030	100	70	130			
Lead		0.000217	mg/L	0.010						
Nickel		0.000698	mg/L	0.010						
Silver		0.000278	mg/L	0.0050						
Thallium		0.000162	mg/L	0.10						
Zinc		0.000869	mg/L	0.010						
Sample ID: **ICSAB**	14	Interference Check Sample AB								09/12/13 17:51
Aluminum		37.9	mg/L	0.10	95	70	130			
Arsenic		0.0108	mg/L	0.0050	108	70	130			
Barium		0.000153	mg/L	0.10		0	0			
Beryllium		3.00E-06	mg/L	0.0010		0	0			
Cadmium		0.0114	mg/L	0.0010	114	70	130			
Chromium		0.0221	mg/L	0.010	110	70	130			
Cobalt		0.0215	mg/L	0.010	108	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 09/27/13
Project: Barker Hughsville Pilot
Work Order: H13090077

Method: **E200.8** Analytical Run: ICPMS204-B_130910B

Sample ID: **ICSAB** 14 Interference Check Sample AB 09/12/13 17:51

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Copper		0.0207	mg/L	0.010	103	70	130			
Iron		102	mg/L	0.030	102	70	130			
Lead		0.000171	mg/L	0.010		0	0			
Nickel		0.0214	mg/L	0.010	107	70	130			
Silver		0.0191	mg/L	0.0050	96	70	130			
Thallium		8.60E-05	mg/L	0.10		0	0			
Zinc		0.0110	mg/L	0.010	110	70	130			

Method: **E200.8** Batch: 21587

Sample ID: **MB-21587** 14 Method Blank Run: ICPMS204-B_130910B 09/12/13 00:17

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Aluminum		0.02	mg/L	0.0007						
Arsenic		ND	mg/L	0.0002						
Barium		ND	mg/L	0.0002						
Beryllium		ND	mg/L	2E-05						
Cadmium		ND	mg/L	2E-05						
Chromium		ND	mg/L	0.0002						
Cobalt		ND	mg/L	5E-05						
Copper		0.0003	mg/L	0.0002						
Iron		ND	mg/L	0.002						
Lead		ND	mg/L	3E-05						
Nickel		ND	mg/L	0.0001						
Silver		ND	mg/L	0.0001						
Thallium		4E-05	mg/L	3E-05						
Zinc		0.002	mg/L	0.001						

Sample ID: **LCS-21587** 14 Laboratory Control Sample Run: ICPMS204-B_130910B 09/12/13 00:21

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Aluminum		2.27	mg/L	0.030	90	85	115			
Arsenic		0.498	mg/L	0.0010	100	85	115			
Barium		0.461	mg/L	0.050	92	85	115			
Beryllium		0.236	mg/L	0.0010	94	85	115			
Cadmium		0.240	mg/L	0.0010	96	85	115			
Chromium		0.496	mg/L	0.0050	99	85	115			
Cobalt		0.485	mg/L	0.0050	97	85	115			
Copper		0.441	mg/L	0.0050	88	85	115			
Iron		2.50	mg/L	0.030	100	85	115			
Lead		0.476	mg/L	0.0010	95	85	115			
Nickel		0.499	mg/L	0.0050	100	85	115			
Silver		0.0495	mg/L	0.0010	99	85	115			
Thallium		0.484	mg/L	0.00050	97	85	115			
Zinc		0.520	mg/L	0.010	104	85	115			

Sample ID: **H13090077-001CMS3** 14 Sample Matrix Spike Run: ICPMS204-B_130910B 09/12/13 00:39

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Aluminum		10.9	mg/L	0.030	86	70	130			
Arsenic		2.58	mg/L	0.0010	102	70	130			
Barium		2.42	mg/L	0.050	91	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 09/27/13
Project: Barker Hughsville Pilot
Work Order: H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**										Batch: 21587
Sample ID: **H13090077-001CMS3**	14	Sample Matrix Spike				Run: ICPMS204-B_130910B				09/12/13 00:39
Beryllium		1.13	mg/L	0.0010	91	70	130			
Cadmium		1.19	mg/L	0.0010	95	70	130			
Chromium		2.49	mg/L	0.0050	100	70	130			
Cobalt		2.38	mg/L	0.0050	95	70	130			
Copper		2.17	mg/L	0.0050	87	70	130			
Iron		12.6	mg/L	0.030	96	70	130			
Lead		2.42	mg/L	0.0010	97	70	130			
Nickel		2.51	mg/L	0.0050	100	70	130			
Silver		0.230	mg/L	0.0010	92	70	130			
Thallium		2.52	mg/L	0.00050	101	70	130			
Zinc		2.53	mg/L	0.010	100	70	130			
Sample ID: **H13090077-001CMSD3**	14	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130910B				09/12/13 00:43
Aluminum		11.2	mg/L	0.030	89	70	130	3.0	20	
Arsenic		2.53	mg/L	0.0010	100	70	130	1.8	20	
Barium		2.45	mg/L	0.050	93	70	130	1.3	20	
Beryllium		1.14	mg/L	0.0010	91	70	130	0.4	20	
Cadmium		1.20	mg/L	0.0010	96	70	130	0.5	20	
Chromium		2.46	mg/L	0.0050	98	70	130	1.2	20	
Cobalt		2.39	mg/L	0.0050	95	70	130	0.2	20	
Copper		2.17	mg/L	0.0050	86	70	130	0.3	20	
Iron		12.8	mg/L	0.030	98	70	130	1.8	20	
Lead		2.42	mg/L	0.0010	97	70	130	0.0	20	
Nickel		2.46	mg/L	0.0050	98	70	130	2.0	20	
Silver		0.236	mg/L	0.0010	94	70	130	2.5	20	
Thallium		2.51	mg/L	0.00050	101	70	130	0.2	20	
Zinc		2.68	mg/L	0.010	106	70	130	5.8	20	
Sample ID: **H13090086-001CMS3**	14	Sample Matrix Spike				Run: ICPMS204-B_130910B				09/12/13 02:56
Aluminum		2.09	mg/L	0.030	82	70	130			
Arsenic		0.528	mg/L	0.0010	99	70	130			
Barium		0.459	mg/L	0.050	90	70	130			
Beryllium		0.213	mg/L	0.0010	85	70	130			
Cadmium		0.235	mg/L	0.0010	94	70	130			
Chromium		0.481	mg/L	0.0050	96	70	130			
Cobalt		0.468	mg/L	0.0050	94	70	130			
Copper		0.432	mg/L	0.0050	86	70	130			
Iron		2.64	mg/L	0.030	96	70	130			
Lead		0.469	mg/L	0.0010	94	70	130			
Nickel		0.497	mg/L	0.0050	99	70	130			
Silver		0.0486	mg/L	0.0010	97	70	130			
Thallium		0.484	mg/L	0.00050	97	70	130			
Zinc		0.774	mg/L	0.010	101	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 09/27/13

Project: Barker Hughsville Pilot **Work Order:** H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Batch: 21587
Sample ID: H13090086-001CMSD3	14	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130910B				09/12/13 03:00
Aluminum		2.16	mg/L	0.030	85	70	130	3.0	20	
Arsenic		0.539	mg/L	0.0010	102	70	130	2.2	20	
Barium		0.478	mg/L	0.050	94	70	130	4.0	20	
Beryllium		0.219	mg/L	0.0010	87	70	130	2.7	20	
Cadmium		0.246	mg/L	0.0010	98	70	130	4.7	20	
Chromium		0.493	mg/L	0.0050	99	70	130	2.5	20	
Cobalt		0.484	mg/L	0.0050	97	70	130	3.2	20	
Copper		0.442	mg/L	0.0050	88	70	130	2.4	20	
Iron		2.71	mg/L	0.030	98	70	130	2.5	20	
Lead		0.483	mg/L	0.0010	97	70	130	3.0	20	
Nickel		0.505	mg/L	0.0050	101	70	130	1.6	20	
Silver		0.0504	mg/L	0.0010	101	70	130	3.5	20	
Thallium		0.499	mg/L	0.00050	100	70	130	3.1	20	
Zinc		0.783	mg/L	0.010	103	70	130	1.1	20	
Method: E200.8										Batch: R91216
Sample ID: ICB	14	Method Blank				Run: ICPMS204-B_130910B				09/10/13 14:10
Aluminum		ND	mg/L	0.0001						
Arsenic		ND	mg/L	7E-05						
Barium		ND	mg/L	5E-05						
Beryllium		ND	mg/L	2E-05						
Cadmium		7E-06	mg/L	7E-06						
Chromium		ND	mg/L	4E-05						
Cobalt		ND	mg/L	2E-05						
Copper		ND	mg/L	3E-05						
Iron		0.001	mg/L	0.0002						
Lead		1E-05	mg/L	6E-06						
Nickel		ND	mg/L	6E-05						
Silver		ND	mg/L	4E-05						
Thallium		ND	mg/L	1E-05						
Zinc		0.0005	mg/L	0.0003						
Sample ID: LFB	14	Laboratory Fortified Blank				Run: ICPMS204-B_130910B				09/10/13 14:15
Aluminum		0.0533	mg/L	0.10	107	85	115			
Arsenic		0.0501	mg/L	0.0050	100	85	115			
Barium		0.0500	mg/L	0.10	100	85	115			
Beryllium		0.0513	mg/L	0.0010	103	85	115			
Cadmium		0.0519	mg/L	0.0010	104	85	115			
Chromium		0.0501	mg/L	0.010	100	85	115			
Cobalt		0.0506	mg/L	0.010	101	85	115			
Copper		0.0548	mg/L	0.010	110	85	115			
Iron		0.159	mg/L	0.030	105	85	115			
Lead		0.0508	mg/L	0.010	102	85	115			
Nickel		0.0518	mg/L	0.010	104	85	115			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 09/27/13

Work Order: H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**									Batch: R91216	
Sample ID: **LFB**	14	Laboratory Fortified Blank				Run: ICPMS204-B_130910B			09/10/13 14:15	
Silver		0.0204	mg/L	0.0050	102	85	115			
Thallium		0.0494	mg/L	0.10	99	85	115			
Zinc		0.0557	mg/L	0.010	110	85	115			
Sample ID: **H13090077-001BMS**	14	Sample Matrix Spike				Run: ICPMS204-B_130910B			09/10/13 23:33	
Aluminum		0.262	mg/L	0.030	100	70	130			
Arsenic		0.291	mg/L	0.0010	107	70	130			
Barium		0.390	mg/L	0.050	107	70	130			
Beryllium		0.256	mg/L	0.0010	102	70	130			
Cadmium		0.268	mg/L	0.0010	107	70	130			
Chromium		0.252	mg/L	0.0050	101	70	130			
Cobalt		0.258	mg/L	0.0050	102	70	130			
Copper		0.207	mg/L	0.0050	83	70	130			
Iron		0.853	mg/L	0.030	102	70	130			
Lead		0.330	mg/L	0.0010	132	70	130			S
Nickel		0.260	mg/L	0.0050	103	70	130			
Silver		0.0750	mg/L	0.0010	75	70	130			
Thallium		0.321	mg/L	0.00050	129	70	130			
Zinc		0.273	mg/L	0.010	106	70	130			
Sample ID: **H13090077-001BMSD**	14	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130910B			09/10/13 23:37	
Aluminum		0.271	mg/L	0.030	104	70	130	3.7	20	
Arsenic		0.301	mg/L	0.0010	111	70	130	3.6	20	
Barium		0.401	mg/L	0.050	111	70	130	2.7	20	
Beryllium		0.264	mg/L	0.0010	106	70	130	3.1	20	
Cadmium		0.279	mg/L	0.0010	111	70	130	3.8	20	
Chromium		0.262	mg/L	0.0050	105	70	130	3.9	20	
Cobalt		0.264	mg/L	0.0050	104	70	130	2.1	20	
Copper		0.208	mg/L	0.0050	83	70	130	0.3	20	
Iron		0.888	mg/L	0.030	107	70	130	4.0	20	
Lead		0.346	mg/L	0.0010	138	70	130	4.8	20	S
Nickel		0.265	mg/L	0.0050	105	70	130	2.1	20	
Silver		0.0753	mg/L	0.0010	75	70	130	0.3	20	
Thallium		0.338	mg/L	0.00050	135	70	130	5.0	20	S
Zinc		0.279	mg/L	0.010	108	70	130	2.2	20	
Sample ID: **ICB**	14	Method Blank				Run: ICPMS204-B_130910B			09/11/13 23:27	
Aluminum		ND	mg/L	0.0001						
Arsenic		ND	mg/L	7E-05						
Barium		ND	mg/L	5E-05						
Beryllium		ND	mg/L	2E-05						
Cadmium		ND	mg/L	7E-06						
Chromium		ND	mg/L	4E-05						
Cobalt		ND	mg/L	2E-05						
Copper		ND	mg/L	3E-05						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 09/27/13
Project: Barker Hughsville Pilot **Work Order:** H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**										Batch: R91216
Sample ID: **ICB**	14	Method Blank				Run: ICPMS204-B_130910B				09/11/13 23:27
Iron		0.001	mg/L	0.0002						
Lead		ND	mg/L	6E-06						
Nickel		ND	mg/L	6E-05						
Silver		5E-05	mg/L	4E-05						
Thallium		ND	mg/L	1E-05						
Zinc		0.001	mg/L	0.0003						
Sample ID: **LFB**	14	Laboratory Fortified Blank				Run: ICPMS204-B_130910B				09/11/13 23:32
Aluminum		0.0509	mg/L	0.10	102	85	115			
Arsenic		0.0505	mg/L	0.0050	101	85	115			
Barium		0.0494	mg/L	0.10	99	85	115			
Beryllium		0.0493	mg/L	0.0010	99	85	115			
Cadmium		0.0530	mg/L	0.0010	106	85	115			
Chromium		0.0506	mg/L	0.010	101	85	115			
Cobalt		0.0509	mg/L	0.010	102	85	115			
Copper		0.0518	mg/L	0.010	104	85	115			
Iron		0.154	mg/L	0.030	102	85	115			
Lead		0.0518	mg/L	0.010	104	85	115			
Nickel		0.0516	mg/L	0.010	103	85	115			
Silver		0.0194	mg/L	0.0050	97	85	115			
Thallium		0.0500	mg/L	0.10	100	85	115			
Zinc		0.0547	mg/L	0.010	107	85	115			
Sample ID: **H12060321-048AMS**	14	Sample Matrix Spike				Run: ICPMS204-B_130910B				09/11/13 23:54
Aluminum		0.253	mg/L	0.030	96	70	130			
Arsenic		0.259	mg/L	0.0010	103	70	130			
Barium		0.284	mg/L	0.050	103	70	130			
Beryllium		0.240	mg/L	0.0010	96	70	130			
Cadmium		0.247	mg/L	0.0010	99	70	130			
Chromium		0.254	mg/L	0.0050	101	70	130			
Cobalt		0.252	mg/L	0.0050	101	70	130			
Copper		0.277	mg/L	0.0050	103	70	130			
Iron		0.792	mg/L	0.030	103	70	130			
Lead		0.268	mg/L	0.0010	107	70	130			
Nickel		0.289	mg/L	0.0050	100	70	130			
Silver		0.0860	mg/L	0.0010	86	70	130			
Thallium		0.257	mg/L	0.00050	103	70	130			
Zinc		0.257	mg/L	0.010	99	70	130			
Sample ID: **H12060321-048AMSD**	14	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130910B				09/11/13 23:59
Aluminum		0.251	mg/L	0.030	95	70	130	0.7	20	
Arsenic		0.254	mg/L	0.0010	101	70	130	2.0	20	
Barium		0.280	mg/L	0.050	101	70	130	1.4	20	
Beryllium		0.234	mg/L	0.0010	94	70	130	2.8	20	
Cadmium		0.243	mg/L	0.0010	97	70	130	1.7	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 09/27/13
Project: Barker Hughsville Pilot **Work Order:** H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Batch: R91216	
Sample ID: H12060321-048AMSD	14	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130910B			09/11/13 23:59	
Chromium		0.250	mg/L	0.0050	99	70	130	1.8	20	
Cobalt		0.252	mg/L	0.0050	100	70	130	0.1	20	
Copper		0.271	mg/L	0.0050	100	70	130	2.4	20	
Iron		0.764	mg/L	0.030	99	70	130	3.6	20	
Lead		0.264	mg/L	0.0010	105	70	130	1.5	20	
Nickel		0.287	mg/L	0.0050	100	70	130	0.7	20	
Silver		0.0857	mg/L	0.0010	86	70	130	0.3	20	
Thallium		0.254	mg/L	0.00050	101	70	130	1.4	20	
Zinc		0.257	mg/L	0.010	99	70	130	0.0	20	
Sample ID: H13090077-009BMS	14	Sample Matrix Spike				Run: ICPMS204-B_130910B			09/12/13 01:54	
Aluminum		0.218	mg/L	0.030	86	70	130			
Arsenic		0.296	mg/L	0.0010	105	70	130			
Barium		0.283	mg/L	0.050	103	70	130			
Beryllium		0.221	mg/L	0.0010	88	70	130			
Cadmium		0.273	mg/L	0.0010	109	70	130			
Chromium		0.238	mg/L	0.0050	95	70	130			
Cobalt		0.247	mg/L	0.0050	97	70	130			
Copper		0.250	mg/L	0.0050	99	70	130			
Iron		35.4	mg/L	0.030		70	130			A
Lead		0.263	mg/L	0.0010	105	70	130			
Nickel		0.250	mg/L	0.0050	98	70	130			
Silver		0.0690	mg/L	0.0010	69	70	130			S
Thallium		0.251	mg/L	0.00050	100	70	130			
Zinc		0.284	mg/L	0.010	91	70	130			
Sample ID: H13090077-009BMSD	14	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130910B			09/12/13 01:58	
Aluminum		0.222	mg/L	0.030	88	70	130	1.9	20	
Arsenic		0.293	mg/L	0.0010	104	70	130	1.1	20	
Barium		0.285	mg/L	0.050	104	70	130	0.7	20	
Beryllium		0.225	mg/L	0.0010	90	70	130	2.1	20	
Cadmium		0.276	mg/L	0.0010	110	70	130	1.1	20	
Chromium		0.242	mg/L	0.0050	97	70	130	1.7	20	
Cobalt		0.251	mg/L	0.0050	98	70	130	1.7	20	
Copper		0.252	mg/L	0.0050	100	70	130	1.0	20	
Iron		35.1	mg/L	0.030		70	130	0.9	20	A
Lead		0.268	mg/L	0.0010	107	70	130	1.8	20	
Nickel		0.253	mg/L	0.0050	99	70	130	1.1	20	
Silver		0.0696	mg/L	0.0010	70	70	130	0.9	20	
Thallium		0.255	mg/L	0.00050	102	70	130	1.4	20	
Zinc		0.289	mg/L	0.010	93	70	130	1.9	20	
Sample ID: ICB	14	Method Blank				Run: ICPMS204-B_130910B			09/12/13 18:18	
Aluminum		ND	mg/L	0.0001						
Arsenic		ND	mg/L	7E-05						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 09/27/13
Project: Barker Hughsville Pilot
Work Order: H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**										Batch: R91216
Sample ID: **ICB**	14	Method Blank				Run: ICPMS204-B_130910B				09/12/13 18:18
Barium		ND	mg/L	5E-05						
Beryllium		ND	mg/L	2E-05						
Cadmium		ND	mg/L	2E-05						
Chromium		ND	mg/L	4E-05						
Cobalt		ND	mg/L	2E-05						
Copper		ND	mg/L	3E-05						
Iron		0.001	mg/L	0.0002						
Lead		ND	mg/L	6E-06						
Nickel		ND	mg/L	6E-05						
Silver		0.0001	mg/L	4E-05						
Thallium		ND	mg/L	1E-05						
Zinc		ND	mg/L	0.0003						
Sample ID: **LFB**	14	Laboratory Fortified Blank				Run: ICPMS204-B_130910B				09/12/13 18:23
Aluminum		0.0506	mg/L	0.10	101	85	115			
Arsenic		0.0505	mg/L	0.0050	101	85	115			
Barium		0.0510	mg/L	0.10	102	85	115			
Beryllium		0.0504	mg/L	0.0010	101	85	115			
Cadmium		0.0532	mg/L	0.0010	106	85	115			
Chromium		0.0498	mg/L	0.010	100	85	115			
Cobalt		0.0516	mg/L	0.010	103	85	115			
Copper		0.0514	mg/L	0.010	103	85	115			
Iron		0.159	mg/L	0.030	105	85	115			
Lead		0.0529	mg/L	0.010	106	85	115			
Nickel		0.0518	mg/L	0.010	104	85	115			
Silver		0.0205	mg/L	0.0050	102	85	115			
Thallium		0.0503	mg/L	0.10	101	85	115			
Zinc		0.0547	mg/L	0.010	109	85	115			
Sample ID: **H13090077-006BMS**	14	Sample Matrix Spike				Run: ICPMS204-B_130910B				09/12/13 18:36
Aluminum		9.85	mg/L	0.030		70	130			A
Arsenic		0.359	mg/L	0.0010	99	70	130			
Barium		0.258	mg/L	0.050	101	70	130			
Beryllium		0.252	mg/L	0.0010	98	70	130			
Cadmium		0.469	mg/L	0.0010	101	70	130			
Chromium		0.244	mg/L	0.0050	96	70	130			
Cobalt		0.288	mg/L	0.0050	99	70	130			
Copper		1.32	mg/L	0.0050		70	130			A
Iron		123	mg/L	0.030		70	130			A
Lead		0.415	mg/L	0.0010	102	70	130			
Nickel		0.278	mg/L	0.0050	100	70	130			
Silver		0.0976	mg/L	0.0010	97	70	130			
Thallium		0.262	mg/L	0.00050	104	70	130			
Zinc		43.5	mg/L	0.010		70	130			A

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 09/27/13
Project: Barker Hughsville Pilot
Work Order: H13090077

Method: **E200.8** Batch: R91216

Sample ID: **H13090077-006BMSD** 14 Sample Matrix Spike Duplicate Run: ICPMS204-B_130910B 09/12/13 18:41

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Aluminum		9.83	mg/L	0.030		70	130	0.2	20	A
Arsenic		0.364	mg/L	0.0010	100	70	130	1.3	20	
Barium		0.258	mg/L	0.050	101	70	130	0.1	20	
Beryllium		0.249	mg/L	0.0010	97	70	130	1.1	20	
Cadmium		0.459	mg/L	0.0010	97	70	130	2.1	20	
Chromium		0.247	mg/L	0.0050	97	70	130	1.2	20	
Cobalt		0.286	mg/L	0.0050	98	70	130	0.9	20	
Copper		1.33	mg/L	0.0050		70	130	0.7	20	A
Iron		129	mg/L	0.030		70	130	4.8	20	A
Lead		0.410	mg/L	0.0010	100	70	130	1.2	20	
Nickel		0.281	mg/L	0.0050	101	70	130	0.9	20	
Silver		0.0999	mg/L	0.0010	99	70	130	2.4	20	
Thallium		0.255	mg/L	0.00050	101	70	130	2.4	20	
Zinc		43.8	mg/L	0.010		70	130	0.6	20	A

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 09/27/13

Project: Barker Hughsville Pilot **Work Order:** H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130924A
Sample ID: ICV STD	11	Initial Calibration Verification Standard								09/24/13 14:11
Aluminum		0.287	mg/L	0.10	96	90	110			
Arsenic		0.0580	mg/L	0.0050	97	90	110			
Barium		0.0579	mg/L	0.10	97	90	110			
Beryllium		0.0301	mg/L	0.0010	100	90	110			
Cadmium		0.0306	mg/L	0.0010	102	90	110			
Chromium		0.0588	mg/L	0.010	98	90	110			
Cobalt		0.0589	mg/L	0.010	98	90	110			
Copper		0.0600	mg/L	0.010	100	90	110			
Lead		0.0592	mg/L	0.010	99	90	110			
Silver		0.0301	mg/L	0.0050	100	90	110			
Thallium		0.0579	mg/L	0.10	97	90	110			
Sample ID: ICSA	11	Interference Check Sample A								09/24/13 14:15
Aluminum		34.8	mg/L	0.10	87	70	130			
Arsenic		-7.90E-05	mg/L	0.0050						
Barium		9.80E-05	mg/L	0.10						
Beryllium		-1.70E-05	mg/L	0.0010						
Cadmium		0.00106	mg/L	0.0010						
Chromium		0.00105	mg/L	0.010						
Cobalt		0.000225	mg/L	0.010						
Copper		0.000341	mg/L	0.010						
Lead		0.000188	mg/L	0.010						
Silver		0.000103	mg/L	0.0050						
Thallium		3.70E-05	mg/L	0.10						
Sample ID: ICSAB	11	Interference Check Sample AB								09/24/13 14:19
Aluminum		35.0	mg/L	0.10	87	70	130			
Arsenic		0.00944	mg/L	0.0050	94	70	130			
Barium		9.10E-05	mg/L	0.10		0	0			
Beryllium		-2.60E-05	mg/L	0.0010		0	0			
Cadmium		0.0101	mg/L	0.0010	101	70	130			
Chromium		0.0192	mg/L	0.010	96	70	130			
Cobalt		0.0187	mg/L	0.010	94	70	130			
Copper		0.0184	mg/L	0.010	92	70	130			
Lead		0.000189	mg/L	0.010		0	0			
Silver		0.0184	mg/L	0.0050	92	70	130			
Thallium		1.90E-05	mg/L	0.10		0	0			
Sample ID: ICV STD	12	Initial Calibration Verification Standard								09/24/13 17:44
Aluminum		0.287	mg/L	0.10	96	90	110			
Arsenic		0.0580	mg/L	0.0050	97	90	110			
Barium		0.0585	mg/L	0.10	98	90	110			
Beryllium		0.0297	mg/L	0.0010	99	90	110			
Cadmium		0.0308	mg/L	0.0010	103	90	110			
Chromium		0.0590	mg/L	0.010	98	90	110			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 09/27/13
Project: Barker Hughsville Pilot
Work Order: H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130924A
Sample ID: ICV STD	12	Initial Calibration Verification Standard								09/24/13 17:44
Cobalt		0.0611	mg/L	0.010	102	90	110			
Copper		0.0607	mg/L	0.010	101	90	110			
Lead		0.0595	mg/L	0.010	99	90	110			
Nickel		0.0599	mg/L	0.010	100	90	110			
Silver		0.0295	mg/L	0.0050	98	90	110			
Thallium		0.0571	mg/L	0.10	95	90	110			
Sample ID: ICSA	12	Interference Check Sample A								09/24/13 17:49
Aluminum		36.3	mg/L	0.10	91	70	130			
Arsenic		9.30E-05	mg/L	0.0050						
Barium		0.000115	mg/L	0.10						
Beryllium		1.20E-05	mg/L	0.0010						
Cadmium		0.00102	mg/L	0.0010						
Chromium		0.00104	mg/L	0.010						
Cobalt		0.000360	mg/L	0.010						
Copper		0.000267	mg/L	0.010						
Lead		0.000164	mg/L	0.010						
Nickel		0.000405	mg/L	0.010						
Silver		0.000110	mg/L	0.0050						
Thallium		3.40E-05	mg/L	0.10						
Sample ID: ICSAB	12	Interference Check Sample AB								09/24/13 17:53
Aluminum		37.0	mg/L	0.10	92	70	130			
Arsenic		0.0102	mg/L	0.0050	102	70	130			
Barium		9.90E-05	mg/L	0.10		0	0			
Beryllium		1.20E-05	mg/L	0.0010		0	0			
Cadmium		0.0104	mg/L	0.0010	104	70	130			
Chromium		0.0209	mg/L	0.010	105	70	130			
Cobalt		0.0203	mg/L	0.010	102	70	130			
Copper		0.0199	mg/L	0.010	99	70	130			
Lead		0.000168	mg/L	0.010		0	0			
Nickel		0.0203	mg/L	0.010	101	70	130			
Silver		0.0194	mg/L	0.0050	97	70	130			
Thallium		2.30E-05	mg/L	0.10		0	0			
Sample ID: ICSA	12	Interference Check Sample A								09/25/13 08:36
Aluminum		40.4	mg/L	0.10	101	70	130			
Arsenic		0.000138	mg/L	0.0050						
Barium		0.000137	mg/L	0.10						
Beryllium		2.20E-05	mg/L	0.0010						
Cadmium		0.000995	mg/L	0.0010						
Chromium		0.00102	mg/L	0.010						
Cobalt		0.000360	mg/L	0.010						
Copper		0.000136	mg/L	0.010						
Lead		0.000146	mg/L	0.010						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 09/27/13

Work Order: H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130924A
Sample ID: ICSA	12	Interference Check Sample A								09/25/13 08:36
Nickel		0.000674	mg/L	0.010						
Silver		9.60E-05	mg/L	0.0050						
Thallium		2.40E-05	mg/L	0.10						
Sample ID: ICSAB	12	Interference Check Sample AB								09/25/13 08:40
Aluminum		40.0	mg/L	0.10	100	70	130			
Arsenic		0.0112	mg/L	0.0050	113	70	130			
Barium		0.000115	mg/L	0.10		0	0			
Beryllium		2.40E-05	mg/L	0.0010		0	0			
Cadmium		0.0112	mg/L	0.0010	113	70	130			
Chromium		0.0216	mg/L	0.010	108	70	130			
Cobalt		0.0212	mg/L	0.010	106	70	130			
Copper		0.0203	mg/L	0.010	102	70	130			
Lead		0.000176	mg/L	0.010		0	0			
Nickel		0.0212	mg/L	0.010	106	70	130			
Silver		0.0211	mg/L	0.0050	106	70	130			
Thallium		2.30E-05	mg/L	0.10		0	0			
Sample ID: ICV STD	12	Initial Calibration Verification Standard								09/25/13 09:31
Aluminum		0.315	mg/L	0.10	105	90	110			
Arsenic		0.0604	mg/L	0.0050	101	90	110			
Barium		0.0591	mg/L	0.10	98	90	110			
Beryllium		0.0298	mg/L	0.0010	99	90	110			
Cadmium		0.0305	mg/L	0.0010	102	90	110			
Chromium		0.0615	mg/L	0.010	102	90	110			
Cobalt		0.0614	mg/L	0.010	102	90	110			
Copper		0.0631	mg/L	0.010	105	90	110			
Lead		0.0607	mg/L	0.010	101	90	110			
Nickel		0.0621	mg/L	0.010	104	90	110			
Silver		0.0292	mg/L	0.0050	97	90	110			
Thallium		0.0629	mg/L	0.10	105	90	110			
Sample ID: ICSA	12	Interference Check Sample A								09/25/13 09:35
Aluminum		37.6	mg/L	0.10	94	70	130			
Arsenic		0.000103	mg/L	0.0050						
Barium		6.60E-05	mg/L	0.10						
Beryllium		2.20E-05	mg/L	0.0010						
Cadmium		0.000949	mg/L	0.0010						
Chromium		0.00121	mg/L	0.010						
Cobalt		0.000311	mg/L	0.010						
Copper		0.000250	mg/L	0.010						
Lead		0.000158	mg/L	0.010						
Nickel		0.000458	mg/L	0.010						
Silver		0.000131	mg/L	0.0050						
Thallium		3.80E-05	mg/L	0.10						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 09/27/13

Project: Barker Hughsville Pilot **Work Order:** H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130924A
Sample ID: ICSA	12	Interference Check Sample A								09/25/13 09:35
Sample ID: ICSAB	12	Interference Check Sample AB								09/25/13 09:40
Aluminum		37.4	mg/L	0.10	94	70	130			
Arsenic		0.0109	mg/L	0.0050	109	70	130			
Barium		4.50E-05	mg/L	0.10		0	0			
Beryllium		2.60E-05	mg/L	0.0010		0	0			
Cadmium		0.0104	mg/L	0.0010	104	70	130			
Chromium		0.0213	mg/L	0.010	106	70	130			
Cobalt		0.0201	mg/L	0.010	101	70	130			
Copper		0.0209	mg/L	0.010	104	70	130			
Lead		0.000155	mg/L	0.010		0	0			
Nickel		0.0212	mg/L	0.010	106	70	130			
Silver		0.0196	mg/L	0.0050	98	70	130			
Thallium		2.20E-05	mg/L	0.10		0	0			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 09/27/13
Project: Barker Hughsville Pilot
Work Order: H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E300.0**										Analytical Run: IC102-H_130909A
Sample ID: **ICV**	2	Initial Calibration Verification Standard								09/09/13 14:20
Chloride		100	mg/L	1.0	103	90	110			
Sulfate		410	mg/L	1.0	102	90	110			
Sample ID: **CCV090913-1**	2	Continuing Calibration Verification Standard								09/09/13 14:58
Chloride		100	mg/L	1.0	103	90	110			
Sulfate		410	mg/L	1.0	103	90	110			
Sample ID: **CCV090913-2**	2	Continuing Calibration Verification Standard								09/09/13 18:10
Chloride		100	mg/L	1.0	104	90	110			
Sulfate		420	mg/L	1.0	105	90	110			
Method: **E300.0**										Batch: R91159
Sample ID: **ICB**	2	Method Blank				Run: IC102-H_130909A				09/09/13 14:33
Chloride		ND	mg/L	0.008						
Sulfate		0.08	mg/L	0.08						
Sample ID: **LFB**	2	Laboratory Fortified Blank				Run: IC102-H_130909A				09/09/13 14:45
Chloride		52	mg/L	1.0	104	90	110			
Sulfate		210	mg/L	1.0	104	90	110			
Sample ID: **H13090077-008AMS**	2	Sample Matrix Spike				Run: IC102-H_130909A				09/09/13 17:45
Chloride		53	mg/L	1.0	101	90	110			
Sulfate		1200	mg/L	1.0		90	110			A
Sample ID: **H13090077-008AMSD**	2	Sample Matrix Spike Duplicate				Run: IC102-H_130909A				09/09/13 17:57
Chloride		53	mg/L	1.0	102	90	110	0.7	20	
Sulfate		1200	mg/L	1.0		90	110	0.0	20	A

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 09/27/13
Work Order: H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E300.0										Analytical Run: IC102-H_130910A
Sample ID: ICV		Initial Calibration Verification Standard								09/10/13 10:47
Sulfate		390	mg/L	1.0	98	90	110			
Sample ID: CCV091013-1		Continuing Calibration Verification Standard								09/10/13 11:24
Sulfate		410	mg/L	1.0	103	90	110			
Sample ID: CCV091013-2		Continuing Calibration Verification Standard								09/10/13 14:21
Sulfate		410	mg/L	1.0	103	90	110			
Method: E300.0										Batch: R91199
Sample ID: ICB		Method Blank				Run: IC102-H_130910A				09/10/13 10:59
Sulfate		0.2	mg/L	0.08						
Sample ID: LFB		Laboratory Fortified Blank				Run: IC102-H_130910A				09/10/13 11:12
Sulfate		220	mg/L	1.0	107	90	110			
Sample ID: H13090077-007AMS		Sample Matrix Spike				Run: IC102-H_130910A				09/10/13 13:56
Sulfate		2100	mg/L	1.0	84	90	110			S
Sample ID: H13090077-007AMSD		Sample Matrix Spike Duplicate				Run: IC102-H_130910A				09/10/13 14:08
Sulfate		2100	mg/L	1.0	86	90	110	0.9	20	S

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 09/27/13
Work Order: H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E350.1										Analytical Run: FIA203-HE_130905A
Sample ID: ICB		Initial Calibration Blank, Instrument Blank								09/05/13 11:08
Nitrogen, Ammonia as N		-0.0519	mg/L	0.050		0	0			
Sample ID: ICV		Initial Calibration Verification Standard								09/05/13 11:24
Nitrogen, Ammonia as N		5.48	mg/L	0.25	97	90	110			
Sample ID: CCV		Continuing Calibration Verification Standard								09/05/13 11:59
Nitrogen, Ammonia as N		0.497	mg/L	0.050	99	90	110			
Method: E350.1										Batch: R91050
Sample ID: LFB		Laboratory Fortified Blank				Run: FIA203-HE_130905A				09/05/13 11:06
Nitrogen, Ammonia as N		0.981	mg/L	0.055	98	90	110			
Sample ID: H13090057-001CMS		Sample Matrix Spike				Run: FIA203-HE_130905A				09/05/13 12:02
Nitrogen, Ammonia as N		0.960	mg/L	0.055	96	80	120			
Sample ID: H13090057-001CMSD		Sample Matrix Spike Duplicate				Run: FIA203-HE_130905A				09/05/13 12:03
Nitrogen, Ammonia as N		0.949	mg/L	0.055	95	80	120	1.1	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 09/27/13
Work Order: H13090077

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E365.1**										Analytical Run: FIA202-HE_130905B
Sample ID: **ICV**		Initial Calibration Verification Standard							09/05/13 16:07	
Phosphorus, Orthophosphate as P		0.245	mg/L	0.0050	98	90	110			
Sample ID: **ICB**		Initial Calibration Blank, Instrument Blank							09/05/13 16:08	
Phosphorus, Orthophosphate as P		-0.000260	mg/L	0.0050		0	0			
Sample ID: **CCV**		Continuing Calibration Verification Standard							09/05/13 16:10	
Phosphorus, Orthophosphate as P		0.0995	mg/L	0.0050	99	90	110			
Sample ID: **CCV**		Continuing Calibration Verification Standard							09/05/13 16:20	
Phosphorus, Orthophosphate as P		0.101	mg/L	0.0050	101	90	110			
Method: **E365.1**										Batch: R91060
Sample ID: **LFB**		Laboratory Fortified Blank				Run: FIA202-HE_130905B			09/05/13 16:09	
Phosphorus, Orthophosphate as P		0.208	mg/L	0.0050	104	90	110			
Sample ID: **H13090077-002AMS**		Sample Matrix Spike				Run: FIA202-HE_130905B			09/05/13 16:14	
Phosphorus, Orthophosphate as P		0.393	mg/L	0.0050	91	90	110			
Sample ID: **H13090077-002AMSD**		Sample Matrix Spike Duplicate				Run: FIA202-HE_130905B			09/05/13 16:15	
Phosphorus, Orthophosphate as P		0.393	mg/L	0.0050	91	90	110	0.1	20	
Method: **E365.1**										Analytical Run: FIA202-HE_130905C
Sample ID: **ICV**		Initial Calibration Verification Standard							09/05/13 16:52	
Phosphorus, Orthophosphate as P		0.244	mg/L	0.0050	98	90	110			
Sample ID: **ICB**		Initial Calibration Blank, Instrument Blank							09/05/13 16:53	
Phosphorus, Orthophosphate as P		-0.00316	mg/L	0.0050		0	0			
Sample ID: **CCV**		Continuing Calibration Verification Standard							09/05/13 16:55	
Phosphorus, Orthophosphate as P		0.106	mg/L	0.0050	106	90	110			
Sample ID: **CCV**		Continuing Calibration Verification Standard							09/05/13 17:03	
Phosphorus, Orthophosphate as P		0.105	mg/L	0.0050	105	90	110			
Method: **E365.1**										Batch: R91065
Sample ID: **LFB**		Laboratory Fortified Blank				Run: FIA202-HE_130905C			09/05/13 16:54	
Phosphorus, Orthophosphate as P		0.206	mg/L	0.0050	103	90	110			
Sample ID: **H13090077-002AMS**		Sample Matrix Spike				Run: FIA202-HE_130905C			09/05/13 16:58	
Phosphorus, Orthophosphate as P		0.374	mg/L	0.0050	84	90	110			S
Sample ID: **H13090077-002AMSD**		Sample Matrix Spike Duplicate				Run: FIA202-HE_130905C			09/05/13 16:59	
Phosphorus, Orthophosphate as P		0.388	mg/L	0.0050	88	90	110	3.9	20	S

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

Standard Reporting Procedures

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Workorder Receipt Checklist

CDM Federal Programs

H13090077

Login completed by: Tracy L. Lorash
Reviewed by: BL2000\jweidemoyer
Reviewed Date: 9/9/2013

Date Received: 9/5/2013
Received by: elm
Carrier name: Hand Del

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Applicable ☐
Container/Temp Blank temperature:	℃ See comments		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☑	Not Applicable ☐

Contact and Corrective Action Comments:

Cooler 1 was received at 1.6℃, Cooler 2 at 0.8℃. Samples were received on wet ice.
BCR3 and BCR3-POST sample(s) for Nutrients were preserved to pH <2 with 2 mL of sulfuric acid per 250 mL in the laboratory upon receipt. TI 9/5/13

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

PLEASE PRINT- Provide as much information as possible.

Page ____ of ____

Company Name: CDM Smith	Project Name, PWS, Permit, Etc. Barker Hughesville	Sample Origin State: Montana	EPA/State Compliance: Yes ☐ No X
Report Mail Address: 50 W 14th Street, Suite 200 Helena, MT 59601	Contact Name: Angela Frandsen Phone/Fax: 406-441-1435	Email: frandsenak@cdmsmith.com	Sampler: (Please Print) Angela Frandsen
Invoice Address: Contact Raquel Cisneros 720-264-1148	Invoice Contact & Phone: Contact Raquel Cisneros 720-264-1148	Purchase Order:	Quote/Bottle Order:

Special Report/Formats – ELI must be notified prior to sample submittal for the following:

☐ DW
☐ GSA
☐ POTW/WWTP
☐ State: ________
☐ Other: ________
☐ A2LA
x EDD/EDT(Electronic Data)
Format: excel
☐ LEVEL IV
☐ NELAC

Number of Containers
Sample Type: A W S V B O
Air Water Soils/Solids
Vegetation Bioassay Other

ANALYSIS REQUESTED

RUSH

Contact ELI prior to **RUSH** sample submittal for charges and scheduling – See Instruction Page

Comments:
10 day TAT
Pull phosphate from 1 L bottle

Shipped by: Hand
Cooler ID(s): 4
Receipt Temp: See Comme
On Ice: [✓ Yes] No
Custody Seal Y [✓ N]
Intact Y N
Signature Match Y N

	SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	Dissolved Metals	Total Metals	Sulfide	Orthophosphate	Alkalinity and Acidity	SO4, Cl, F, TDS	BOD	Ammonia			SEE ATTACHED	Normal Turnaround (TAT)		LABORATORY USE ONLY
C2	13BH-DT-PILOT-BCR3-090413	09/04/13	0940	6 W	X	X	X	X	X	X	X	X					TB	
	13BH-DT-PILOT-BCR1-090413	09/04/13	1025	4 W	X	X	X	X	X	X							C1→1.6	H13090077
	13BH-DT-PILOT-BDR1-090413	09/04/13	1030	4 W	X	X	X	X	X	X							C2→0.8	
	13BH-DT-PILOT-BCR2-090413	09/04/13	1055	4 W	X	X	X	X	X	X								
	13BH-DT-PILOT-BCR4-090413	09/04/13	1110	4 W	X	X	X	X	X	X								
C1	13BH-DT-PILOT-INFL-090413	09/04/13	1120	LH 09/04/13 ~~4~~ 3 W	X	X		X	X	X								
	13BH-DT-PILOT-SAPS-090413	09/04/13	1135	3 W	X	X		X	X	X								
	13BH-DT-PILOT-MeOH-090413	09/04/13	1145	3 W	X	X		X	X	X								
	13BH-DT-PILOT-CHIT-090413	09/04/13	1155	3 W	X	X		X	X	X								
	13BH-DT-PILOT-BCR3-POST-090413	09/04/13	1210	3 W			X				X	X						

Custody Record MUST be Signed

Relinquished by (print): Lauren Helland Date/Time: 09/05/13 10:20 Signature: Lauren Helland
Relinquished by (print): Date/Time: Signature:
Received by (print): Date/Time: Signature:
Received by (print): Date/Time: Signature:
Received by Laboratory: Esther Merritt Date/Time: 9.5.13 10:20 Signature: Esther Merritt
Sample Disposal: Return to Client: ________ Lab Disposal: ________

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.
Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

ENERGY LABORATORIES
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Helena, MT 877-472-0711 • Billings, MT 800-735-4489 • Casper, WY 888-235-0515
Gillette, WY 866-686-7175 • Rapid City, SD 888-672-1225 • College Station, TX 888-690-2218

ANALYTICAL SUMMARY REPORT

October 11, 2013

CDM Federal Programs
555 17th St Ste 1100
Denver, CO 80202

Workorder No.: H13090305 Quote ID: H823 - Baker-Hughsville Superfund Site
Project Name: Barker Hughsville Pilot

Energy Laboratories Inc Helena MT received the following 10 samples for CDM Federal Programs on 9/17/2013 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H13090305-001	13BH-DT-PILOT-BCR2-091613	09/16/13 12:15	09/17/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Biochemical Oxygen Demand, 5 Day Conductivity Fluoride Anions by Ion Chromatography Nitrogen, Ammonia Phosphorus, Orthophosphate as P Solids, Total Dissolved Sulfide, Methylene Blue Colorimetric
H13090305-002	13BH-DT-PILOT-INFL-091613	09/16/13 12:40	09/17/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Conductivity Fluoride Anions by Ion Chromatography Phosphorus, Orthophosphate as P Solids, Total Dissolved
H13090305-003	13BH-DT-PILOT-SAPS-091613	09/16/13 12:50	09/17/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Conductivity Fluoride Anions by Ion Chromatography Metals Digestion by EPA 200.2 Preparation, Dissolved Filtration Phosphorus, Orthophosphate as P Solids, Total Dissolved
H13090305-004	13BH-DT-PILOT-CHIT-091613	09/16/13 13:00	09/17/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Conductivity Fluoride Anions by Ion Chromatography Preparation, Dissolved Filtration Phosphorus, Orthophosphate as P Solids, Total Dissolved
H13090305-005	13BH-DT-PILOT-MGOH-091613	09/16/13 13:30	09/17/13	Aqueous	Same As Above

ANALYTICAL SUMMARY REPORT

H13090305-006	13BH-DT-PILOT-BCR1-091613	09/16/13 13:40	09/17/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Conductivity Fluoride Anions by Ion Chromatography Preparation, Dissolved Filtration Phosphorus, Orthophosphate as P Solids, Total Dissolved Sulfide, Methylene Blue Colorimetric
H13090305-007	13BH-DT-PILOT-BCR3-091613	09/16/13 13:50	09/17/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Conductivity Fluoride Anions by Ion Chromatography Phosphorus, Orthophosphate as P Solids, Total Dissolved Sulfide, Iodine Titrimetric
H13090305-008	13BH-DT-PILOT-BDR3-091613	09/16/13 13:55	09/17/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Conductivity Fluoride Anions by Ion Chromatography Preparation, Dissolved Filtration Phosphorus, Orthophosphate as P Solids, Total Dissolved Sulfide, Iodine Titrimetric
H13090305-009	13BH-DT-PILOT-BCR4-091613	09/16/13 14:05	09/17/13	Aqueous	Metals by ICP/ICPMS, Dissolved Acidity, Total as CaCO3 Alkalinity Conductivity Fluoride Anions by Ion Chromatography Phosphorus, Orthophosphate as P Solids, Total Dissolved Sulfide, Methylene Blue Colorimetric
H13090305-010	13BH-DT-PILOT-BCR2-POST-091613	09/16/13 14:15	09/17/13	Aqueous	Biochemical Oxygen Demand, 5 Day Nitrogen, Ammonia Sulfide, Methylene Blue Colorimetric

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By:

CLIENT: CDM Federal Programs
Project: Barker Hughsville Pilot
Sample Delivery Group: H13090305

Report Date: 10/11/13

CASE NARRATIVE

Tests associated with analyst identified as ELI-B were subcontracted to Energy Laboratories, 1120 S. 27th St., Billings, MT, EPA Number MT00005.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	10/22/13
Project:	Barker Hughsville Pilot	**Collection Date:**	09/16/13 12:15
Lab ID:	H13090305-001	**DateReceived:**	09/17/13
Client Sample ID	13BH-DT-PILOT-BCR2-091613	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1460	mg/L		10		A2540 C	09/18/13 14:31 / cmm
INORGANICS							
Acidity, Total as CaCO3	80	mg/L	D	4.0		A2310 B	09/23/13 09:58 / cmm
Alkalinity, Total as CaCO3	110	mg/L		1		A2320 B	09/18/13 16:03 / cmm
Bicarbonate as HCO3	140	mg/L		1		A2320 B	09/18/13 16:03 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	09/18/13 16:03 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	09/18/13 16:03 / cmm
Chloride	ND	mg/L	D	2		E300.0	09/19/13 13:01 / cmm
Sulfate	980	mg/L		1		E300.0	09/19/13 13:01 / cmm
Fluoride	1.5	mg/L	D	0.2	4	A4500-F C	10/10/13 10:58 / cmm
Sulfide	ND	mg/L	D	0.2		A4500-S D	09/20/13 11:45 / eli-b22
AGGREGATE ORGANICS							
Oxygen Demand, Biochemical (BOD)	<35	mg/L	H	40		A5210 B	09/18/13 15:17 / cmm
No BOD dilution depleted greater than 2.0 mg/L DO.							
NUTRIENTS							
Nitrogen, Ammonia as N	ND	mg/L		0.05		E350.1	09/17/13 16:22 / jaw
Phosphorus, Orthophosphate as P	0.02	mg/L	D	0.01		E365.1	09/18/13 11:00 / jaw
METALS, DISSOLVED							
Aluminum	0.06	mg/L		0.03		E200.8	09/20/13 09:23 / dck
Arsenic	0.002	mg/L		0.001		E200.8	09/20/13 09:23 / dck
Barium	0.07	mg/L		0.05		E200.8	09/20/13 09:23 / dck
Beryllium	ND	mg/L		0.001		E200.8	09/20/13 09:23 / dck
Cadmium	ND	mg/L		0.001		E200.8	09/20/13 09:23 / dck
Calcium	280	mg/L		1		E200.7	09/18/13 12:34 / sld
Chromium	ND	mg/L		0.005		E200.8	09/20/13 09:23 / dck
Cobalt	0.035	mg/L		0.005		E200.8	09/20/13 09:23 / dck
Copper	ND	mg/L		0.005		E200.8	09/20/13 09:23 / dck
Iron	33.7	mg/L		0.03		E200.7	09/18/13 12:34 / sld
Lead	ND	mg/L		0.001		E200.8	09/20/13 09:23 / dck
Magnesium	22	mg/L		1		E200.7	09/18/13 12:34 / sld
Manganese	99.9	mg/L	D	0.003		E200.7	09/18/13 12:34 / sld
Nickel	0.024	mg/L		0.005		E200.8	09/20/13 09:23 / dck
Potassium	ND	mg/L		1		E200.7	09/18/13 12:34 / sld
Silver	ND	mg/L		0.001		E200.8	09/27/13 21:05 / dck
Sodium	5	mg/L		1		E200.7	09/18/13 12:34 / sld
Thallium	ND	mg/L		0.0005		E200.8	09/20/13 09:23 / dck
Zinc	13.7	mg/L		0.01		E200.7	09/18/13 12:34 / sld

Report Definitions:	RL - Analyte reporting limit.	MCL - Maximum contaminant level.
	QCL - Quality control limit.	ND - Not detected at the reporting limit.
	D - RL increased due to sample matrix.	H - Analysis performed past recommended holding time.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13090305-002
Client Sample ID 13BH-DT-PILOT-INFL-091613

Report Date: 10/22/13
Collection Date: 09/16/13 12:40
DateReceived: 09/17/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1300	mg/L		10		A2540 C	09/18/13 14:31 / cmm
INORGANICS							
Acidity, Total as CaCO3	460	mg/L	D	4.0		A2310 B	09/23/13 09:58 / cmm
Alkalinity, Total as CaCO3	ND	mg/L		1		A2320 B	09/18/13 16:06 / cmm
Bicarbonate as HCO3	ND	mg/L		1		A2320 B	09/18/13 16:06 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	09/18/13 16:06 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	09/18/13 16:06 / cmm
Chloride	ND	mg/L		1		E300.0	09/30/13 16:26 / abb
Sulfate	1700	mg/L		1		E300.0	09/30/13 16:26 / abb
Fluoride	0.8	mg/L	D	0.2	4	A4500-F C	10/10/13 11:00 / cmm
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.13	mg/L	D	0.01		E365.1	09/18/13 11:04 / jaw
METALS, DISSOLVED							
Aluminum	8.71	mg/L		0.03		E200.7	09/18/13 12:37 / sld
Arsenic	0.093	mg/L		0.001		E200.8	09/20/13 09:28 / dck
Barium	ND	mg/L		0.05		E200.8	09/20/13 09:28 / dck
Beryllium	0.006	mg/L		0.001		E200.8	09/20/13 09:28 / dck
Cadmium	0.154	mg/L		0.001		E200.8	09/20/13 09:28 / dck
Calcium	93	mg/L		1		E200.7	09/18/13 12:37 / sld
Chromium	ND	mg/L		0.005		E200.8	09/20/13 09:28 / dck
Cobalt	0.036	mg/L		0.005		E200.8	09/20/13 09:28 / dck
Copper	0.924	mg/L		0.005		E200.8	09/24/13 19:05 / dck
Iron	112	mg/L		0.03		E200.7	09/18/13 12:37 / sld
Lead	0.122	mg/L		0.001		E200.8	09/20/13 09:28 / dck
Magnesium	20	mg/L		1		E200.7	09/18/13 12:37 / sld
Manganese	98.4	mg/L	D	0.003		E200.7	09/18/13 12:37 / sld
Nickel	0.030	mg/L		0.005		E200.8	09/20/13 09:28 / dck
Potassium	ND	mg/L		1		E200.7	09/18/13 12:37 / sld
Silver	ND	mg/L		0.001		E200.8	09/27/13 21:12 / dck
Sodium	5	mg/L		1		E200.7	09/18/13 12:37 / sld
Thallium	0.0018	mg/L		0.0005		E200.8	09/20/13 09:28 / dck
Zinc	44.5	mg/L		0.01		E200.7	09/18/13 12:37 / sld

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13090305-003
Client Sample ID 13BH-DT-PILOT-SAPS-091613

Report Date: 10/22/13
Collection Date: 09/16/13 12:50
DateReceived: 09/17/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1490	mg/L		10		A2540 C	09/18/13 14:32 / cmm
INORGANICS							
Acidity, Total as CaCO3	320	mg/L	D	4.0		A2310 B	09/23/13 09:58 / cmm
Alkalinity, Total as CaCO3	40	mg/L		1		A2320 B	09/18/13 16:13 / cmm
Bicarbonate as HCO3	49	mg/L		1		A2320 B	09/18/13 16:13 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	09/18/13 16:13 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	09/18/13 16:13 / cmm
Chloride	ND	mg/L		1		E300.0	09/30/13 16:39 / abb
Sulfate	1200	mg/L		1		E300.0	09/19/13 13:26 / cmm
Fluoride	1.8	mg/L	D	0.5	4	A4500-F C	10/10/13 11:06 / cmm
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.05	mg/L	D	0.02		E365.1	09/18/13 11:02 / jaw
METALS, DISSOLVED							
Aluminum	2.02	mg/L	D	0.05		E200.7	09/27/13 13:47 / sld
Arsenic	0.052	mg/L		0.001		E200.8	09/20/13 09:33 / dck
Barium	ND	mg/L		0.05		E200.8	09/20/13 09:33 / dck
Beryllium	0.007	mg/L		0.001		E200.8	09/20/13 09:33 / dck
Cadmium	0.100	mg/L		0.001		E200.8	09/20/13 09:33 / dck
Calcium	233	mg/L		1		E200.7	09/18/13 12:41 / sld
Chromium	0.006	mg/L		0.005		E200.8	09/20/13 09:33 / dck
Cobalt	0.039	mg/L		0.005		E200.8	09/20/13 09:33 / dck
Copper	0.78	mg/L	D	0.02		E200.7	09/18/13 12:41 / sld
Iron	107	mg/L		0.03		E200.7	09/18/13 12:41 / sld
Lead	0.184	mg/L		0.001		E200.8	09/20/13 09:33 / dck
Magnesium	22	mg/L		1		E200.7	09/18/13 12:41 / sld
Manganese	99.0	mg/L	D	0.003		E200.7	09/18/13 12:41 / sld
Nickel	0.026	mg/L		0.005		E200.8	09/20/13 09:33 / dck
Potassium	ND	mg/L		1		E200.7	09/18/13 12:41 / sld
Silver	ND	mg/L		0.001		E200.8	09/27/13 21:18 / dck
Sodium	5	mg/L		1		E200.7	09/18/13 12:41 / sld
Thallium	0.0024	mg/L		0.0005		E200.8	09/20/13 09:33 / dck
Zinc	53.2	mg/L		0.01		E200.7	09/18/13 12:41 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13090305-004
Client Sample ID 13BH-DT-PILOT-CHIT-091613

Report Date: 10/22/13
Collection Date: 09/16/13 13:00
DateReceived: 09/17/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1660	mg/L		10		A2540 C	09/18/13 14:32 / cmm
INORGANICS							
Acidity, Total as CaCO3	ND	mg/L	D	4.0		A2310 B	09/23/13 09:58 / cmm
Alkalinity, Total as CaCO3	620	mg/L		1		A2320 B	09/18/13 16:20 / cmm
Bicarbonate as HCO3	750	mg/L		1		A2320 B	09/18/13 16:20 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	09/18/13 16:20 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	09/18/13 16:20 / cmm
Chloride	16	mg/L	D	2		E300.0	09/19/13 13:39 / cmm
Sulfate	730	mg/L		1		E300.0	09/19/13 13:39 / cmm
Fluoride	0.6	mg/L	D	0.2	4	A4500-F C	10/10/13 11:08 / cmm
NUTRIENTS							
Phosphorus, Orthophosphate as P	14	mg/L	D	1		E365.1	09/18/13 11:03 / jaw
METALS, DISSOLVED							
Aluminum	0.09	mg/L		0.03		E200.7	10/01/13 18:47 / sld
Arsenic	0.034	mg/L		0.001		E200.8	09/20/13 09:51 / dck
Barium	ND	mg/L		0.05		E200.8	09/20/13 09:51 / dck
Beryllium	ND	mg/L		0.001		E200.8	09/20/13 09:51 / dck
Cadmium	ND	mg/L		0.001		E200.8	09/20/13 09:51 / dck
Calcium	377	mg/L		1		E200.7	09/18/13 12:45 / sld
Chromium	ND	mg/L		0.005		E200.8	09/20/13 09:51 / dck
Cobalt	0.011	mg/L		0.005		E200.8	09/20/13 09:51 / dck
Copper	ND	mg/L		0.005		E200.8	09/20/13 09:51 / dck
Iron	39.4	mg/L		0.03		E200.7	09/18/13 12:45 / sld
Lead	ND	mg/L		0.001		E200.8	09/20/13 09:51 / dck
Magnesium	43	mg/L		1		E200.7	09/18/13 12:45 / sld
Manganese	94.1	mg/L	D	0.003		E200.7	09/18/13 12:45 / sld
Nickel	0.015	mg/L		0.005		E200.8	09/20/13 09:51 / dck
Potassium	5	mg/L		1		E200.7	09/18/13 12:45 / sld
Silver	ND	mg/L		0.001		E200.8	09/27/13 21:25 / dck
Sodium	30	mg/L		1		E200.7	09/18/13 12:45 / sld
Thallium	ND	mg/L		0.0005		E200.8	09/20/13 09:51 / dck
Zinc	0.02	mg/L		0.01		E200.8	09/20/13 09:51 / dck

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13090305-005
Client Sample ID 13BH-DT-PILOT-MGOH-091613

Report Date: 10/22/13
Collection Date: 09/16/13 13:30
DateReceived: 09/17/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1320	mg/L		10		A2540 C	09/18/13 14:32 / cmm
INORGANICS							
Acidity, Total as CaCO3	ND	mg/L	D	4.0		A2310 B	09/23/13 09:58 / cmm
Alkalinity, Total as CaCO3	13	mg/L		1		A2320 B	09/18/13 16:26 / cmm
Bicarbonate as HCO3	16	mg/L		1		A2320 B	09/18/13 16:26 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	09/18/13 16:26 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	09/18/13 16:26 / cmm
Chloride	ND	mg/L	D	2		E300.0	09/19/13 13:51 / cmm
Sulfate	990	mg/L		1		E300.0	09/19/13 13:51 / cmm
Fluoride	1.9	mg/L	D	0.2	4	A4500-F C	10/10/13 11:10 / cmm
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.02	mg/L	D	0.02		E365.1	09/18/13 11:01 / jaw
METALS, DISSOLVED							
Aluminum	0.18	mg/L		0.03		E200.7	10/01/13 18:51 / sld
Arsenic	0.012	mg/L		0.001		E200.8	09/20/13 09:55 / dck
Barium	ND	mg/L		0.05		E200.8	09/20/13 09:55 / dck
Beryllium	0.003	mg/L		0.001		E200.8	09/20/13 09:55 / dck
Cadmium	0.140	mg/L		0.001		E200.8	09/20/13 09:55 / dck
Calcium	95	mg/L		1		E200.7	09/18/13 13:06 / sld
Chromium	ND	mg/L		0.005		E200.8	09/20/13 09:55 / dck
Cobalt	0.035	mg/L		0.005		E200.8	09/20/13 09:55 / dck
Copper	0.480	mg/L		0.005		E200.8	09/24/13 19:18 / dck
Iron	37.6	mg/L		0.03		E200.7	09/18/13 13:06 / sld
Lead	0.052	mg/L		0.001		E200.8	09/20/13 09:55 / dck
Magnesium	89	mg/L		1		E200.7	09/18/13 13:06 / sld
Manganese	92.1	mg/L	D	0.003		E200.7	09/18/13 13:06 / sld
Nickel	0.026	mg/L		0.005		E200.8	09/20/13 09:55 / dck
Potassium	ND	mg/L		1		E200.7	09/18/13 13:06 / sld
Silver	ND	mg/L		0.001		E200.8	09/27/13 21:31 / dck
Sodium	6	mg/L		1		E200.7	09/18/13 13:06 / sld
Thallium	0.0017	mg/L		0.0005		E200.8	09/20/13 09:55 / dck
Zinc	36.2	mg/L		0.01		E200.7	09/18/13 13:06 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13090305-006
Client Sample ID 13BH-DT-PILOT-BCR1-091613

Report Date: 10/22/13
Collection Date: 09/16/13 13:40
DateReceived: 09/17/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1500	mg/L		10		A2540 C	09/18/13 14:32 / cmm
INORGANICS							
Acidity, Total as CaCO3	130	mg/L	D	4.0		A2310 B	09/23/13 09:58 / cmm
Alkalinity, Total as CaCO3	70	mg/L		1		A2320 B	09/18/13 16:32 / cmm
Bicarbonate as HCO3	85	mg/L		1		A2320 B	09/18/13 16:32 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	09/18/13 16:32 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	09/18/13 16:32 / cmm
Chloride	ND	mg/L	D	2		E300.0	09/19/13 14:04 / cmm
Sulfate	1000	mg/L		1		E300.0	09/19/13 14:04 / cmm
Fluoride	1.4	mg/L	D	0.2	4	A4500-F C	10/10/13 11:12 / cmm
Sulfide	ND	mg/L	D	0.2		A4500-S D	09/20/13 11:45 / eli-b22
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.04	mg/L	D	0.01		E365.1	09/18/13 10:56 / jaw
METALS, DISSOLVED							
Aluminum	0.29	mg/L		0.03		E200.7	10/01/13 19:28 / sld
Arsenic	0.006	mg/L		0.001		E200.8	09/20/13 10:00 / dck
Barium	ND	mg/L		0.05		E200.8	09/20/13 10:00 / dck
Beryllium	0.001	mg/L		0.001		E200.8	09/20/13 10:00 / dck
Cadmium	ND	mg/L		0.001		E200.8	09/20/13 10:00 / dck
Calcium	223	mg/L		1		E200.7	09/18/13 13:10 / sld
Chromium	ND	mg/L		0.005		E200.8	09/20/13 10:00 / dck
Cobalt	0.042	mg/L		0.005		E200.8	09/20/13 10:00 / dck
Copper	ND	mg/L		0.005		E200.8	09/20/13 10:00 / dck
Iron	74.7	mg/L		0.03		E200.7	09/18/13 13:10 / sld
Lead	ND	mg/L		0.001		E200.8	09/20/13 10:00 / dck
Magnesium	22	mg/L		1		E200.7	09/18/13 13:10 / sld
Manganese	98.6	mg/L	D	0.003		E200.7	09/18/13 13:10 / sld
Nickel	0.030	mg/L		0.005		E200.8	09/20/13 10:00 / dck
Potassium	ND	mg/L		1		E200.7	09/18/13 13:10 / sld
Silver	ND	mg/L		0.001		E200.8	09/27/13 21:37 / dck
Sodium	5	mg/L		1		E200.7	09/18/13 13:10 / sld
Thallium	ND	mg/L		0.0005		E200.8	09/20/13 10:00 / dck
Zinc	39.4	mg/L		0.01		E200.7	09/18/13 13:10 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13090305-007
Client Sample ID 13BH-DT-PILOT-BCR3-091613

Report Date: 10/22/13
Collection Date: 09/16/13 13:50
DateReceived: 09/17/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	2050	mg/L		10		A2540 C	09/18/13 14:32 / cmm
INORGANICS							
Acidity, Total as CaCO3	ND	mg/L	D	4.0		A2310 B	09/23/13 09:58 / cmm
Alkalinity, Total as CaCO3	1300	mg/L		1		A2320 B	09/18/13 16:42 / cmm
Bicarbonate as HCO3	1600	mg/L		1		A2320 B	09/18/13 16:42 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	09/18/13 16:42 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	09/18/13 16:42 / cmm
Chloride	8	mg/L	D	5		E300.0	09/19/13 14:16 / cmm
Sulfate	600	mg/L	D	2		E300.0	09/19/13 14:16 / cmm
Fluoride	0.5	mg/L	D	0.2	4	A4500-F C	10/10/13 11:12 / cmm
Sulfide	56	mg/L		1		A4500-S F	09/20/13 11:30 / eli-b22
NUTRIENTS							
Phosphorus, Orthophosphate as P	26	mg/L	D	1		E365.1	09/18/13 11:05 / jaw
METALS, DISSOLVED							
Aluminum	ND	mg/L		0.03		E200.8	09/20/13 10:04 / dck
Arsenic	0.015	mg/L		0.001		E200.8	09/20/13 10:04 / dck
Barium	0.09	mg/L		0.05		E200.8	09/20/13 10:04 / dck
Beryllium	ND	mg/L		0.001		E200.8	09/20/13 10:04 / dck
Cadmium	ND	mg/L		0.001		E200.8	09/20/13 10:04 / dck
Calcium	435	mg/L		1		E200.7	09/18/13 13:14 / sld
Chromium	ND	mg/L		0.005		E200.8	09/20/13 10:04 / dck
Cobalt	ND	mg/L		0.005		E200.8	09/20/13 10:04 / dck
Copper	ND	mg/L		0.005		E200.8	09/20/13 10:04 / dck
Iron	0.52	mg/L		0.03		E200.8	09/20/13 10:04 / dck
Lead	ND	mg/L		0.001		E200.8	09/20/13 10:04 / dck
Magnesium	36	mg/L		1		E200.7	09/18/13 13:14 / sld
Manganese	61.3	mg/L	D	0.003		E200.7	09/18/13 13:14 / sld
Nickel	ND	mg/L		0.005		E200.8	09/20/13 10:04 / dck
Potassium	6	mg/L		1		E200.8	09/20/13 10:04 / dck
Silver	ND	mg/L		0.001		E200.8	09/27/13 21:44 / dck
Sodium	24	mg/L		1		E200.7	09/18/13 13:14 / sld
Thallium	ND	mg/L		0.0005		E200.8	09/20/13 10:04 / dck
Zinc	0.04	mg/L		0.01		E200.8	09/20/13 10:04 / dck

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	10/22/13
Project:	Barker Hughsville Pilot	**Collection Date:**	09/16/13 13:55
Lab ID:	H13090305-008	**DateReceived:**	09/17/13
Client Sample ID	13BH-DT-PILOT-BDR3-091613	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	2060	mg/L		10		A2540 C	09/18/13 14:33 / cmm
INORGANICS							
Acidity, Total as CaCO3	ND	mg/L	D	4.0		A2310 B	09/23/13 09:58 / cmm
Alkalinity, Total as CaCO3	1300	mg/L		1		A2320 B	09/18/13 16:53 / cmm
Bicarbonate as HCO3	1600	mg/L		1		A2320 B	09/18/13 16:53 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	09/18/13 16:53 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	09/18/13 16:53 / cmm
Chloride	9	mg/L	D	5		E300.0	09/19/13 14:29 / cmm
Sulfate	450	mg/L		1		E300.0	09/30/13 17:04 / abb
Fluoride	0.5	mg/L	D	0.2	4	A4500-F C	10/10/13 11:13 / cmm
Sulfide	52	mg/L		1		A4500-S F	09/20/13 11:30 / eli-b22
NUTRIENTS							
Phosphorus, Orthophosphate as P	36	mg/L	D	1		E365.1	09/18/13 11:06 / jaw
METALS, DISSOLVED							
Aluminum	ND	mg/L		0.03		E200.8	09/24/13 19:50 / dck
Arsenic	0.016	mg/L		0.001		E200.8	09/20/13 10:09 / dck
Barium	0.09	mg/L		0.05		E200.8	09/20/13 10:09 / dck
Beryllium	ND	mg/L		0.001		E200.8	09/20/13 10:09 / dck
Cadmium	ND	mg/L		0.001		E200.8	09/20/13 10:09 / dck
Calcium	427	mg/L		1		E200.7	09/18/13 13:17 / sld
Chromium	ND	mg/L		0.005		E200.8	09/20/13 10:09 / dck
Cobalt	ND	mg/L		0.005		E200.8	09/20/13 10:09 / dck
Copper	ND	mg/L		0.005		E200.8	09/20/13 10:09 / dck
Iron	0.10	mg/L		0.03		E200.8	09/20/13 10:09 / dck
Lead	ND	mg/L		0.001		E200.8	09/20/13 10:09 / dck
Magnesium	36	mg/L		1		E200.7	09/18/13 13:17 / sld
Manganese	61.9	mg/L	D	0.003		E200.7	09/18/13 13:17 / sld
Nickel	ND	mg/L		0.005		E200.8	09/20/13 10:09 / dck
Potassium	4	mg/L		1		E200.7	09/18/13 13:17 / sld
Silver	ND	mg/L		0.001		E200.8	09/30/13 18:39 / dck
Sodium	23	mg/L		1		E200.7	09/18/13 13:17 / sld
Thallium	ND	mg/L		0.0005		E200.8	09/20/13 10:09 / dck
Zinc	ND	mg/L		0.01		E200.8	09/20/13 10:09 / dck

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	10/22/13
Project:	Barker Hughsville Pilot	**Collection Date:**	09/16/13 14:05
Lab ID:	H13090305-009	**DateReceived:**	09/17/13
Client Sample ID	13BH-DT-PILOT-BCR4-091613	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Dissolved TDS @ 180 C	1460	mg/L		10		A2540 C	09/18/13 14:33 / cmm
INORGANICS							
Acidity, Total as CaCO3	68	mg/L	D	4.0		A2310 B	09/23/13 09:58 / cmm
Alkalinity, Total as CaCO3	93	mg/L		1		A2320 B	09/18/13 17:10 / cmm
Bicarbonate as HCO3	110	mg/L		1		A2320 B	09/18/13 17:10 / cmm
Carbonate as CO3	ND	mg/L		1		A2320 B	09/18/13 17:10 / cmm
Hydroxide as OH	ND	mg/L		1		A2320 B	09/18/13 17:10 / cmm
Chloride	ND	mg/L	D	2		E300.0	09/19/13 14:42 / cmm
Sulfate	990	mg/L		1		E300.0	09/19/13 14:42 / cmm
Fluoride	1.4	mg/L	D	0.2	4	A4500-F C	10/10/13 11:14 / cmm
Sulfide	ND	mg/L	D	0.2		A4500-S D	09/20/13 11:45 / eli-b22
NUTRIENTS							
Phosphorus, Orthophosphate as P	0.04	mg/L	D	0.01		E365.1	09/18/13 10:59 / jaw
METALS, DISSOLVED							
Aluminum	0.06	mg/L		0.03		E200.8	09/20/13 10:32 / dck
Arsenic	0.002	mg/L		0.001		E200.8	09/24/13 19:54 / dck
Barium	0.07	mg/L		0.05		E200.8	09/20/13 10:32 / dck
Beryllium	ND	mg/L		0.001		E200.8	09/20/13 10:32 / dck
Cadmium	ND	mg/L		0.001		E200.8	09/20/13 10:32 / dck
Calcium	191	mg/L		1		E200.7	09/18/13 13:21 / sld
Chromium	ND	mg/L		0.005		E200.8	09/20/13 10:32 / dck
Cobalt	0.019	mg/L		0.005		E200.8	09/24/13 19:54 / dck
Copper	ND	mg/L		0.005		E200.8	09/24/13 19:54 / dck
Iron	29.8	mg/L		0.03		E200.7	09/18/13 13:21 / sld
Lead	ND	mg/L		0.001		E200.8	09/20/13 10:32 / dck
Magnesium	94	mg/L		1		E200.7	09/18/13 13:21 / sld
Manganese	86.4	mg/L	D	0.003		E200.7	09/18/13 13:21 / sld
Nickel	0.013	mg/L		0.005		E200.8	09/20/13 10:32 / dck
Potassium	ND	mg/L		1		E200.7	09/18/13 13:21 / sld
Silver	ND	mg/L		0.001		E200.8	09/30/13 18:52 / dck
Sodium	6	mg/L		1		E200.7	09/18/13 13:21 / sld
Thallium	ND	mg/L		0.0005		E200.8	09/24/13 19:54 / dck
Zinc	3.29	mg/L		0.01		E200.7	09/18/13 13:21 / sld

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13090305-010
Client Sample ID 13BH-DT-PILOT-BCR2-POST-091613

Report Date: 10/22/13
Collection Date: 09/16/13 14:15
DateReceived: 09/17/13
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
INORGANICS							
Sulfide	ND	mg/L	D	0.2		A4500-S D	09/20/13 11:45 / eli-b22
AGGREGATE ORGANICS							
Oxygen Demand, Biochemical (BOD)	<35	mg/L	H	40		A5210 B	09/18/13 15:19 / cmm
No BOD dilution depleted greater than 2.0 mg/L DO.							
NUTRIENTS							
Nitrogen, Ammonia as N	ND	mg/L		0.05		E350.1	09/17/13 16:23 / jaw

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 10/22/13
Project: Barker Hughsville Pilot **Work Order:** H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **A2310 B**										Batch: H13090305-001A
Sample ID: **H13090305-009ADUP**		Sample Duplicate				Run: MISC WC_130923A				09/23/13 09:58
Acidity, Total as CaCO3		80	mg/L	4.0				16	20	
Sample ID: **LCS1309230958**		Laboratory Control Sample				Run: MISC WC_130923A				09/23/13 09:58
Acidity, Total as CaCO3		660	mg/L	4.0	102	90	110			
Sample ID: **MBLK1309230958**		Method Blank				Run: MISC WC_130923A				09/23/13 09:58
Acidity, Total as CaCO3		ND	mg/L	3						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 10/22/13

Project: Barker Hughsville Pilot **Work Order:** H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2320 B										Batch: R91398
Sample ID: MBLK		Method Blank				Run: MAN-TECH_130918B				09/18/13 15:42
Alkalinity, Total as CaCO3		ND	mg/L	2						
Sample ID: LCS-09182013		Laboratory Control Sample				Run: MAN-TECH_130918B				09/18/13 15:50
Alkalinity, Total as CaCO3		640	mg/L	4.0	107	90	110			
Sample ID: H13090305-008ADUP	3	Sample Duplicate				Run: MAN-TECH_130918B				09/18/13 17:04
Alkalinity, Total as CaCO3		1300	mg/L	4.0				0.7	10	
Bicarbonate as HCO3		1600	mg/L	4.0				0.7	10	
Carbonate as CO3		ND	mg/L	4.0					10	
Sample ID: H13090305-009AMS		Sample Matrix Spike				Run: MAN-TECH_130918B				09/18/13 17:18
Alkalinity, Total as CaCO3		670	mg/L	4.0	95	80	120			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 10/22/13
Work Order: H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2540 C									Batch: TDS130918A	
Sample ID: MB-1_130918A	Method Blank					Run: ACCU-124 (14410200)_130918			09/18/13 14:30	
Solids, Total Dissolved TDS @ 180 C		ND	mg/L	1						
Sample ID: LCS-2_130918A	Laboratory Control Sample					Run: ACCU-124 (14410200)_130918			09/18/13 14:30	
Solids, Total Dissolved TDS @ 180 C		1880	mg/L	10	94	90	110			
Sample ID: H13090288-001A DUP	Sample Duplicate					Run: ACCU-124 (14410200)_130918			09/18/13 14:31	
Solids, Total Dissolved TDS @ 180 C		11600	mg/L	10				6.5	5	R
Sample ID: H13090305-001A MS	Sample Matrix Spike					Run: ACCU-124 (14410200)_130918			09/18/13 14:31	
Solids, Total Dissolved TDS @ 180 C		3370	mg/L	10	96	80	120			
Sample ID: H13090315-001A DUP	Sample Duplicate					Run: ACCU-124 (14410200)_130918			09/18/13 14:33	
Solids, Total Dissolved TDS @ 180 C		1080	mg/L	10				0.4	5	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

R - RPD exceeds advisory limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 10/22/13

Work Order: H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-F C										Analytical Run: PH_131010A
Sample ID: ICV1_130923A		Initial Calibration Verification Standard								10/10/13 10:33
Fluoride		0.7	mg/L	0.1	98	90	110			
Sample ID: CCV1_131009A		Continuing Calibration Verification Standard								10/10/13 11:06
Fluoride		0.2	mg/L	0.1	100	90	110			
Method: A4500-F C										Batch: 131009A-F-ISE-W
Sample ID: MBLK1_130923A		Method Blank				Run: PH_131010A				10/10/13 09:53
Fluoride		0.009	mg/L	0.005						
Sample ID: LFB1_130923A		Laboratory Fortified Blank				Run: PH_131010A				10/10/13 10:34
Fluoride		0.5	mg/L	0.1	97	90	110			
Sample ID: H13090305-004AMS		Sample Matrix Spike				Run: PH_131010A				10/10/13 11:08
Fluoride		1.6	mg/L	0.2	95	85	115			
Sample ID: H13090305-004AMSD		Sample Matrix Spike Duplicate				Run: PH_131010A				10/10/13 11:09
Fluoride		1.6	mg/L	0.2	95	85	115	0.3	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 10/22/13
Project: Barker Hughsville Pilot **Work Order:** H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-S D										Batch: B_R212014
Sample ID: MB-R212014		Method Blank				Run: SUB-B212014				09/20/13 11:45
Sulfide		ND	mg/L	0.002						
Sample ID: LCS-R212014		Laboratory Control Sample				Run: SUB-B212014				09/20/13 11:45
Sulfide		0.310	mg/L	0.040	122	70	130			
Sample ID: B13091569-001EMS		Sample Matrix Spike				Run: SUB-B212014				09/20/13 11:45
Sulfide		0.259	mg/L	0.040	102	70	130			
Sample ID: B13091569-001EMSD		Sample Matrix Spike Duplicate				Run: SUB-B212014				09/20/13 11:45
Sulfide		0.279	mg/L	0.040	110	70	130	7.6	20	
Sample ID: B13091670-001DMS		Sample Matrix Spike				Run: SUB-B212014				09/20/13 11:45
Sulfide		0.312	mg/L	0.040	110	70	130			
Sample ID: B13091670-001DMSD		Sample Matrix Spike Duplicate				Run: SUB-B212014				09/20/13 11:45
Sulfide		0.313	mg/L	0.040	110	70	130	0.4	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 10/22/13

Work Order: H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **A4500-S F**										Batch: B_R212012
Sample ID: **MB-R212012**		Method Blank				Run: SUB-B212012				09/20/13 11:30
Sulfide		ND	mg/L	0.5						
Sample ID: **LCS-R212012**		Laboratory Control Sample				Run: SUB-B212012				09/20/13 11:30
Sulfide		18.2	mg/L	1.0	100	70	130			
Sample ID: **B13091603-002AMS**		Sample Matrix Spike				Run: SUB-B212012				09/20/13 11:30
Sulfide		311	mg/L	1.0	100	80	120			
Sample ID: **B13091603-002AMSD**		Sample Matrix Spike Duplicate				Run: SUB-B212012				09/20/13 11:30
Sulfide		310	mg/L	1.0	99	80	120	0.4	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 10/22/13
Work Order: H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A5210 B							Batch: 130918_1_BOD5-W			
Sample ID: Dil-H201_130918	Dilution Water Blank					Run: MISC WC_130918A			09/18/13 15:09	
Oxygen Demand, Biochemical (BOD)		0.22	mg/L	2.0		0	0.2			
Dilution water blank exceeds 0.2 mg/L.										
Sample ID: GGA1_130918	Laboratory Control Sample					Run: MISC WC_130918A			09/18/13 15:14	
Oxygen Demand, Biochemical (BOD)		210	mg/L	58	104	85	115			
Sample ID: H13090338-001BDUP	Sample Duplicate					Run: MISC WC_130918A			09/18/13 15:27	
Oxygen Demand, Biochemical (BOD)		ND	mg/L	120		90	110		10	
No BOD dilution depleted greater than 2.0 mg/L DO.										

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 10/22/13
Project: Barker Hughsville Pilot **Work Order:** H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7										Analytical Run: ICP2-HE_130918A
Sample ID: ICV	8	Initial Calibration Verification Standard								09/18/13 11:11
Aluminum		4.04	mg/L	0.10	101	95	105			
Calcium		40.1	mg/L	1.0	100	95	105			
Iron		3.97	mg/L	0.030	99	95	105			
Magnesium		39.8	mg/L	1.0	100	95	105			
Manganese		3.98	mg/L	0.010	99	95	105			
Potassium		40.6	mg/L	1.0	102	95	105			
Sodium		40.7	mg/L	1.0	102	95	105			
Zinc		0.816	mg/L	0.010	102	95	105			
Sample ID: CCV-1	8	Continuing Calibration Verification Standard								09/18/13 11:15
Aluminum		2.54	mg/L	0.10	101	95	105			
Calcium		25.2	mg/L	1.0	101	95	105			
Iron		2.51	mg/L	0.030	101	95	105			
Magnesium		24.9	mg/L	1.0	99	95	105			
Manganese		2.49	mg/L	0.010	100	95	105			
Potassium		25.2	mg/L	1.0	101	95	105			
Sodium		25.2	mg/L	1.0	101	95	105			
Zinc		2.55	mg/L	0.010	102	95	105			
Sample ID: ICSA	8	Interference Check Sample A								09/18/13 11:30
Aluminum		516	mg/L	0.10	103	80	120			
Calcium		473	mg/L	1.0	95	80	120			
Iron		188	mg/L	0.030	94	80	120			
Magnesium		508	mg/L	1.0	102	80	120			
Manganese		0.00164	mg/L	0.010		0	0			
Potassium		-0.0799	mg/L	1.0		0	0			
Sodium		0.0312	mg/L	1.0		0	0			
Zinc		0.0123	mg/L	0.010		0	0			
Sample ID: ICSAB	8	Interference Check Sample AB								09/18/13 11:34
Aluminum		522	mg/L	0.10	104	80	120			
Calcium		470	mg/L	1.0	94	80	120			
Iron		187	mg/L	0.030	94	80	120			
Magnesium		506	mg/L	1.0	101	80	120			
Manganese		0.480	mg/L	0.010	96	80	120			
Potassium		23.0	mg/L	1.0	115	80	120			
Sodium		23.1	mg/L	1.0	115	80	120			
Zinc		1.05	mg/L	0.010	105	80	120			
Sample ID: CCV	8	Continuing Calibration Verification Standard								09/18/13 12:04
Aluminum		2.53	mg/L	0.10	101	90	110			
Calcium		25.2	mg/L	1.0	101	90	110			
Iron		2.52	mg/L	0.030	101	90	110			
Magnesium		25.4	mg/L	1.0	101	90	110			
Manganese		2.48	mg/L	0.010	99	90	110			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 10/22/13

Project: Barker Hughsville Pilot **Work Order:** H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7										Analytical Run: ICP2-HE_130918A
Sample ID: CCV	8	Continuing Calibration Verification Standard								09/18/13 12:04
Potassium		24.9	mg/L	1.0	100	90	110			
Sodium		24.9	mg/L	1.0	99	90	110			
Zinc		2.73	mg/L	0.010	109	90	110			
Sample ID: CCV	8	Continuing Calibration Verification Standard								09/18/13 12:48
Aluminum		2.55	mg/L	0.10	102	90	110			
Calcium		25.5	mg/L	1.0	102	90	110			
Iron		2.53	mg/L	0.030	101	90	110			
Magnesium		26.2	mg/L	1.0	105	90	110			
Manganese		2.50	mg/L	0.010	100	90	110			
Potassium		24.8	mg/L	1.0	99	90	110			
Sodium		24.9	mg/L	1.0	99	90	110			
Zinc		2.67	mg/L	0.010	107	90	110			
Method: E200.7										Batch: R91399
Sample ID: ICB	8	Method Blank				Run: ICP2-HE_130918A				09/18/13 11:42
Aluminum		ND	mg/L	0.009						
Calcium		0.04	mg/L	0.03						
Iron		ND	mg/L	0.005						
Magnesium		ND	mg/L	0.02						
Manganese		ND	mg/L	0.0005						
Potassium		ND	mg/L	0.03						
Sodium		ND	mg/L	0.03						
Zinc		ND	mg/L	0.001						
Sample ID: LFB	8	Laboratory Fortified Blank				Run: ICP2-HE_130918A				09/18/13 11:46
Aluminum		4.92	mg/L	0.10	98	85	115			
Calcium		48.5	mg/L	1.0	97	85	115			
Iron		4.84	mg/L	0.030	97	85	115			
Magnesium		49.2	mg/L	1.0	98	85	115			
Manganese		4.81	mg/L	0.010	96	85	115			
Potassium		49.0	mg/L	1.0	98	85	115			
Sodium		49.2	mg/L	1.0	98	85	115			
Zinc		1.02	mg/L	0.010	102	85	115			
Sample ID: H13090305-004BMS2	8	Sample Matrix Spike				Run: ICP2-HE_130918A				09/18/13 12:59
Aluminum		25.5	mg/L	0.046	102	70	130			
Calcium		614	mg/L	1.0	95	70	130			
Iron		62.9	mg/L	0.030	94	70	130			
Magnesium		297	mg/L	1.0	102	70	130			
Manganese		116	mg/L	0.0027	88	70	130			
Potassium		258	mg/L	1.0	101	70	130			
Sodium		283	mg/L	1.0	101	70	130			
Zinc		5.51	mg/L	0.010	110	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 10/22/13

Work Order: H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.7**									Batch: R91399	
Sample ID: **H13090305-004BMSD2**	8	Sample Matrix Spike Duplicate				Run: ICP2-HE_130918A			09/18/13 13:03	
Aluminum		25.6	mg/L	0.046	102	70	130	0.4	20	
Calcium		610	mg/L	1.0	93	70	130	0.8	20	
Iron		62.7	mg/L	0.030	93	70	130	0.2	20	
Magnesium		297	mg/L	1.0	102	70	130	0.2	20	
Manganese		115	mg/L	0.0027	84	70	130	0.8	20	
Potassium		258	mg/L	1.0	101	70	130	0.3	20	
Sodium		282	mg/L	1.0	101	70	130	0.1	20	
Zinc		5.38	mg/L	0.010	107	70	130	2.4	20	
Sample ID: **H13090286-001BMS2**	8	Sample Matrix Spike				Run: ICP2-HE_130918A			09/18/13 13:43	
Aluminum		5.24	mg/L	0.030	104	70	130			
Calcium		154	mg/L	1.0	99	70	130			
Iron		5.18	mg/L	0.030	100	70	130			
Magnesium		78.5	mg/L	1.0	103	70	130			
Manganese		5.91	mg/L	0.0010	99	70	130			
Potassium		72.3	mg/L	1.0	104	70	130			
Sodium		63.0	mg/L	1.0	104	70	130			
Zinc		1.17	mg/L	0.010	103	70	130			
Sample ID: **H13090286-001BMSD2**	8	Sample Matrix Spike Duplicate				Run: ICP2-HE_130918A			09/18/13 13:47	
Aluminum		5.16	mg/L	0.030	103	70	130	1.4	20	
Calcium		152	mg/L	1.0	96	70	130	0.8	20	
Iron		5.12	mg/L	0.030	99	70	130	1.2	20	
Magnesium		78.4	mg/L	1.0	103	70	130	0.2	20	
Manganese		5.83	mg/L	0.0010	98	70	130	1.3	20	
Potassium		70.7	mg/L	1.0	101	70	130	2.3	20	
Sodium		61.5	mg/L	1.0	101	70	130	2.4	20	
Zinc		1.22	mg/L	0.010	109	70	130	4.4	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 10/22/13
Work Order: H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.7**										Analytical Run: ICP2-HE_130927A
Sample ID: **ICV**		Initial Calibration Verification Standard								09/27/13 11:59
Aluminum		4.06	mg/L	0.10	102	95	105			
Sample ID: **CCV-1**		Continuing Calibration Verification Standard								09/27/13 12:03
Aluminum		2.53	mg/L	0.10	101	95	105			
Sample ID: **ICSA**		Interference Check Sample A								09/27/13 12:14
Aluminum		517	mg/L	0.10	103	80	120			
Sample ID: **ICSAB**		Interference Check Sample AB								09/27/13 12:18
Aluminum		509	mg/L	0.10	102	80	120			
Sample ID: **CCV**		Continuing Calibration Verification Standard								09/27/13 13:32
Aluminum		2.52	mg/L	0.10	101	90	110			
Method: **E200.7**										Batch: R91627
Sample ID: **ICB**		Method Blank				Run: ICP2-HE_130927A				09/27/13 12:26
Aluminum		0.006	mg/L	0.004						
Sample ID: **LFB**		Laboratory Fortified Blank				Run: ICP2-HE_130927A				09/27/13 12:30
Aluminum		4.88	mg/L	0.10	98	85	115			
Sample ID: **H13090305-006CMS2**		Sample Matrix Spike				Run: ICP2-HE_130927A				09/27/13 14:05
Aluminum		25.1	mg/L	0.046	99	70	130			
Sample ID: **H13090305-006CMSD2**		Sample Matrix Spike Duplicate				Run: ICP2-HE_130927A				09/27/13 14:09
Aluminum		25.4	mg/L	0.046	101	70	130	1.2	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 10/22/13

Project: Barker Hughsville Pilot **Work Order:** H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.7**										Analytical Run: ICP2-HE_131001A
Sample ID: **ICV**		Initial Calibration Verification Standard								10/01/13 15:07
Aluminum		4.02	mg/L	0.10	100	95	105			
Sample ID: **CCV-1**		Continuing Calibration Verification Standard								10/01/13 15:10
Aluminum		2.52	mg/L	0.10	101	95	105			
Sample ID: **ICSA**		Interference Check Sample A								10/01/13 15:22
Aluminum		523	mg/L	0.10	105	80	120			
Sample ID: **ICSAB**		Interference Check Sample AB								10/01/13 15:26
Aluminum		520	mg/L	0.10	104	80	120			
Sample ID: **CCV**		Continuing Calibration Verification Standard								10/01/13 18:10
Aluminum		2.50	mg/L	0.10	100	90	110			
Sample ID: **CCV**		Continuing Calibration Verification Standard								10/01/13 19:21
Aluminum		2.54	mg/L	0.10	101	90	110			
Method: **E200.7**										Batch: R91692
Sample ID: **ICB**		Method Blank				Run: ICP2-HE_131001A				10/01/13 15:33
Aluminum		ND	mg/L	0.009						
Sample ID: **LFB**		Laboratory Fortified Blank				Run: ICP2-HE_131001A				10/01/13 15:37
Aluminum		4.87	mg/L	0.10	97	85	115			
Sample ID: **H13090274-007DMS2**		Sample Matrix Spike				Run: ICP2-HE_131001A				10/01/13 18:03
Aluminum		4.99	mg/L	0.030	99	70	130			
Sample ID: **H13090274-007DMSD2**		Sample Matrix Spike Duplicate				Run: ICP2-HE_131001A				10/01/13 18:06
Aluminum		5.08	mg/L	0.030	101	70	130	1.9	20	
Sample ID: **H13090305-006CMS2**		Sample Matrix Spike				Run: ICP2-HE_131001A				10/01/13 19:36
Aluminum		25.1	mg/L	0.046	99	70	130			
Sample ID: **H13090305-006CMSD2**		Sample Matrix Spike Duplicate				Run: ICP2-HE_131001A				10/01/13 19:39
Aluminum		25.4	mg/L	0.046	101	70	130	1.2	20	
Sample ID: **H13090305-008DMS2**		Sample Matrix Spike				Run: ICP2-HE_131001A				10/01/13 19:50
Aluminum		25.2	mg/L	0.046	101	70	130			
Sample ID: **H13090305-008DMSD2**		Sample Matrix Spike Duplicate				Run: ICP2-HE_131001A				10/01/13 19:53
Aluminum		25.9	mg/L	0.046	104	70	130	2.8	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 10/22/13

Project: Barker Hughsville Pilot **Work Order:** H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130918A
Sample ID: ICV STD	14	Initial Calibration Verification Standard								09/18/13 19:57
Aluminum		0.284	mg/L	0.10	95	90	110			
Arsenic		0.0578	mg/L	0.0050	96	90	110			
Barium		0.0596	mg/L	0.10	99	90	110			
Beryllium		0.0300	mg/L	0.0010	100	90	110			
Cadmium		0.0298	mg/L	0.0010	99	90	110			
Chromium		0.0610	mg/L	0.010	102	90	110			
Cobalt		0.0610	mg/L	0.010	102	90	110			
Copper		0.0627	mg/L	0.010	105	90	110			
Iron		0.320	mg/L	0.030	107	90	110			
Lead		0.0617	mg/L	0.010	103	90	110			
Nickel		0.0616	mg/L	0.010	103	90	110			
Potassium		2.92	mg/L	0.50	97	90	110			
Thallium		0.0586	mg/L	0.10	98	90	110			
Zinc		0.0613	mg/L	0.010	102	90	110			
Sample ID: ICSA	14	Interference Check Sample A								09/19/13 06:12
Aluminum		37.1	mg/L	0.10	93	70	130			
Arsenic		0.000217	mg/L	0.0050						
Barium		0.000183	mg/L	0.10						
Beryllium		1.30E-05	mg/L	0.0010						
Cadmium		0.00109	mg/L	0.0010						
Chromium		0.00120	mg/L	0.010						
Cobalt		0.000270	mg/L	0.010						
Copper		0.000140	mg/L	0.010						
Iron		97.6	mg/L	0.030	98	70	130			
Lead		0.000163	mg/L	0.010						
Nickel		0.000607	mg/L	0.010						
Potassium		37.2	mg/L	0.50	93	70	130			
Thallium		0.000165	mg/L	0.10						
Zinc		0.000910	mg/L	0.010						
Sample ID: ICSAB	14	Interference Check Sample AB								09/19/13 06:17
Aluminum		37.1	mg/L	0.10	93	70	130			
Arsenic		0.00995	mg/L	0.0050	100	70	130			
Barium		9.90E-05	mg/L	0.10		0	0			
Beryllium		1.00E-05	mg/L	0.0010		0	0			
Cadmium		0.0103	mg/L	0.0010	103	70	130			
Chromium		0.0214	mg/L	0.010	107	70	130			
Cobalt		0.0202	mg/L	0.010	101	70	130			
Copper		0.0203	mg/L	0.010	101	70	130			
Iron		96.4	mg/L	0.030	96	70	130			
Lead		0.000150	mg/L	0.010		0	0			
Nickel		0.0206	mg/L	0.010	103	70	130			
Potassium		37.2	mg/L	0.50	93	70	130			
Thallium		0.000115	mg/L	0.10		0	0			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 10/22/13

Project: Barker Hughsville Pilot **Work Order:** H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130918A
Sample ID: ICSAB	14	Interference Check Sample AB								09/19/13 06:17
Zinc		0.0111	mg/L	0.010	111	70	130			
Sample ID: ICV STD	14	Initial Calibration Verification Standard								09/19/13 14:22
Aluminum		0.289	mg/L	0.10	96	90	110			
Arsenic		0.0585	mg/L	0.0050	98	90	110			
Barium		0.0601	mg/L	0.10	100	90	110			
Beryllium		0.0300	mg/L	0.0010	100	90	110			
Cadmium		0.0313	mg/L	0.0010	104	90	110			
Chromium		0.0602	mg/L	0.010	100	90	110			
Cobalt		0.0655	mg/L	0.010	109	90	110			
Copper		0.0608	mg/L	0.010	101	90	110			
Iron		0.317	mg/L	0.030	106	90	110			
Lead		0.0601	mg/L	0.010	100	90	110			
Nickel		0.0602	mg/L	0.010	100	90	110			
Potassium		3.09	mg/L	0.50	103	90	110			
Thallium		0.0629	mg/L	0.10	105	90	110			
Zinc		0.0598	mg/L	0.010	100	90	110			
Sample ID: ICSA	14	Interference Check Sample A								09/19/13 14:27
Aluminum		37.1	mg/L	0.10	93	70	130			
Arsenic		0.000208	mg/L	0.0050						
Barium		0.000172	mg/L	0.10						
Beryllium		1.70E-05	mg/L	0.0010						
Cadmium		0.00110	mg/L	0.0010						
Chromium		0.00112	mg/L	0.010						
Cobalt		0.000303	mg/L	0.010						
Copper		0.000224	mg/L	0.010						
Iron		95.8	mg/L	0.030	96	70	130			
Lead		0.000183	mg/L	0.010						
Nickel		0.000551	mg/L	0.010						
Potassium		39.0	mg/L	0.50	97	70	130			
Thallium		0.000110	mg/L	0.10						
Zinc		0.00106	mg/L	0.010						
Sample ID: ICSAB	14	Interference Check Sample AB								09/19/13 14:31
Aluminum		37.5	mg/L	0.10	94	70	130			
Arsenic		0.0105	mg/L	0.0050	105	70	130			
Barium		0.000105	mg/L	0.10		0	0			
Beryllium		2.60E-05	mg/L	0.0010		0	0			
Cadmium		0.0108	mg/L	0.0010	108	70	130			
Chromium		0.0215	mg/L	0.010	107	70	130			
Cobalt		0.0219	mg/L	0.010	109	70	130			
Copper		0.0205	mg/L	0.010	103	70	130			
Iron		101	mg/L	0.030	101	70	130			
Lead		0.000140	mg/L	0.010		0	0			

Qualifiers:

RL - Analyte reporting limit. ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 10/22/13

Project: Barker Hughsville Pilot **Work Order:** H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**										Analytical Run: ICPMS204-B_130918A
Sample ID: **ICSAB**	14	Interference Check Sample AB								09/19/13 14:31
Nickel		0.0210	mg/L	0.010	105	70	130			
Potassium		41.5	mg/L	0.50	104	70	130			
Thallium		6.10E-05	mg/L	0.10		0	0			
Zinc		0.0110	mg/L	0.010	110	70	130			
Sample ID: **ICSA**	14	Interference Check Sample A								09/20/13 06:41
Aluminum		36.9	mg/L	0.10	92	70	130			
Arsenic		0.000233	mg/L	0.0050						
Barium		0.000149	mg/L	0.10						
Beryllium		6.20E-05	mg/L	0.0010						
Cadmium		0.00107	mg/L	0.0010						
Chromium		0.00119	mg/L	0.010						
Cobalt		0.000298	mg/L	0.010						
Copper		0.000291	mg/L	0.010						
Iron		103	mg/L	0.030	103	70	130			
Lead		0.000167	mg/L	0.010						
Nickel		0.000625	mg/L	0.010						
Potassium		41.1	mg/L	0.50	103	70	130			
Thallium		8.00E-05	mg/L	0.10						
Zinc		0.000951	mg/L	0.010						
Sample ID: **ICSAB**	14	Interference Check Sample AB								09/20/13 06:46
Aluminum		36.9	mg/L	0.10	92	70	130			
Arsenic		0.0111	mg/L	0.0050	111	70	130			
Barium		0.000124	mg/L	0.10		0	0			
Beryllium		3.30E-05	mg/L	0.0010		0	0			
Cadmium		0.0107	mg/L	0.0010	107	70	130			
Chromium		0.0211	mg/L	0.010	106	70	130			
Cobalt		0.0216	mg/L	0.010	108	70	130			
Copper		0.0205	mg/L	0.010	103	70	130			
Iron		100	mg/L	0.030	100	70	130			
Lead		0.000145	mg/L	0.010		0	0			
Nickel		0.0211	mg/L	0.010	106	70	130			
Potassium		41.0	mg/L	0.50	103	70	130			
Thallium		6.90E-05	mg/L	0.10		0	0			
Zinc		0.0117	mg/L	0.010	117	70	130			
Method: **E200.8**										Batch: R91408
Sample ID: **ICB**	14	Method Blank				Run: ICPMS204-B_130918A				09/19/13 15:14
Aluminum		ND	mg/L	0.0001						
Arsenic		ND	mg/L	7E-05						
Barium		ND	mg/L	5E-05						
Beryllium		ND	mg/L	2E-05						
Cadmium		ND	mg/L	7E-06						
Chromium		ND	mg/L	4E-05						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 10/22/13

Work Order: H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Batch: R91408
Sample ID: ICB	14	Method Blank				Run: ICPMS204-B_130918A				09/19/13 15:14
Cobalt		ND	mg/L	2E-05						
Copper		ND	mg/L	3E-05						
Iron		0.0007	mg/L	0.0002						
Lead		ND	mg/L	6E-06						
Nickel		ND	mg/L	6E-05						
Potassium		ND	mg/L	0.02						
Thallium		ND	mg/L	1E-05						
Zinc		ND	mg/L	0.0003						
Sample ID: LFB	14	Laboratory Fortified Blank				Run: ICPMS204-B_130918A				09/19/13 15:19
Aluminum		0.0513	mg/L	0.10	103	85	115			
Arsenic		0.0490	mg/L	0.0050	98	85	115			
Barium		0.0493	mg/L	0.10	99	85	115			
Beryllium		0.0504	mg/L	0.0010	101	85	115			
Cadmium		0.0507	mg/L	0.0010	101	85	115			
Chromium		0.0497	mg/L	0.010	99	85	115			
Cobalt		0.0544	mg/L	0.010	109	85	115			
Copper		0.0502	mg/L	0.010	100	85	115			
Iron		0.159	mg/L	0.030	106	85	115			
Lead		0.0501	mg/L	0.010	100	85	115			
Nickel		0.0508	mg/L	0.010	102	85	115			
Potassium		1.02	mg/L	0.50	102	85	115			
Thallium		0.0517	mg/L	0.10	103	85	115			
Zinc		0.0502	mg/L	0.010	100	85	115			
Sample ID: H13090305-003BMS	14	Sample Matrix Spike				Run: ICPMS204-B_130918A				09/20/13 09:37
Aluminum		10.3	mg/L	0.030		70	130			A
Arsenic		0.102	mg/L	0.0010	99	70	130			
Barium		0.0677	mg/L	0.050	92	70	130			
Beryllium		0.0503	mg/L	0.0010	88	70	130			
Cadmium		0.136	mg/L	0.0010	73	70	130			
Chromium		0.0529	mg/L	0.0050	93	70	130			
Cobalt		0.0877	mg/L	0.0050	97	70	130			
Copper		0.695	mg/L	0.0050		70	130			A
Iron		101	mg/L	0.030		70	130			A
Lead		0.228	mg/L	0.0010	89	70	130			
Nickel		0.0719	mg/L	0.0050	91	70	130			
Potassium		1.73	mg/L	1.0	96	70	130			
Thallium		0.0542	mg/L	0.00050	104	70	130			
Zinc		42.3	mg/L	0.010		70	130			A
Sample ID: H13090305-003BMSD	14	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130918A				09/20/13 09:42
Aluminum		10.4	mg/L	0.030		70	130	1.5	20	A
Arsenic		0.103	mg/L	0.0010	102	70	130	1.6	20	
Barium		0.0682	mg/L	0.050	93	70	130	0.8	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 10/22/13

Project: Barker Hughsville Pilot **Work Order:** H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Batch: R91408
Sample ID: H13090305-003BMSD	14	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130918A				09/20/13 09:42
Beryllium		0.0521	mg/L	0.0010	91	70	130	3.6	20	
Cadmium		0.137	mg/L	0.0010	75	70	130	0.7	20	
Chromium		0.0535	mg/L	0.0050	94	70	130	1.1	20	
Cobalt		0.0905	mg/L	0.0050	102	70	130	3.2	20	
Copper		0.715	mg/L	0.0050		70	130	2.9	20	A
Iron		101	mg/L	0.030		70	130	0.0	20	A
Lead		0.233	mg/L	0.0010	97	70	130	1.9	20	
Nickel		0.0739	mg/L	0.0050	95	70	130	2.7	20	
Potassium		1.77	mg/L	1.0	100	70	130	2.3	20	
Thallium		0.0558	mg/L	0.00050	107	70	130	3.0	20	
Zinc		42.7	mg/L	0.010		70	130	0.8	20	A

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 10/22/13

Work Order: H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130924A
Sample ID: ICV STD	5	Initial Calibration Verification Standard								09/24/13 14:11
Aluminum		0.287	mg/L	0.10	96	90	110			
Arsenic		0.0580	mg/L	0.0050	97	90	110			
Cobalt		0.0589	mg/L	0.010	98	90	110			
Copper		0.0600	mg/L	0.010	100	90	110			
Thallium		0.0579	mg/L	0.10	97	90	110			
Sample ID: ICSA	5	Interference Check Sample A								09/24/13 14:15
Aluminum		34.8	mg/L	0.10	87	70	130			
Arsenic		-7.90E-05	mg/L	0.0050						
Cobalt		0.000225	mg/L	0.010						
Copper		0.000341	mg/L	0.010						
Thallium		3.70E-05	mg/L	0.10						
Sample ID: ICSAB	5	Interference Check Sample AB								09/24/13 14:19
Aluminum		35.0	mg/L	0.10	87	70	130			
Arsenic		0.00944	mg/L	0.0050	94	70	130			
Cobalt		0.0187	mg/L	0.010	94	70	130			
Copper		0.0184	mg/L	0.010	92	70	130			
Thallium		1.90E-05	mg/L	0.10		0	0			
Sample ID: ICV STD	5	Initial Calibration Verification Standard								09/24/13 17:44
Aluminum		0.287	mg/L	0.10	96	90	110			
Arsenic		0.0580	mg/L	0.0050	97	90	110			
Cobalt		0.0611	mg/L	0.010	102	90	110			
Copper		0.0607	mg/L	0.010	101	90	110			
Thallium		0.0571	mg/L	0.10	95	90	110			
Sample ID: ICSA	5	Interference Check Sample A								09/24/13 17:49
Aluminum		36.3	mg/L	0.10	91	70	130			
Arsenic		9.30E-05	mg/L	0.0050						
Cobalt		0.000360	mg/L	0.010						
Copper		0.000267	mg/L	0.010						
Thallium		3.40E-05	mg/L	0.10						
Sample ID: ICSAB	5	Interference Check Sample AB								09/24/13 17:53
Aluminum		37.0	mg/L	0.10	92	70	130			
Arsenic		0.0102	mg/L	0.0050	102	70	130			
Cobalt		0.0203	mg/L	0.010	102	70	130			
Copper		0.0199	mg/L	0.010	99	70	130			
Thallium		2.30E-05	mg/L	0.10		0	0			
Sample ID: ICSA	5	Interference Check Sample A								09/25/13 08:36
Aluminum		40.4	mg/L	0.10	101	70	130			
Arsenic		0.000138	mg/L	0.0050						
Cobalt		0.000360	mg/L	0.010						
Copper		0.000136	mg/L	0.010						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 10/22/13
Project: Barker Hughsville Pilot
Work Order: H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**										Analytical Run: ICPMS204-B_130924A
Sample ID: **ICSA**	5	Interference Check Sample A								09/25/13 08:36
Thallium		2.40E-05	mg/L	0.10						
Sample ID: **ICSAB**	5	Interference Check Sample AB								09/25/13 08:40
Aluminum		40.0	mg/L	0.10	100	70	130			
Arsenic		0.0112	mg/L	0.0050	113	70	130			
Cobalt		0.0212	mg/L	0.010	106	70	130			
Copper		0.0203	mg/L	0.010	102	70	130			
Thallium		2.30E-05	mg/L	0.10		0	0			
Sample ID: **ICV STD**	5	Initial Calibration Verification Standard								09/25/13 09:31
Aluminum		0.315	mg/L	0.10	105	90	110			
Arsenic		0.0604	mg/L	0.0050	101	90	110			
Cobalt		0.0614	mg/L	0.010	102	90	110			
Copper		0.0631	mg/L	0.010	105	90	110			
Thallium		0.0629	mg/L	0.10	105	90	110			
Sample ID: **ICSA**	5	Interference Check Sample A								09/25/13 09:35
Aluminum		37.6	mg/L	0.10	94	70	130			
Arsenic		0.000103	mg/L	0.0050						
Cobalt		0.000311	mg/L	0.010						
Copper		0.000250	mg/L	0.010						
Thallium		3.80E-05	mg/L	0.10						
Sample ID: **ICSAB**	5	Interference Check Sample AB								09/25/13 09:40
Aluminum		37.4	mg/L	0.10	94	70	130			
Arsenic		0.0109	mg/L	0.0050	109	70	130			
Cobalt		0.0201	mg/L	0.010	101	70	130			
Copper		0.0209	mg/L	0.010	104	70	130			
Thallium		2.20E-05	mg/L	0.10		0	0			
Method: **E200.8**										Batch: R91546
Sample ID: **ICB**	5	Method Blank				Run: ICPMS204-B_130924A				09/24/13 18:20
Aluminum		0.0002	mg/L	0.0001						
Arsenic		ND	mg/L	7E-05						
Cobalt		ND	mg/L	2E-05						
Copper		8E-05	mg/L	3E-05						
Thallium		ND	mg/L	1E-05						
Sample ID: **LFB**	5	Laboratory Fortified Blank				Run: ICPMS204-B_130924A				09/24/13 18:25
Aluminum		0.0501	mg/L	0.10	100	85	115			
Arsenic		0.0482	mg/L	0.0050	96	85	115			
Cobalt		0.0517	mg/L	0.010	103	85	115			
Copper		0.0494	mg/L	0.010	99	85	115			
Thallium		0.0505	mg/L	0.10	101	85	115			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 10/22/13

Work Order: H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**									Batch: R91546	
Sample ID: **H13090305-001BMS**	5	Sample Matrix Spike				Run: ICPMS204-B_130924A			09/24/13 18:52	
Aluminum		0.302	mg/L	0.030	95	70	130			
Arsenic		0.245	mg/L	0.0010	97	70	130			
Cobalt		0.276	mg/L	0.0050	97	70	130			
Copper		0.247	mg/L	0.0050	98	70	130			
Thallium		0.253	mg/L	0.00050	101	70	130			
Sample ID: **H13090305-001BMSD**	5	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130924A			09/24/13 18:56	
Aluminum		0.290	mg/L	0.030	90	70	130	4.0	20	
Arsenic		0.238	mg/L	0.0010	95	70	130	2.6	20	
Cobalt		0.261	mg/L	0.0050	91	70	130	5.6	20	
Copper		0.239	mg/L	0.0050	95	70	130	3.1	20	
Thallium		0.244	mg/L	0.00050	98	70	130	3.4	20	
Sample ID: **H13090330-001AMS**	5	Sample Matrix Spike				Run: ICPMS204-B_130924A			09/24/13 20:03	
Aluminum		0.0507	mg/L	0.030	100	70	130			
Arsenic		0.0505	mg/L	0.0010	100	70	130			
Cobalt		0.0499	mg/L	0.0050	99	70	130			
Copper		0.0994	mg/L	0.0050	90	70	130			
Thallium		0.0532	mg/L	0.00050	106	70	130			
Sample ID: **H13090330-001AMSD**	5	Sample Matrix Spike Duplicate				Run: ICPMS204-B_130924A			09/24/13 20:07	
Aluminum		0.0508	mg/L	0.030	100	70	130	0.1	20	
Arsenic		0.0540	mg/L	0.0010	107	70	130	6.7	20	
Cobalt		0.0512	mg/L	0.0050	102	70	130	2.6	20	
Copper		0.106	mg/L	0.0050	103	70	130	6.3	20	
Thallium		0.0542	mg/L	0.00050	108	70	130	2.0	20	
Sample ID: **LFB**	5	Laboratory Fortified Blank				Run: ICPMS204-B_130924A			09/25/13 12:27	
Aluminum		0.0490	mg/L	0.10	98	85	115			
Arsenic		0.0488	mg/L	0.0050	98	85	115			
Cobalt		0.0498	mg/L	0.010	100	85	115			
Copper		0.0500	mg/L	0.010	100	85	115			
Thallium		0.0502	mg/L	0.10	100	85	115			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 10/22/13
Project: Barker Hughsville Pilot
Work Order: H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**										Analytical Run: ICPMS204-B_130927A
Sample ID: **ICV STD**		Initial Calibration Verification Standard							09/27/13 18:17	
Silver		0.0297	mg/L	0.0050	99	90	110			
Sample ID: **ICSA**		Interference Check Sample A							09/27/13 18:23	
Silver		0.000120	mg/L	0.0050						
Sample ID: **ICSAB**		Interference Check Sample AB							09/27/13 18:30	
Silver		0.0190	mg/L	0.0050	95	70	130			
Sample ID: **ICV STD**		Initial Calibration Verification Standard							09/28/13 00:44	
Silver		0.0291	mg/L	0.0050	97	90	110			
Sample ID: **ICSA**		Interference Check Sample A							09/28/13 00:51	
Silver		0.000181	mg/L	0.0050						
Sample ID: **ICSAB**		Interference Check Sample AB							09/28/13 00:57	
Silver		0.0180	mg/L	0.0050	90	70	130			
Sample ID: **ICSA**		Interference Check Sample A							09/28/13 14:24	
Silver		7.90E-05	mg/L	0.0050						
Sample ID: **ICSAB**		Interference Check Sample AB							09/28/13 14:31	
Silver		0.0181	mg/L	0.0050	91	70	130			
Method: **E200.8**										Batch: R91637
Sample ID: **ICB**		Method Blank				Run: ICPMS204-B_130927A			09/27/13 19:09	
Silver		5E-05	mg/L	4E-05						
Sample ID: **LFB**		Laboratory Fortified Blank				Run: ICPMS204-B_130927A			09/27/13 19:15	
Silver		0.0191	mg/L	0.0050	95	85	115			
Sample ID: **H13090286-001BMS**		Sample Matrix Spike				Run: ICPMS204-B_130927A			09/27/13 20:46	
Silver		0.0377	mg/L	0.0010	94	70	130			
Sample ID: **H13090286-001BMSD**		Sample Matrix Spike Duplicate				Run: ICPMS204-B_130927A			09/27/13 20:53	
Silver		0.0379	mg/L	0.0010	95	70	130	0.6	20	
Sample ID: **H13090384-008BMS**		Sample Matrix Spike				Run: ICPMS204-B_130927A			09/27/13 22:35	
Silver		0.0150	mg/L	0.0010	75	70	130			
Sample ID: **H13090384-008BMSD**		Sample Matrix Spike Duplicate				Run: ICPMS204-B_130927A			09/27/13 22:42	
Silver		0.0149	mg/L	0.0010	75	70	130	0.4	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs — **Report Date:** 10/22/13

Project: Barker Hughsville Pilot — **Work Order:** H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Analytical Run: ICPMS204-B_130930A
Sample ID: ICV STD		Initial Calibration Verification Standard								09/30/13 11:38
Silver		0.0298	mg/L	0.0050	99	90	110			
Sample ID: ICSA		Interference Check Sample A								09/30/13 11:45
Silver		4.00E-05	mg/L	0.0050						
Sample ID: ICSAB		Interference Check Sample AB								09/30/13 11:51
Silver		0.0200	mg/L	0.0050	100	70	130			
Sample ID: ICSA		Interference Check Sample A								09/30/13 15:57
Silver		0.000426	mg/L	0.0050						
Sample ID: ICSAB		Interference Check Sample AB								09/30/13 16:04
Silver		0.0189	mg/L	0.0050	94	70	130			
Sample ID: ICV STD		Initial Calibration Verification Standard								09/30/13 16:23
Silver		0.0299	mg/L	0.0050	100	90	110			
Sample ID: ICSA		Interference Check Sample A								10/01/13 11:58
Silver		0.000214	mg/L	0.0050						
Sample ID: ICSAB		Interference Check Sample AB								10/01/13 12:04
Silver		0.0190	mg/L	0.0050	95	70	130			
Sample ID: ICV STD		Initial Calibration Verification Standard								10/01/13 16:37
Silver		0.0297	mg/L	0.0050	99	90	110			
Sample ID: ICSA		Interference Check Sample A								10/01/13 16:43
Silver		0.000198	mg/L	0.0050						
Sample ID: ICSAB		Interference Check Sample AB								10/01/13 16:50
Silver		0.0192	mg/L	0.0050	96	70	130			
Sample ID: ICV STD		Initial Calibration Verification Standard								10/02/13 12:01
Silver		0.0305	mg/L	0.0050	102	90	110			
Sample ID: ICSA		Interference Check Sample A								10/02/13 12:07
Silver		0.000213	mg/L	0.0050						
Sample ID: ICSAB		Interference Check Sample AB								10/02/13 12:14
Silver		0.0191	mg/L	0.0050	96	70	130			
Sample ID: ICSA		Interference Check Sample A								10/03/13 01:18
Silver		0.000457	mg/L	0.0050						
Sample ID: ICSAB		Interference Check Sample AB								10/03/13 01:24
Silver		0.0196	mg/L	0.0050	98	70	130			
Sample ID: ICV STD		Initial Calibration Verification Standard								10/03/13 09:35
Silver		0.0306	mg/L	0.0050	102	90	110			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 10/22/13

Project: Barker Hughsville Pilot **Work Order:** H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E200.8**										Analytical Run: ICPMS204-B_130930A
Sample ID: **ICSA**		Interference Check Sample A								10/03/13 09:42
Silver		0.000179	mg/L	0.0050						
Sample ID: **ICSAB**		Interference Check Sample AB								10/03/13 09:48
Silver		0.0193	mg/L	0.0050	97	70	130			
Method: **E200.8**										Batch: R91671
Sample ID: **ICB**		Method Blank				Run: ICPMS204-B_130930A				09/30/13 12:31
Silver		ND	mg/L	4E-05						
Sample ID: **LFB**		Laboratory Fortified Blank				Run: ICPMS204-B_130930A				09/30/13 12:37
Silver		0.0195	mg/L	0.0050	98	85	115			
Sample ID: **H13090305-003CMS**		Sample Matrix Spike				Run: ICPMS204-B_130930A				09/30/13 17:41
Silver		0.0801	mg/L	0.0010	80	70	130			
Sample ID: **H13090305-003CMSD**		Sample Matrix Spike Duplicate				Run: ICPMS204-B_130930A				09/30/13 17:47
Silver		0.0800	mg/L	0.0010	80	70	130	0.1	20	
Sample ID: **ICB**		Method Blank				Run: ICPMS204-B_130930A				10/02/13 02:05
Silver		ND	mg/L	4E-05						
Sample ID: **LFB**		Laboratory Fortified Blank				Run: ICPMS204-B_130930A				10/02/13 02:12
Silver		0.0191	mg/L	0.0050	95	85	115			
Sample ID: **H13090283-006CMS**		Sample Matrix Spike				Run: ICPMS204-B_130930A				10/02/13 06:17
Silver		0.0182	mg/L	0.0010	91	70	130			
Sample ID: **H13090283-006CMSD**		Sample Matrix Spike Duplicate				Run: ICPMS204-B_130930A				10/02/13 06:24
Silver		0.0186	mg/L	0.0010	93	70	130	2.4	20	

Qualifiers:

RL - Analyte reporting limit.	ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 10/22/13
Work Order: H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E300.0										Analytical Run: IC102-H_130919A
Sample ID: ICV	2	Initial Calibration Verification Standard								09/19/13 10:26
Chloride		100	mg/L	1.0	100	90	110			
Sulfate		410	mg/L	1.0	102	90	110			
Sample ID: CCV091913-1	2	Continuing Calibration Verification Standard								09/19/13 11:04
Chloride		100	mg/L	1.0	101	90	110			
Sulfate		410	mg/L	1.0	104	90	110			
Method: E300.0										Batch: R91429
Sample ID: ICB	2	Method Blank				Run: IC102-H_130919A				09/19/13 10:38
Chloride		ND	mg/L	0.008						
Sulfate		ND	mg/L	0.08						
Sample ID: LFB	2	Laboratory Fortified Blank				Run: IC102-H_130919A				09/19/13 10:51
Chloride		49	mg/L	1.0	98	90	110			
Sulfate		200	mg/L	1.0	101	90	110			
Sample ID: H13090315-001AMS	2	Sample Matrix Spike				Run: IC102-H_130919A				09/19/13 15:07
Chloride		61	mg/L	1.0	93	90	110			
Sulfate		950	mg/L	1.0	109	90	110			
Sample ID: H13090315-001AMSD	2	Sample Matrix Spike Duplicate				Run: IC102-H_130919A				09/19/13 15:19
Chloride		61	mg/L	1.0	94	90	110	0.7	20	
Sulfate		950	mg/L	1.0	109	90	110	0.0	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 10/22/13
Project: Barker Hughsville Pilot **Work Order:** H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E300.0										Analytical Run: IC102-H_130930A
Sample ID: ICV	2	Initial Calibration Verification Standard								09/30/13 14:39
Chloride		100	mg/L	1.0	103	90	110			
Sulfate		410	mg/L	1.0	103	90	110			
Sample ID: CCV093013-1	2	Continuing Calibration Verification Standard								09/30/13 15:17
Chloride		100	mg/L	1.0	104	90	110			
Sulfate		420	mg/L	1.0	104	90	110			
Method: E300.0										Batch: R91749
Sample ID: ICB	2	Method Blank				Run: IC102-H_130930A				09/30/13 14:51
Chloride		ND	mg/L	0.008						
Sulfate		0.1	mg/L	0.08						
Sample ID: LFB	2	Laboratory Fortified Blank				Run: IC102-H_130930A				09/30/13 15:49
Chloride		50	mg/L	1.0	101	90	110			
Sulfate		200	mg/L	1.0	101	90	110			
Sample ID: H13090381-012AMS	2	Sample Matrix Spike				Run: IC102-H_130930A				09/30/13 18:07
Chloride		58	mg/L	1.0	103	90	110			
Sulfate		260	mg/L	1.0	105	90	110			
Sample ID: H13090381-012AMSD	2	Sample Matrix Spike Duplicate				Run: IC102-H_130930A				09/30/13 18:20
Chloride		59	mg/L	1.0	104	90	110	1.2	20	
Sulfate		260	mg/L	1.0	105	90	110	0.0	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 10/22/13

Project: Barker Hughsville Pilot **Work Order:** H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E350.1										Analytical Run: FIA203-HE_130917A
Sample ID: ICV		Initial Calibration Verification Standard								09/17/13 14:34
Nitrogen, Ammonia as N		5.38	mg/L	0.25	95	90	110			
Sample ID: ICB		Initial Calibration Blank, Instrument Blank								09/17/13 14:37
Nitrogen, Ammonia as N		-0.0489	mg/L	0.050		0	0			
Sample ID: CCV		Continuing Calibration Verification Standard								09/17/13 16:08
Nitrogen, Ammonia as N		0.481	mg/L	0.050	96	90	110			
Method: E350.1										Batch: R91359
Sample ID: LFB		Laboratory Fortified Blank				Run: FIA203-HE_130917A				09/17/13 14:35
Nitrogen, Ammonia as N		1.03	mg/L	0.055	103	90	110			
Sample ID: H13090306-001CMS		Sample Matrix Spike				Run: FIA203-HE_130917A				09/17/13 16:10
Nitrogen, Ammonia as N		1.06	mg/L	0.055	103	80	120			
Sample ID: H13090306-001CMSD		Sample Matrix Spike Duplicate				Run: FIA203-HE_130917A				09/17/13 16:11
Nitrogen, Ammonia as N		1.06	mg/L	0.055	103	80	120	0.0	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 10/22/13
Work Order: H13090305

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E365.1										Analytical Run: FIA202-HE_130918D
Sample ID: ICV		Initial Calibration Verification Standard							09/18/13 10:51	
Phosphorus, Orthophosphate as P		0.239	mg/L	0.0050	96	90	110			
Sample ID: ICB		Initial Calibration Blank, Instrument Blank							09/18/13 10:52	
Phosphorus, Orthophosphate as P		-0.000750	mg/L	0.0050		0	0			
Sample ID: CCV		Continuing Calibration Verification Standard							09/18/13 10:54	
Phosphorus, Orthophosphate as P		0.105	mg/L	0.0050	105	90	110			
Method: E365.1										Batch: R91376
Sample ID: LFB		Laboratory Fortified Blank				Run: FIA202-HE_130918D			09/18/13 10:53	
Phosphorus, Orthophosphate as P		0.187	mg/L	0.0050	93	90	110			
Sample ID: H13090305-006AMS		Sample Matrix Spike				Run: FIA202-HE_130918D			09/18/13 10:57	
Phosphorus, Orthophosphate as P		1.71	mg/L	0.010	83	90	110			S
Sample ID: H13090305-006AMSD		Sample Matrix Spike Duplicate				Run: FIA202-HE_130918D			09/18/13 10:58	
Phosphorus, Orthophosphate as P		1.80	mg/L	0.010	88	90	110	4.9	20	S

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

Standard Reporting Procedures

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Workorder Receipt Checklist

CDM Federal Programs H13090305

Login completed by: Tracy L. Lorash
Reviewed by: BL2000\jweidemoyer
Reviewed Date: 9/19/2013

Date Received: 9/17/2013
Received by: elm
Carrier name: Hand Del

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Applicable ☐
Container/Temp Blank temperature:	4.4℃ On Ice		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Contact and Corrective Action Comments:

None

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

Page 1 of 1

PLEASE PRINT- Provide as much information as possible.

Company Name:
CDM Smith

Project Name, PWS, Permit, Etc.
Barker Hughesville

Sample Origin
State: Montana

EPA/State Compliance:
Yes ☐ No X

Report Mail Address:
50 W 14th Street, Suite 200
Helena, MT 59601

Contact Name:
Angela Frandsen

Phone/Fax:
406-441-1435

Email:
frandsenak@cdmsmith.com

Sampler: (Please Print)
Angela Frandsen

Invoice Address:
Contact Raquel Cisneros 720-264-1148

Invoice Contact & Phone:
Contact Raquel Cisneros 720-264-1148

Purchase Order:

Quote/Bottle Order:

Special Report/Formats – ELI must be notified prior to sample submittal for the following:

☐ DW
☐ GSA
☐ POTW/WWTP
☐ State: __________
☐ Other: __________

☐ A2LA
x EDD/EDT(Electronic Data)
Format: excel
☐ LEVEL IV
☐ NELAC

Number of Containers
Sample Type: A W S V B O
Air Water Soils/Solids
Vegetation Bioassay Other

ANALYSIS REQUESTED

R U S H

Contact ELI prior to **RUSH** sample submittal for charges and scheduling – See Instruction Page

Comments:
10 day TAT
Pull phosphate from 1 L bottle

Shipped by: Hand

Cooler ID(s): 4

Receipt Temp 4.4 °C TB

On Ice: [✓ Yes] No

Custody Seal Y [✓ N]

Intact Y N

Signature Match Y N

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	Dissolved Metals	Total Metals	Sulfide	Orthophosphate	Alkalinity and Acidity	SO4, Cl, F, TDS	BOD	Ammonia		SEE ATTACHED	Normal Turnaround (TAT)	LABORATORY USE ONLY
13BH-DT-PILOT-BCR2-091613	09/16/13	1215	5 W	X		X	X	X	X	X	X				H13090305
13BH-DT-PILOT-INFL-091613	09/16/13	1240	2 W	X			X	X	X						
13BH-DT-PILOT-SAPS-091613	09/16/13	1250	2 W	X			X	X	X						
13BH-DT-PILOT-CHIT-091613	09/16/13	1300	2 W	X			X	X	X						
13BH-DT-PILOT-MGOH-091613	09/16/13	1330	2 W	X			X	X	X						
13BH-DT-PILOT-BCR1-091613	09/16/13	1340	3 W	X		X	X	X	X						
13BH-DT-PILOT-BCR3-091613	09/16/13	1350	3 W	X		X	X	X	X						
13BH-DT-PILOT-BDR3-091613	09/16/13	1355	3 W	X		X	X	X	X						
13BH-DT-PILOT-BCR4-091613	09/16/13	1405	3 W	X		X	X	X	X						
13BH-DT-PILOT-BCR2-POST-091613	09/16/13	1415	3 W			X				X	X				

Custody Record MUST be Signed

Relinquished by (print): Lauren Helland Date/Time: 09/16/13 Signature: Lauren Helland

Received by (print): Angela Frandsen Date/Time: 9/18/13 19:00 Signature:

Relinquished by (print): Angela Frandsen Date/Time: 9/17/13 11:45 Signature:

Received by (print): Date/Time: Signature:

Sample Disposal: Return to Client: ________ Lab Disposal: ________

Received by Laboratory: Esther Merritt Date/Time: 9.17.13 11:45 Signature:

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested.
This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.
Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

ANALYTICAL SUMMARY REPORT

October 23, 2013

CDM Federal Programs
555 17th St Ste 1100
Denver, CO 80202

Workorder No.: H13090479 Quote ID: H823 - Baker-Hughsville Superfund Site

Project Name: Barker Hughsville Pilot

Energy Laboratories Inc Helena MT received the following 4 samples for CDM Federal Programs on 9/24/2013 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H13090479-001	13BH-DT-PILOT-COMP-SPLP	09/24/13 14:00	09/24/13	Solid	Metals by ICP/ICPMS, Total SPLP Extraction, Regular
H13090479-002	13BH-DT-PILOT-WOOD-SPLP	09/24/13 14:05	09/24/13	Solid	Same As Above
H13090479-003	13BH-DT-PILOT-SDST-SPLP	09/24/13 14:10	09/24/13	Solid	Same As Above
H13090479-004	13BH-DT-PILOT-CHIT-SPLP	09/24/13 14:15	09/24/13	Solid	Same As Above

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By:

CLIENT: CDM Federal Programs
Project: Barker Hughsville Pilot
Sample Delivery Group: H13090479

Report Date: 10/23/13

CASE NARRATIVE

Tests associated with analyst identified as ELI-B were subcontracted to Energy Laboratories, 1120 S. 27th St., Billings, MT, EPA Number MT00005.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	10/23/13
Project:	Barker Hughsville Pilot	**Collection Date:**	09/24/13 14:00
Lab ID:	H13090479-001	**DateReceived:**	09/24/13
Client Sample ID	13BH-DT-PILOT-COMP-SPLP	**Matrix:**	Solid

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
SPLP EXTRACTABLE CONSTITUENTS							
Aluminum	4.5	mg/L		0.03		SW6020	10/09/13 11:28 / eli-b
Beryllium	ND	mg/L		0.001		SW6020	10/09/13 11:28 / eli-b
Calcium	16	mg/L		1		SW6010B	10/09/13 23:00 / eli-b22
Cobalt	ND	mg/L		0.005		SW6020	10/09/13 11:28 / eli-b
Copper	0.018	mg/L		0.005		SW6020	10/09/13 11:28 / eli-b
Iron	3.7	mg/L		0.03		SW6010B	10/09/13 23:00 / eli-b22
Magnesium	5	mg/L		1		SW6010B	10/09/13 23:00 / eli-b22
Manganese	0.30	mg/L		0.001		SW6020	10/09/13 11:28 / eli-b
Nickel	0.007	mg/L		0.005		SW6020	10/09/13 11:28 / eli-b
Potassium	25	mg/L		1		SW6010B	10/09/13 23:00 / eli-b22
Thallium	ND	mg/L		0.0005		SW6020	10/09/13 11:28 / eli-b
Zinc	0.10	mg/L		0.01		SW6020	10/09/13 11:28 / eli-b
Arsenic	0.027	mg/L	D	0.002		SW6020	10/09/13 11:28 / eli-b
Barium	0.50	mg/L		0.05		SW6020	10/09/13 11:28 / eli-b
Cadmium	ND	mg/L		0.001		SW6020	10/09/13 11:28 / eli-b
Chromium	0.010	mg/L		0.005		SW6020	10/09/13 11:28 / eli-b
Lead	0.011	mg/L		0.001		SW6020	10/09/13 11:28 / eli-b
Silver	ND	mg/L		0.001		SW6020	10/09/13 11:28 / eli-b
Sodium	59	mg/L	D	10		SW6010B	10/09/13 23:00 / eli-b22

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13090479-002
Client Sample ID 13BH-DT-PILOT-WOOD-SPLP

Report Date: 10/23/13
Collection Date: 09/24/13 14:05
DateReceived: 09/24/13
Matrix: Solid

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
SPLP EXTRACTABLE CONSTITUENTS							
Aluminum	0.23	mg/L		0.03		SW6020	10/09/13 11:31 / eli-b
Beryllium	ND	mg/L		0.001		SW6020	10/09/13 11:31 / eli-b
Calcium	17	mg/L		1		SW6010B	10/09/13 23:08 / eli-b22
Cobalt	ND	mg/L		0.005		SW6020	10/09/13 11:31 / eli-b
Copper	0.012	mg/L		0.005		SW6020	10/09/13 11:31 / eli-b
Iron	0.25	mg/L		0.03		SW6010B	10/09/13 23:08 / eli-b22
Magnesium	5	mg/L		1		SW6010B	10/09/13 23:08 / eli-b22
Manganese	0.54	mg/L		0.001		SW6020	10/09/13 11:31 / eli-b
Nickel	ND	mg/L		0.005		SW6020	10/09/13 11:31 / eli-b
Potassium	32	mg/L		1		SW6010B	10/09/13 23:08 / eli-b22
Thallium	ND	mg/L		0.0005		SW6020	10/09/13 11:31 / eli-b
Zinc	0.08	mg/L		0.01		SW6020	10/09/13 11:31 / eli-b
Arsenic	0.006	mg/L	D	0.002		SW6020	10/09/13 11:31 / eli-b
Barium	0.17	mg/L		0.05		SW6020	10/09/13 11:31 / eli-b
Cadmium	0.001	mg/L		0.001		SW6020	10/09/13 11:31 / eli-b
Chromium	0.008	mg/L		0.005		SW6020	10/09/13 11:31 / eli-b
Lead	0.008	mg/L		0.001		SW6020	10/09/13 11:31 / eli-b
Silver	ND	mg/L		0.001		SW6020	10/09/13 11:31 / eli-b
Sodium	53	mg/L	D	10		SW6010B	10/09/13 23:08 / eli-b22

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	10/23/13
Project:	Barker Hughsville Pilot	**Collection Date:**	09/24/13 14:10
Lab ID:	H13090479-003	**DateReceived:**	09/24/13
Client Sample ID	13BH-DT-PILOT-SDST-SPLP	**Matrix:**	Solid

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
SPLP EXTRACTABLE CONSTITUENTS							
Aluminum	0.98	mg/L		0.03		SW6020	10/09/13 11:34 / eli-b
Beryllium	ND	mg/L		0.001		SW6020	10/09/13 11:34 / eli-b
Calcium	6	mg/L		1		SW6010B	10/09/13 23:15 / eli-b22
Cobalt	ND	mg/L		0.005		SW6020	10/09/13 11:34 / eli-b
Copper	0.009	mg/L		0.005		SW6020	10/09/13 11:34 / eli-b
Iron	0.93	mg/L		0.03		SW6010B	10/09/13 23:15 / eli-b22
Magnesium	1	mg/L		1		SW6010B	10/09/13 23:15 / eli-b22
Manganese	0.021	mg/L		0.001		SW6020	10/09/13 11:34 / eli-b
Nickel	ND	mg/L		0.005		SW6020	10/09/13 11:34 / eli-b
Potassium	2	mg/L		1		SW6010B	10/09/13 23:15 / eli-b22
Thallium	ND	mg/L		0.0005		SW6020	10/09/13 11:34 / eli-b
Zinc	0.06	mg/L		0.01		SW6020	10/09/13 11:34 / eli-b
Arsenic	0.003	mg/L	D	0.002		SW6020	10/09/13 11:34 / eli-b
Barium	0.18	mg/L		0.05		SW6020	10/09/13 11:34 / eli-b
Cadmium	ND	mg/L		0.001		SW6020	10/09/13 11:34 / eli-b
Chromium	0.008	mg/L		0.005		SW6020	10/09/13 11:34 / eli-b
Lead	0.002	mg/L		0.001		SW6020	10/09/13 11:34 / eli-b
Silver	ND	mg/L		0.001		SW6020	10/09/13 11:34 / eli-b
Sodium	63	mg/L	D	10		SW6010B	10/09/13 23:15 / eli-b22

Report Definitions:

RL - Analyte reporting limit.

QCL - Quality control limit.

D - RL increased due to sample matrix.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot
Lab ID: H13090479-004
Client Sample ID 13BH-DT-PILOT-CHIT-SPLP

Report Date: 10/23/13
Collection Date: 09/24/13 14:15
DateReceived: 09/24/13
Matrix: Solid

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
SPLP EXTRACTABLE CONSTITUENTS							
Aluminum	0.29	mg/L		0.03		SW6020	10/09/13 11:37 / eli-b
Beryllium	ND	mg/L		0.001		SW6020	10/09/13 11:37 / eli-b
Calcium	890	mg/L		1		SW6010B	10/09/13 23:31 / eli-b22
Cobalt	0.072	mg/L		0.005		SW6020	10/09/13 11:37 / eli-b
Copper	0.84	mg/L		0.005		SW6020	10/09/13 11:37 / eli-b
Iron	2.0	mg/L		0.03		SW6010B	10/09/13 23:31 / eli-b22
Magnesium	470	mg/L		1		SW6010B	10/09/13 23:31 / eli-b22
Manganese	0.092	mg/L		0.001		SW6020	10/09/13 11:37 / eli-b
Nickel	0.68	mg/L		0.005		SW6020	10/09/13 11:37 / eli-b
Potassium	870	mg/L		1		SW6010B	10/09/13 23:31 / eli-b22
Thallium	ND	mg/L		0.0005		SW6020	10/09/13 11:37 / eli-b
Zinc	1.9	mg/L		0.01		SW6020	10/09/13 11:37 / eli-b
Arsenic	1.6	mg/L	D	0.004		SW6020	10/09/13 11:37 / eli-b
Barium	2.0	mg/L		0.05		SW6020	10/09/13 11:37 / eli-b
Cadmium	0.19	mg/L		0.001		SW6020	10/09/13 11:37 / eli-b
Chromium	0.054	mg/L		0.005		SW6020	10/09/13 11:37 / eli-b
Lead	0.003	mg/L		0.001		SW6020	10/09/13 11:37 / eli-b
Silver	0.002	mg/L		0.001		SW6020	10/09/13 11:37 / eli-b
Sodium	3700	mg/L	D	20		SW6010B	10/09/13 23:31 / eli-b22

Report Definitions:

RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 10/23/13
Project: Barker Hughsville Pilot **Work Order:** H13090479

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B									Analytical Run: SUB-B213043
Sample ID: QCS	Initial Calibration Verification Standard								10/09/13 11:40
Calcium	40	mg/L	1.0	100	90	110			
Iron	4.0	mg/L	0.030	100	90	110			
Magnesium	40	mg/L	1.0	99	90	110			
Potassium	40	mg/L	1.0	99	90	110			
Sodium	40	mg/L	1.0	100	90	110			
Sample ID: ICSA	Interference Check Sample A								10/09/13 11:55
Calcium	460	mg/L	1.0	93	80	120			
Iron	180	mg/L	0.030	90	80	120			
Magnesium	500	mg/L	1.0	99	80	120			
Potassium	0.018	mg/L	1.0						
Sodium	-0.70	mg/L	1.0						
Sample ID: ICSAB	Interference Check Sample AB								10/09/13 12:00
Calcium	450	mg/L	1.0	91	80	120			
Iron	180	mg/L	0.030	88	80	120			
Magnesium	480	mg/L	1.0	97	80	120			
Potassium	19	mg/L	1.0	97	80	120			
Sodium	19	mg/L	1.0	94	80	120			
Method: SW6010B									Batch: B_75024
Sample ID: MB-75024	Method Blank				Run: SUB-B213043				10/09/13 22:49
Calcium	0.6	mg/L	0.010						
Iron	0.009	mg/L	0.002						
Magnesium	0.05	mg/L	0.002						
Potassium	0.07	mg/L	0.02						
Sodium	9	mg/L	0.01						
Sample ID: LCS-75024	Laboratory Control Sample				Run: SUB-B213043				10/09/13 22:52
Calcium	23	mg/L	1.0	91	85	115			
Iron	2.3	mg/L	0.030	91	85	115			
Magnesium	22	mg/L	1.0	89	85	115			
Potassium	23	mg/L	1.0	91	85	115			
Sodium	32	mg/L	1.0	92	85	115			
Sample ID: LCSD-75024	Laboratory Control Sample Duplicate				Run: SUB-B213043				10/09/13 22:56
Calcium	23	mg/L	1.0	90	85	115	1.3	20	
Iron	2.2	mg/L	0.030	89	85	115	1.4	20	
Magnesium	22	mg/L	1.0	88	85	115	1.1	20	
Potassium	22	mg/L	1.0	90	85	115	1.2	20	
Sodium	32	mg/L	1.0	90	85	115	1.1	20	
Sample ID: H13090479-001B	Sample Matrix Spike				Run: SUB-B213043				10/09/13 23:04
Calcium	60	mg/L	1.0	88	75	125			

Qualifiers:

RL - Analyte reporting limit. ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Report Date: 10/23/13

Project: Barker Hughsville Pilot

Work Order: H13090479

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6010B									Batch: B_75024
Sample ID: H13090479-001B	Sample Matrix Spike				Run: SUB-B213043				10/09/13 23:04
Iron	8.8	mg/L	0.030	103	75	125			
Magnesium	48	mg/L	1.0	86	75	125			
Potassium	70	mg/L	1.0	90	75	125			
Sodium	110	mg/L	1.0	95	75	125			
Sample ID: H13090479-002B	Sample Matrix Spike				Run: SUB-B213043				10/09/13 23:12
Calcium	63	mg/L	1.0	94	75	125			
Iron	4.9	mg/L	0.030	94	75	125			
Magnesium	51	mg/L	1.0	92	75	125			
Potassium	79	mg/L	1.0	94	75	125			
Sodium	100	mg/L	1.0	97	75	125			
Sample ID: H13090479-003B	Sample Matrix Spike				Run: SUB-B213043				10/09/13 23:27
Calcium	50	mg/L	1.0	90	75	125			
Iron	5.4	mg/L	0.030	90	75	125			
Magnesium	45	mg/L	1.0	88	75	125			
Potassium	46	mg/L	1.0	89	75	125			
Sodium	110	mg/L	1.0	88	75	125			
Sample ID: H13090479-004B	Serial Dilution				Run: SUB-B213043				10/09/13 23:35
Calcium	950	mg/L	1.0		0	0	6.6	20	
Iron	2.3	mg/L	0.059		0	0	10	20	
Magnesium	500	mg/L	1.0		0	0	5.8	20	
Potassium	920	mg/L	1.0		0	0	5.5	20	
Sodium	3900	mg/L	4.9		0	0			
Sample ID: H13090479-004B	Sample Matrix Spike				Run: SUB-B213043				10/09/13 23:38
Calcium	880	mg/L	1.0		75	125			A
Iron	12	mg/L	0.030	81	75	125			
Magnesium	520	mg/L	1.0	37	75	125			S
Potassium	870	mg/L	1.0		75	125			A
Sodium	3300	mg/L	1.0		75	125			A

Qualifiers:

RL - Analyte reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 10/23/13
Project: Barker Hughsville Pilot
Work Order: H13090479

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6020**									Analytical Run: SUB-B213031
Sample ID: **QCS**	Initial Calibration Verification Standard								10/09/13 10:22
Aluminum	0.234	mg/L	0.0010	94	90	110			
Arsenic	0.0479	mg/L	0.0010	96	90	110			
Barium	0.0487	mg/L	0.0010	97	90	110			
Beryllium	0.0244	mg/L	0.0010	98	90	110			
Cadmium	0.0252	mg/L	0.0010	101	90	110			
Chromium	0.0479	mg/L	0.0010	96	90	110			
Cobalt	0.0496	mg/L	0.0010	99	90	110			
Copper	0.0491	mg/L	0.0010	98	90	110			
Lead	0.0489	mg/L	0.0010	98	90	110			
Manganese	0.237	mg/L	0.0010	95	90	110			
Nickel	0.0492	mg/L	0.0010	98	90	110			
Silver	0.0251	mg/L	0.0010	100	90	110			
Thallium	0.0487	mg/L	0.0010	97	90	110			
Zinc	0.0510	mg/L	0.0010	102	90	110			
Sample ID: **ICSA**	Interference Check Sample A								10/09/13 10:31
Aluminum	37.7	mg/L	0.0010	94	70	130			
Arsenic	0.000100	mg/L	0.0010						
Barium	0.000480	mg/L	0.0010						
Beryllium	ND	mg/L	0.0010						
Cadmium	0.000470	mg/L	0.0010						
Chromium	0.00125	mg/L	0.0010						
Cobalt	0.000140	mg/L	0.0010						
Copper	0.00151	mg/L	0.0010						
Lead	0.000300	mg/L	0.0010						
Manganese	0.000160	mg/L	0.0010						
Nickel	0.00144	mg/L	0.0010						
Silver	0.000280	mg/L	0.0010						
Thallium	6.00E-05	mg/L	0.0010						
Zinc	0.00225	mg/L	0.0010						
Sample ID: **ICSAB**	Interference Check Sample AB								10/09/13 10:34
Aluminum	37.8	mg/L	0.0010	95	70	130			
Arsenic	0.0102	mg/L	0.0010	102	70	130			
Barium	0.000570	mg/L	0.0010		0	0			
Beryllium	ND	mg/L	0.0010		0	0			
Cadmium	0.0102	mg/L	0.0010	102	70	130			
Chromium	0.0222	mg/L	0.0010	111	70	130			
Cobalt	0.0216	mg/L	0.0010	108	70	130			
Copper	0.0215	mg/L	0.0010	107	70	130			
Lead	0.000290	mg/L	0.0010		0	0			
Manganese	0.0213	mg/L	0.0010	106	70	130			
Nickel	0.0216	mg/L	0.0010	108	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 10/23/13

Project: Barker Hughsville Pilot **Work Order:** H13090479

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020									Analytical Run: SUB-B213031
Sample ID: ICSAB	Interference Check Sample AB								10/09/13 10:34
Silver	0.0205	mg/L	0.0010	103	70	130			
Thallium	ND	mg/L	0.0010		0	0			
Zinc	0.0116	mg/L	0.0010	116	70	130			
Method: SW6020									Batch: B_75024
Sample ID: H13090479-004B	Serial Dilution				Run: SUB-B213031				10/09/13 11:40
Aluminum	0.21	mg/L	0.030		0	0	32	20	R
Beryllium	ND	mg/L	0.0010		0	0		20	
Cobalt	0.081	mg/L	0.0050		0	0	13	20	
Copper	1.0	mg/L	0.0072		0	0	21	20	R
Manganese	0.11	mg/L	0.0010		0	0	15	20	
Nickel	0.81	mg/L	0.0050		0	0	17	20	
Thallium	ND	mg/L	0.00062		0	0		20	
Zinc	2.5	mg/L	0.010		0	0	29	20	R
Arsenic	1.9	mg/L	0.019		0	0	16	20	
Barium	2.3	mg/L	0.050		0	0	15	20	
Cadmium	0.25	mg/L	0.0024		0	0	25	20	R
Chromium	0.065	mg/L	0.0064		0	0		20	N
Lead	0.0045	mg/L	0.0010		0	0		20	N
Silver	ND	mg/L	0.0010		0	0		20	
Sample ID: H13090479-001B	Sample Matrix Spike				Run: SUB-B213031				10/09/13 11:49
Aluminum	10	mg/L	0.030	119	75	125			
Beryllium	0.42	mg/L	0.0010	83	75	125			
Cobalt	1.0	mg/L	0.0050	102	75	125			
Copper	0.99	mg/L	0.0050	97	75	125			
Manganese	4.6	mg/L	0.0010	85	75	125			
Nickel	0.96	mg/L	0.0050	95	75	125			
Thallium	0.94	mg/L	0.00050	94	75	125			
Zinc	0.92	mg/L	0.010	83	75	125			
Arsenic	0.78	mg/L	0.0015	75	75	125			
Barium	10	mg/L	0.050	88	75	125			
Cadmium	0.46	mg/L	0.0010	91	75	125			
Chromium	0.98	mg/L	0.0050	97	75	125			
Lead	0.96	mg/L	0.0010	95	75	125			
Silver	0.10	mg/L	0.0010	104	75	125			
Sample ID: H13090479-002B	Sample Matrix Spike				Run: SUB-B213031				10/09/13 11:52
Aluminum	4.6	mg/L	0.030	87	75	125			
Beryllium	0.44	mg/L	0.0010	88	75	125			
Cobalt	1.1	mg/L	0.0050	106	75	125			
Copper	1.0	mg/L	0.0050	102	75	125			
Manganese	5.0	mg/L	0.0010	89	75	125			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

N - The analyte concentration was not sufficiently high to calculate a RPD for the serial dilution test.

R - RPD exceeds advisory limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Project: Barker Hughsville Pilot

Report Date: 10/23/13
Work Order: H13090479

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: SW6020									Batch: B_75024
Sample ID: H13090479-002B	Sample Matrix Spike				Run: SUB-B213031				10/09/13 11:52
Nickel	1.0	mg/L	0.0050	101	75	125			
Thallium	0.98	mg/L	0.00050	98	75	125			
Zinc	0.93	mg/L	0.010	85	75	125			
Arsenic	0.79	mg/L	0.0015	79	75	125			
Barium	9.9	mg/L	0.050	88	75	125			
Cadmium	0.48	mg/L	0.0010	96	75	125			
Chromium	1.0	mg/L	0.0050	100	75	125			
Lead	1.0	mg/L	0.0010	99	75	125			
Silver	0.11	mg/L	0.0010	109	75	125			
Sample ID: H13090479-003B	Sample Matrix Spike				Run: SUB-B213031				10/09/13 12:04
Aluminum	7.1	mg/L	0.030	123	75	125			
Beryllium	0.48	mg/L	0.0010	96	75	125			
Cobalt	1.0	mg/L	0.0050	101	75	125			
Copper	0.99	mg/L	0.0050	98	75	125			
Manganese	4.7	mg/L	0.0010	94	75	125			
Nickel	0.98	mg/L	0.0050	98	75	125			
Thallium	0.96	mg/L	0.00050	96	75	125			
Zinc	0.96	mg/L	0.010	90	75	125			
Arsenic	0.86	mg/L	0.0015	86	75	125			
Barium	11	mg/L	0.050	95	75	125			
Cadmium	0.47	mg/L	0.0010	95	75	125			
Chromium	1.00	mg/L	0.0050	99	75	125			
Lead	0.99	mg/L	0.0010	99	75	125			
Silver	0.10	mg/L	0.0010	101	75	125			
Sample ID: H13090479-004B	Sample Matrix Spike				Run: SUB-B213031				10/09/13 12:07
Aluminum	14	mg/L	0.030	106	75	125			
Beryllium	1.1	mg/L	0.0010	90	75	125			
Cobalt	2.5	mg/L	0.0050	98	75	125			
Copper	3.0	mg/L	0.0050	86	75	125			
Manganese	12	mg/L	0.0010	94	75	125			
Nickel	2.9	mg/L	0.0050	88	75	125			
Thallium	2.4	mg/L	0.00050	97	75	125			
Zinc	3.7	mg/L	0.010	74	75	125			S
Arsenic	3.7	mg/L	0.0038	85	75	125			
Barium	28	mg/L	0.050	95	75	125			
Cadmium	1.3	mg/L	0.0010	86	75	125			
Chromium	2.5	mg/L	0.0050	99	75	125			
Lead	2.5	mg/L	0.0010	99	75	125			
Silver	0.23	mg/L	0.0010	91	75	125			
Sample ID: MB-75024	Method Blank				Run: SUB-B213031				10/09/13 13:17
Aluminum	0.01	mg/L	0.0002						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

S - Spike recovery outside of advisory limits.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs
Report Date: 10/23/13
Project: Barker Hughsville Pilot
Work Order: H13090479

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6020**									Batch: B_75024
Sample ID: **MB-75024**	Method Blank				Run: SUB-B213031				10/09/13 13:17
Beryllium	ND	mg/L	2E-05						
Cobalt	ND	mg/L	1E-05						
Copper	0.004	mg/L	0.0001						
Manganese	0.0004	mg/L	2E-05						
Nickel	0.001	mg/L	5E-05						
Thallium	ND	mg/L	1E-05						
Zinc	0.005	mg/L	0.0001						
Arsenic	ND	mg/L	0.0004						
Barium	0.003	mg/L	3E-05						
Cadmium	5E-05	mg/L	5E-05						
Chromium	0.0006	mg/L	0.0001						
Lead	0.0001	mg/L	2E-05						
Silver	ND	mg/L	1E-05						
Sample ID: **LCS-75024**	Laboratory Control Sample				Run: SUB-B213031				10/09/13 14:27
Aluminum	2.8	mg/L	0.030	110	85	115			
Beryllium	0.23	mg/L	0.0010	93	85	115			
Cobalt	0.51	mg/L	0.0050	102	85	115			
Copper	0.52	mg/L	0.0050	103	85	115			
Manganese	2.4	mg/L	0.0010	94	85	115			
Nickel	0.51	mg/L	0.0050	101	85	115			
Thallium	0.48	mg/L	0.00050	95	85	115			
Zinc	0.50	mg/L	0.010	99	85	115			
Arsenic	0.47	mg/L	0.0038	95	85	115			
Barium	5.1	mg/L	0.050	93	85	115			
Cadmium	0.25	mg/L	0.0010	99	85	115			
Chromium	0.50	mg/L	0.0050	99	85	115			
Lead	0.50	mg/L	0.0010	101	85	115			
Silver	0.049	mg/L	0.0010	98	85	115			
Sample ID: **LCSD-75024**	Laboratory Control Sample Duplicate				Run: SUB-B213031				10/09/13 14:39
Aluminum	2.7	mg/L	0.030	109	85	115	0.0	20	
Beryllium	0.24	mg/L	0.0010	94	85	115	0.0	20	
Cobalt	0.51	mg/L	0.0050	102	85	115	0.0	20	
Copper	0.52	mg/L	0.0050	103	85	115	0.0	20	
Manganese	2.4	mg/L	0.0010	96	85	115	0.0	20	
Nickel	0.51	mg/L	0.0050	101	85	115	0.0	20	
Thallium	0.48	mg/L	0.00050	96	85	115	0.0	20	
Zinc	0.51	mg/L	0.010	101	85	115	0.0	20	
Arsenic	0.47	mg/L	0.0038	95	85	115	0.0	20	
Barium	5.2	mg/L	0.050	95	85	115	0.0	20	
Cadmium	0.25	mg/L	0.0010	99	85	115	0.0	20	
Chromium	0.50	mg/L	0.0050	99	85	115	0.0	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs **Report Date:** 10/23/13
Project: Barker Hughsville Pilot **Work Order:** H13090479

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **SW6020**								Batch: B_75024	
Sample ID: **LCSD-75024**	Laboratory Control Sample Duplicate				Run: SUB-B213031			10/09/13 14:39	
Lead	0.51	mg/L	0.0010	102	85	115	0.0	20	
Silver	0.052	mg/L	0.0010	103	85	115	0.0	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

Workorder Receipt Checklist

CDM Federal Programs H13090479

Login completed by:	Tracy L. Lorash	Date Received:	9/24/2013
Reviewed by:	BL2000\sdull	Received by:	elm
Reviewed Date:	10/21/2013	Carrier name:	Hand Del

Shipping container/cooler in good condition?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☐	No ☑	Not Applicable ☐
Container/Temp Blank temperature:	19.1℃ No Ice - From Field		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☑

Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Contact and Corrective Action Comments:

None

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

Page ____ of ____

PLEASE PRINT (Provide as much information as possible.)

Company Name: CDM Smith

Project Name, PWS, Permit, Etc.: Barker Hughesville Pilot

Sample Origin State: MT

EPA/State Compliance: Yes ☐ No ☒

Report Mail Address (Required):
50 W 14th St, Suite 200
Helena, MT 59601

☒ No Hard Copy Email: frandsenak@cdmsmith.com

Contact Name: Angela Frandsen

Phone/Fax: 441-1435

Cell: 439-3776

Sampler: (Please Print) Angela Frandsen

Invoice Contact & Phone: Raquel Cisneros - Denver office

Purchase Order:

Quote/Bottle Order: NA

Invoice Address (Required): Contact Raquel Cisneros - 720-264-1148

☐ No Hard Copy Email:

Special Report/Formats:

☐ DW
☐ POTW/WWTP
☐ State: ____
☐ Other: ____
☒ EDD/EDT (Electronic Data)
Format: ____
☐ LEVEL IV
☐ NELAC

Number of Containers
Sample Type: A W S V B O DW
Air Water Soils/Solids
Vegetation Bioassay Other
DW - Drinking Water

ANALYSIS REQUESTED

SEE ATTACHED

Standard Turnaround (TAT)

RUSH

Contact ELI prior to **RUSH** sample submittal for charges and scheduling – See Instruction Page

Comments:

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	Dissolved metals
1 13BH-DT-PILOT-COMP-SPLP	09/24/13	1400	1 S	X
2 13BH-DT-PILOT-WOOD-SPLP	09/24/13	1405	1 S	X
3 13BH-DT-PILOT-SDST-SPLP	09/24/13	1410	1 S	X
4 13BH-DT-PILOT-CHT-SPLP	09/24/13	1415	1 S	X
5				
6				
7				
8				
9				
10				

Shipped by: Hand

Cooler ID(s): N/P

Receipt Temp 19.1 °C

On Ice: Y [✓ N]

Custody Seal
On Bottle Y [✓ N]
On Cooler Y [✓ N]

Intact Y N

Signature Match Y N

LABORATORY USE ONLY

H13090479

Custody Record MUST be Signed

Relinquished by (print): Lauren Helland Date/Time: 09/24/13 15:00 Signature: Lauren Helland

Relinquished by (print): Date/Time: Signature:

Received by (print): Date/Time: Signature:

Received by (print): Date/Time: Signature:

Received by Laboratory: Esther Merritt Date/Time: 9-24-13 15:00 Signature: Esther Merritt

Sample Disposal: Return to Client: ____ Lab Disposal: ____

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.

ANALYTICAL SUMMARY REPORT

October 25, 2013

CDM Federal Programs
555 17th St Ste 1100
Denver, CO 80202

Workorder No.: H13100450 Quote ID: H823 - Baker-Hughsville Superfund Site

Project Name: Barker Hughsville Pilot

Energy Laboratories Inc Helena MT received the following 1 sample for CDM Federal Programs on 10/23/2013 for analysis.

Sample ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H13100450-001	13BH-DT-PILOT-MGOH-102213	10/22/13 11:00	10/23/13	Aqueous	Preparation for TSS Solids, Total Suspended

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By:

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client:	CDM Federal Programs	**Report Date:**	10/25/13
Project:	Barker Hughsville Pilot	**Collection Date:**	10/22/13 11:00
Lab ID:	H13100450-001	**DateReceived:**	10/23/13
Client Sample ID	13BH-DT-PILOT-MGOH-102213	**Matrix:**	Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
Solids, Total Suspended TSS @ 105 C	12700	mg/L		10		A2540 D	10/24/13 12:36 / cmm

Report Definitions:	RL - Analyte reporting limit. QCL - Quality control limit.	MCL - Maximum contaminant level. ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: CDM Federal Programs

Project: Barker Hughsville Pilot

Report Date: 10/25/13

Work Order: H13100450

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2540 D									Batch: 22220	
Sample ID: MB-22220	Method Blank					Run: ACCU-124 (14410200)_131024			10/24/13 12:35	
Solids, Total Suspended TSS @ 105 C		ND	mg/L	1						
Sample ID: LCS-22220	Laboratory Control Sample					Run: ACCU-124 (14410200)_131024			10/24/13 12:35	
Solids, Total Suspended TSS @ 105 C		1850	mg/L	10	92	70	130			
Sample ID: H13100451-001ADUP	Sample Duplicate					Run: ACCU-124 (14410200)_131024			10/24/13 12:37	
Solids, Total Suspended TSS @ 105 C		74800	mg/L	10				8.7	5	R

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

R - RPD exceeds advisory limit.

Workorder Receipt Checklist

CDM Federal Programs

H13100450

Login completed by:	Wanda Johnson	Date Received:	10/23/2013
Reviewed by:	BL2000\wjohnson	Received by:	TLL
Reviewed Date:	10/25/2013	Carrier name:	Hand Del

Shipping container/cooler in good condition?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☐	No ☑	Not Applicable ☐
Container/Temp Blank temperature:	21.1°C No Ice		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Contact and Corrective Action Comments:

None

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

Page 1 of 1

PLEASE PRINT- Provide as much information as possible.

Company Name: CDM Smith	Project Name, PWS, Permit, Etc. Barker Hughesville	Sample Origin State: Montana	EPA/State Compliance: Yes ☐ No X
Report Mail Address: 50 W 14th Street, Suite 200 Helena, MT 59601	Contact Name: Angela Frandsen Phone/Fax: 406-441-1435	Email: frandsenak@cdmsmith.com	Sampler: (Please Print) Angela Frandsen
Invoice Address: Contact Raquel Cisneros 720-264-1148	Invoice Contact & Phone: Contact Raquel Cisneros 720-264-1148	Purchase Order:	Quote/Bottle Order:

Special Report/Formats – ELI must be notified prior to sample submittal for the following:

☐ DW
☐ GSA
☐ POTW/WWTP
☐ State: ____________
☐ Other: ____________

☐ A2LA
x EDD/EDT(Electronic Data)
Format: excel
☐ LEVEL IV
☐ NELAC

Contact ELI prior to **RUSH** sample submittal for charges and scheduling – See Instruction Page

Comments:

10 day TAT

Pull phosphate from 1 L bottle

Shipped by: Hand
Cooler ID(s): None
Receipt Temp 21.1 °C
On Ice: Yes [✓ No]
Custody Seal Y [✓ N]
Intact Y N
Signature Match Y N

ANALYSIS REQUESTED

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX (Number of Containers; Sample Type: A W S V B O; Air Water Soils/Solids Vegetation Bioassay Other)	Dissolved Metals	Total Metals	Sulfide	Orthophosphate	Alkalinity and Acidity	SO4, Cl, F, TDS	BOD	Ammonia	TSS (total suspended solids)	SEE ATTACHED	Normal Turnaround (TAT)	RUSH	LABORATORY USE ONLY
13BH-DT-PILOT- MGOH - 102213	10/22/13	1100	1 W									X				H13100450
13BH- DT-PILOT-																
13BH- DT-PILOT-																
13BH- DT-PILOT-																
13BH- DT-PILOT-																
13BH- DT-PILOT-																
13BH- DT-PILOT-																
13BH- DT-PILOT-																
13BH- DT-PILOT-																
13BH- DT-PILOT-																

Custody Record MUST be Signed

Relinquished by (print): Tawnia Smith	Date/Time: 10.23.13/16:11	Signature: T. Smith	Received by (print):	Date/Time:	Signature:
Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
Sample Disposal: Return to Client: ________	Lab Disposal: ________		Received by Laboratory: Tracy Lorash	Date/Time: 10/23/11 16:11	Signature: Tracy Lorash

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested.
This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.
Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.