FINAL

Conda/Woodall Mountain Mine

Field-Scale Permeable Reactive Barrier Treatability Study Implementation Plan

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LIST OF ACRONYMS

AMMR	Annual Maintenance and Monitoring Report
AMSL	above mean sea level
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirements
ASTM	American Society for Testing and Materials
AWQC	Ambient Water Quality Criterion
bgs	below ground surface
BLM	Bureau of Land Management
BMP	Best Management Practices
CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CLP	Contract Laboratory Program
COC	Chain of Custody
Conda	Conda/Woodall Mountain Phosphate Mine
COPC	Chemical of Potential Concern
CQA	Construction Quality Assurance
CQC	Construction Quality Control
CSR	Construction Summary Report
DO	Dissolved Oxygen
DOI	Department of the Interior
DQI	Data Quality Indicator
DQO	Data Quality Objective
ECO	Engineering Change Order
FS	Feasibility Study
ft	feet
ft.day	feet per day
GW	Groundwater
HRT	Hydraulic Retention Times
ICB	Initial Calibration Blank
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
ICV	Initial Calibration Verification
IDEQ	Idaho Department of Environmental Quality
IDW	Investigation-Derived Waste

LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
mg/L	milligrams per liter
mL	milliliter
MOU	Memorandum of Understanding
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NFG	National Functional Guidelines
NTCRA	Non-Time Critical Removal Action
ODA	Overburden Disposal Area
ORP	Oxidation Reduction Potential
PRB	Permeable Reactive Barrier
QA	Quality Assurance
QC	Quality Control
PRSC	Post-Removal Site Control
PV	Pore Volume
PVC	Polyvinyl chloride
RAO	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RM	Reactive Media
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SAP	Sampling and Analysis Plan
SHPO	State Historical Preservation Office
Simplot	J.R. Simplot Company
SOP	Standard Operating Procedure
SW	Surface Water
TCLP	Toxicity Characteristic Leaching Procedure
Tribes	Shoshone-Bannock Tribes
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service

1.0 INTRODUCTION

The J.R. Simplot Company (Simplot) as an owner and operator of the former Conda/Woodall Mountain Phosphate Mine (Conda, Figure 1-1) has prepared this document to describe the concept of implementing a Field-Scale Permeable Reactive Barrier (PRB) Pilot Study to evaluate its effectiveness in treating contaminant levels in seep and groundwater at Conda. The Field-Scale PRB Pilot Study will be conducted in the Pedro Creek headwaters area on water present in the NES-5 Seep Collection Pond as well as the near-surface groundwater downgradient of the pond (Figure 1-2).

Simplot voluntarily entered into an Administrative Order on Consent (AOC) in 2008 with the Idaho Department of Environmental Quality (IDEQ), the United States Environmental Protection Agency (USEPA), and the US Department of the Interior (DOI) Bureau of Land Management (BLM) to conduct a Remedial Investigation/Feasibility Study (RI/FS). Pursuant to a July 17, 2000 Memorandum of Understanding (MOU) concerning contamination from the phosphate mining operations in southeastern Idaho, IDEQ is the "Lead Agency," with USEPA implementing Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The BLM, US Fish and Wildlife Service (USFWS), and the Shoshone-Bannock Tribes (Tribes) have elected to participate as "Support Agencies." The IDEQ, USEPA, BLM, USFWS, and the Tribes are collectively referred to as the Agencies.

A range of water treatment systems were assessed during the development and screening of alternatives for the ongoing Conda FS. Passive in-situ treatment of water was retained in the FS Technical Memorandum 1 for further analysis (Formation 2017a). Passive biochemical treatment as a technology for removing selenium from water has several advantages over active treatment systems. Notably, it would not require a significant level of operation and maintenance like active physicochemical treatments. This is an important consideration for some of the relatively remote locations that exist on the east side of Conda. The information obtained from the Field-Scale PRB Pilot Study will be used to support the comparative and detailed analysis of alternatives presented in the Draft FS.

1.1 Background

Phosphate mining at Conda resulted in the disturbance of overburden materials naturally high in concentrations of selenium and other trace metals. This material was placed in Overburden Disposal Areas (ODAs), which have been identified as the primary sources of selenium and other Chemicals of Potential Concern (COPC) releases to the environment. A comparison of the RI data against Applicable or Relevant and Appropriate Requirements (ARARs) and risk-based comparison values showed that selenium has the widest extent of release, and greatest order-of-magnitude exceedances among the identified COPCs (Formation 2017a). All the identified COPCs for the site will be monitored under the Field-Scale PRB Pilot Study, but selenium is considered the primary indicator constituent for the study (Formation 2016).

Based on findings from the RI, groundwater with the highest concentrations of selenium and other COPCs at Conda occurs in the seeps and shallow alluvial/colluvial aquifer downgradient of the Pedro Creek ODA (Figure 1-2) (Formation 2016). This ODA was subject to a Non-Time-Critical Removal Action (NTCRA) constructed in 2013 and 2014 (Formation 2015). While the NTCRA has improved some conditions in the Pedro Creek Sub-Basin, selenium concentrations in the NES-5 seep and alluvial/colluvial groundwater continue to be elevated (as high as 9.4 milligrams per liter [mg/L] and 3.7 mg/L, respectively) post-construction (Formation 2017b). The proposed location of the Field-Scale PRB Pilot Study was selected because this area has elevated selenium concentrations and favorable topographical and geological conditions for construction of a PRB (Figure 1-2).

1.2 Objective of Pilot Study

The principal objective for the Field-Scale PRB Pilot Study is to determine the effectiveness of the system in treating selenium and other COPCs in groundwater to levels below the 0.05 mg/L Maximum Contaminant Level (MCL) and identify any limitations of the technology. The following are other objectives of this pilot study:

- Assess rate of treatment as well as the short- and long-term effectiveness.
- Optimize treatment parameters for the specific geochemical conditions.
- Assess generation of unwanted secondary products.
- Evaluate implementability and develop more accurate cost estimates of full-scale treatment.

Performing this Pilot Study for a period of one year allows for evaluating the system's responsiveness to seasonally fluctuating COPC concentrations. These objectives are consistent with the preliminary Remedial Action Objectives (RAOs) for groundwater remedies at Conda.

1.3 Document Organization

This document is comprised of the following sections:

- 1.0 Introduction – Background information and purpose of the PRB study;
- 2.0 Technology Overview – Description of the PRB technology;
- 3.0 Study Setting Characteristics – Overview of site characteristics relevant to the PRB Pilot Study;
- 4.0 Data Quality Objectives (DQOs) – Description of data needed to evaluate the effectiveness of the PRB;
- 5.0 Study Details – Summary of the bench-scale results, and the proposed Field-Scale PRB Pilot Study design;

- 6.0 Study Implementation Procedures – Description of the preliminary PRB design, and procedures for obtaining additional information for the final design;
- 7.0 Sampling and Analysis Plan (SAP) – Description of the sample collection, field measurement, quality assurance and quality control (QA/QC), and related data review and documentation procedures;
- 8.0 Data Analysis and Reporting – Description of data validation and result reporting;
- 9.0 Roles and Schedule – General summary of the project roles, responsibilities and timeline; and
- 10.0 References – List of references cited.

2.0 TECHNOLOGY OVERVIEW

The PRB technology is an in-situ permeable system that uses reactive media designed to passively treat intercepted contaminated groundwater. The type of reactive material selected for the PRB depends on local hydrogeologic conditions and types of contaminants in the groundwater. The reactive media is placed in a trench across the water-bearing zone to be treated. The trench is aligned perpendicular to groundwater flow such as to intercept and treat contaminated groundwater. Chemical reactions between the reactive media and contaminated groundwater flowing through the media results in transformation or immobilization of the contaminants.

Unlike conventional pump-and-treat systems, PRBs do not require treatment equipment reliant on access to power and other infrastructure. The technology is capable of successfully treating many inorganic contaminants. To treat selenium, PRBs rely on reactive media that use chemical and microbially-mediated processes to chemically reduce and transform it from selenate (SeO_4^{-2}) to selenite (SeO_3^{-2}) and ultimately to elemental selenium (Se^0). Elemental selenium (Se^0) precipitates out of solution and is not bioavailable as an insoluble element. Materials suitable to promote selenium treatment include inert sand (to maintain matrix permeability for the flow of water), and a carbon source (e.g., wood chips, alfalfa hay, rice straw, etc.) for microbial utilization. Carbon utilization results in oxygen depletion which creates anaerobic conditions resulting in the chemical reduction of water soluble selenium species (selenate and selenite) to insoluble elemental selenium which precipitates from solution. Various factors influence the reduction speed of microbial processes, including pH, temperature, and salinity. For selenium reduction, a target pH range between 6.5 and 9.5 is optimal (NAMC 2010). Selenate reduction decreases with higher salinity (NAMC 2010).

PRBs have two basic subsurface configurations, either funnel-and-gate or trench designs (ITRC 2011, USEPA 1998, USEPA 2014). In a funnel-and-gate configuration, the system extends laterally beyond the extent of the zone targeted for treatment and directs groundwater toward and through the reactive media for treatment (ITRC 2011, USEPA 1998, USEPA 2014). The trench PRB is installed perpendicular to the direction of groundwater flow for treatment (ITRC 2011, USEPA 1998, USEPA 2014). The dimensions of the trench depend on the extent of groundwater contamination, and the amount of reactive media necessary to provide the required Hydraulic Retention Time (HRT) to achieve adequate treatment.

The hydraulic and chemical properties of both the aquifer and the reactive media are important considerations for PRBs. The soil type, groundwater depth, flow direction, hydraulic conductivity, plume dimensions and geochemical composition of the aquifer should be well understood to ensure adequate capture and treatment. For the reactive media, it is important to understand the hydraulic conductivity and chemical composition, as well as the potential for release of unwanted chemicals. The reactive media should have a hydraulic conductivity at least as high as the aquifer, so that the groundwater can easily flow through and not bypass the media. The reactive

media should also be able to maintain its hydraulic conductivity and reactivity throughout its anticipated lifespan.

3.0 STUDY SETTING CHARACTERISTICS

As previously mentioned, Simplot proposes to perform the Field-Scale PRB Pilot Study to evaluate the effectiveness in treating the range of selenium concentrations in water present in the NES-5 Seep Collection Pond and near-surface groundwater downgradient from the pond (Figure 1-2). The conditions in the area of the study are described below, based on information from the RI (Formation 2016), ongoing monitoring of the NTCRA under the Post-Removal Site Control (PRSC) Plan (Formation 2017b), and a supplemental hydrogeological characterization performed in October 2017 (Formation 2017c).

3.1 Topographic and Climatic Conditions

Surface elevations in the study area range from approximately 6,734 feet above mean sea level (ft AMSL) in the drainage floor to approximately 6,770 ft AMSL along the flanks of the drainage (Figure 1-2). The ground surface slopes eastward at approximately 20 to 30 percent.

Based on the data from a meteorological station located at the Blackfoot Bridge Mine (Table 3-1), total annual precipitation ranges between approximately 28 to 43 inches. Summer temperatures in the region are mild, normally ranging from 42 to 80 degrees Fahrenheit, with the highest temperatures occurring in July. Winter temperatures normally range from 9 to 40 degrees Fahrenheit, while spring and fall months range from 16 to 72 and 9 to 70 degrees Fahrenheit, respectively.

3.2 Hydrogeological Conditions

Hydrogeological conditions in the PRB area were evaluated using information obtained from wells GW-41-MA, GW-42-MD, and GW-58-MA through GW-62-MA (Figure 1-2 and Table 3-2). The geology in the study area consists of unconsolidated alluvium/colluvium deposits, weathered and unweathered Dinwoody Formation. The shallow groundwater elevation ranges from approximately 6,718.2 ft AMSL to 6750.1 ft AMSL and is predominantly associated with sand and gravel intervals in the unconsolidated deposits and upper portion of the weathered Dinwoody Formation (Figure 3-1 and Table 3-3). This shallow water bearing zone appears to generally correspond with the drainage-bed footprint, pinching out farther up the flanks of the draw. Water bearing zones were not encountered at either GW-62-MA or PRB-BH-1 (Figure 3-1) in the fall of 2017. However, water was present in GW-62-MA in the spring of 2018, although the water levels differ from other wells in the PRB area. This indicates that GW-62-MA is screened across intermittently water-producing zones. At GW-60-MA, only a thin lens of water was encountered above the unweathered Dinwoody contact. The groundwater potentiometric surface mimics the topography, with flow in an eastward direction (Figure 3-1).

Hydrogeologic cross sections are shown on Figures 3-2 through 3-6. The thickness of the unconsolidated deposits ranges from approximately 2 feet (GW-60-MA) to 48 feet (GW-59-MA).

The weathered Dinwoody Formation is predominantly composed of clay with angular chert and siltstone fragments and thin discreet layers of angular gravel and silts (Appendix A). The unweathered Dinwoody surface is present from approximately 12 feet below ground surface (bgs) (GW-60-MA) to 50 feet bgs (GW-42-MD) and is comprised of gravelly siltstone.

Hydraulic conductivities of the unconsolidated deposits were estimated by performing mechanical slug tests (provided in Appendix B) in accordance with American Society for Testing and Materials (ASTM) D4044/D4044M (ASTM 2015a). Prior to slug testing, the wells were developed by bailing and pumping until measured field parameters stabilized and the water became relatively clear and free of sediments. Slug tests were conducted by rapidly inserting (falling head) and/or removing (rising head) a solid slug of known volume from below the static water level in the well to cause an instantaneous change in head. Water level recovery was measured and recorded using a pressure transducer/data logger. Barometric pressures were also recorded during slug testing to allow for barometric compensation of pressure readings. Multiple slug tests were performed on each well after allowing the water level to re-equilibrate to verify coincidence in recovery data. Calculated estimates of hydraulic conductivity ranged from 0.29 to 0.97 feet per day (ft/day) (Table 3-4).[1] Slug tests were not performed on GW-60-MA, GW-61-MA, and GW-62-MA due to insufficient water.

3.3 Seep and Groundwater Quality

Total selenium in the shallow groundwater near the Pedro Creek ODA have continued to exceed the USEPA MCL in the years following the NTCRA construction (2015 to 2017 for the purposes of this document), with concentrations that ranged from 0.0171 mg/L (GW-59-MA, fall 2017) to 7.18 mg/L (GW-41-MA, summer 2015) (Table 3-5). Post-construction selenium concentrations at the groundwater seep NES-5 and Seep Pond have ranged from 3.95 mg/L (fall 2016) to 9.64 mg/L (spring 2016) (Table 3-5). Other COPCs that exceeded standards in the proposed study area include: aluminum, cadmium, cobalt, iron, manganese, molybdenum, nickel, uranium, and vanadium. The sulfate and total dissolved solids concentrations exceeded their respective secondary standards (250 and 500 mg/L). Figure 3-7 summarizes the results for the fall 2017 and spring 2018 total selenium concentrations.

Major-ion chemistry data indicate that the groundwater is a calcium-sulfate type water. The groundwater is high in hardness (between 865 and 2,580 mg/L as $CaCO_3$), high in sulfate (692 and 2,210 mg/L) and high in total dissolved solids (between 1260 and 3460 mg/L), with circum-neutral pH (average pH of 6.6). Groundwater temperatures range between 3.5 and 12 degrees Celsius.

[1] Slug tests were analyzed using the Bouwer – Rice (1976) and Hvorslev (1951) Slug Test Solutions assuming an unconfined aquifer model using the Aqtesolv Aquifer Test Analysis software.

4.0 DATA QUALITY OBJECTIVES

The following sub-sections describe the types and quality of data needed to support the evaluation of the PRB's implementability and effectiveness, consistent with USEPA's Guidance for Conducting Treatability Studies under CERCLA (USEPA 1992).

4.1 Problem and Decision Statements

Problem Statement - Levels of COPCs in shallow groundwater at the NTCRA exceed groundwater standards.

Decision Statement - Does the PRB system effectively and consistently remove COPCs to levels below the groundwater MCL?

4.2 Inputs to the Decision and Decision Rules

To evaluate whether the PRB can effectively remove selenium and other COPCs, NES-5 Seep Pond water and downgradient shallow alluvial groundwater will be tested, and the following inputs are needed, and rules apply.

Decision Input - What are the COPC concentrations in both the influent and the treated effluent?

Decision Rule - If COPC concentrations in the treated effluent are consistently at levels at or below the MCL, then the system is effective in removing COPCs.

4.3 Null Hypothesis and Limits on Decision Errors

The null hypothesis for this study is that the PRB cannot effectively remove COPCs to levels below the MCL. The alternative is that this technology can reduce COPC concentrations to levels below the MCL.

There are two types of decision errors, classified as a false rejection error (Type 1) and a false acceptance error (Type 2). A Type 1 error is determining that COPC concentrations in the effluent are below the MCL, indicating that the treatment is effective, when in fact COPC concentrations in the effluent remain above the MCL and the treatment does not provide sufficient concentration reductions. A Type 2 error is determining that COPC concentrations remain above the MCL in the treated effluent, indicating ineffective treatment, when in fact COPC concentrations have decreased to levels below the MCL and effective treatment occurs. A Type 1 error may result in inadequate treatment and continued discharge of elevated COPC concentrations. A Type 2 error may result in unnecessary further treatment.

To control decision errors, only quantitative data with acceptable accuracy and precision documentation will be used for comparison to groundwater standards. Samples will be analyzed by laboratories in good standing, using USEPA-approved methods with detection limits below the standards. Measurement errors will be minimized by implementing standard operating procedures for the sample collection, handling, preparation and analysis methods.

4.4 Optimizing the Sampling Design

The sampling design, strategy and QA/QC requirements are presented in Section 7. Additional samples may be collected during the Field-Scale PRB Pilot Study, if and as necessary, to increase the confidence of the decision.

5.0 STUDY DETAILS

This section summarizes the results of bench-scale studies conducted in support of the Field-Scale PRB Pilot Study and presents the proposed pilot study approach.

5.1 Bench-Scale Studies

Simplot conducted bench-scale studies to evaluate treatment media and residence time requirements for the Pilot Study. The following bench-scale testing was conducted:

- Batch leach testing to evaluate general properties of the proposed treatment media and provide insight into anticipated effluent chemistry.
- Column reactor studies to determine the residence time required to effectively remove selenium and other COPCs and achieve groundwater quality standards.

The bench-scale studies were conducted using water collected from the NES-5 Seep Pond and alluvial groundwater collected downgradient of the pond. The treatment media evaluated in the bench-scale studies consisted of 50 percent well-graded sand (granular support media), as well as 12.5 percent chopped alfalfa hay and 37.5 percent woodchips/shavings by volume (organic carbon source to enhance microbial activity).[2] The sand is relatively inert, and its function is to maintain the permeability of the treatment media as the organic components degrade. The alfalfa and woodchips are short- and long-term sources of degradable organic material to support the microbial community. The results of the bench-scale studies are described in a technical memorandum provided in Appendix C and are briefly summarized below.

5.1.1 Batch Leach Tests

Batch leach tests were conducted on the individual components of the proposed treatment media to identify potential unexpected by-products from the media/site-water interaction. A total of four samples were tested (alfalfa hay, woodchips/shavings, sand, and a solution blank). Treatment media samples were placed in capped bottles with equal proportions of contaminated water to media mass (or surface area). After shaking the samples for 24 hours, the leachate in each sample container was analyzed and results were compared to site water chemistry to determine whether a difference exists. The tests were conducted using the NES-5 seep water because it had a higher dissolved selenium concentration (3.37 mg/L) than the site groundwater (0.944 mg/L) based on the results of post-shipping water quality samples. Table 5-1 summarizes the results of the batch leach tests.

Changes observed in water chemistry during the batch leach tests include the following:

[2] This initial mixture is based on the findings in successful field-scale tests and full-scale implementation of bio-mulch PRBs by P4 Production, LLC at their South Rasmussen Mine (NewFields 2016).

- The barium concentration in leachate from wood chips was higher than in seep water (0.413 mg/L vs. 0.0243 mg/L).
- The copper concentration in the alfalfa batch leachate was 0.0629 mg/L compared to below the laboratory reporting limit (0.01 mg/L) in seep water.
- The manganese concentration was lower in the seep water (0.046 mg/L) compared to 0.6, 1.3, and 0.08 mg/L in leachate samples from the alfalfa, wood chips, and sand, respectively.

Greater than 99 percent of the selenium in the seep water was removed during the 24-hour batch leach test of the alfalfa-seep water mixture (Table 5-1). This suggests that the alfalfa readily releases soluble organic carbon, resulting in the initial reducing conditions necessary for selenium reduction to take place. Selenium was not appreciably affected by the wood chips or sand components of the media.

5.1.2 Column Leach Studies

Following the batch leach tests, column reactor studies were conducted to evaluate residence time requirements for removal of selenium and other constituents. The columns were constructed from 2-inch diameter Polyvinyl chloride (PVC) pipe and were 30 inches in length. The columns were packed with the proposed ratio of sand, chopped alfalfa, and woodchips/shavings (50 percent sand, 12.5 percent alfalfa and 37.5 percent wood chips by volume). Two replicated columns were run using seep water and two replicate columns were run using shallow groundwater collected from the site. The seep water was spiked with sodium selenate to increase the total selenium concentration in the water to 9.61 mg/L.

Prior to initiating the tests, the columns were saturated with site water, capped, and allowed to equilibrate for several days to allow biological activity and reducing conditions to develop. Water was then pumped through the columns in an up-flow configuration such that the total contact time within the bed was approximately 12 hours. Samples were collected from the column influent, effluent, and from three ports along the column bed after 25 and 50 pore volumes (PV) for laboratory analysis. Tables 5-2 and 5-3 summarize the results of the column leach tests.

As shown in Tables 5-2 and 5-3, the 25 and 50 PV samples results indicate that the proposed treatment media is capable of reducing selenium concentrations by more than 98 percent. The 25 PV and 50 PV effluent sample results for both the seep and groundwater columns were similar, indicating that reducing conditions were established within the columns prior to 25 PV. For the groundwater, total selenium concentrations in the influent ranged from 0.843 to 0.913 mg/L, while the selenium concentrations in the effluent ranged from 0.007 to 0.021 mg/L (below the Idaho groundwater quality standard of 0.05 mg/L) (Tables 5-2 and 5-3). For the seep water, total selenium concentrations in the influent at 25 and 50 PV were 9.05 and 8.21 mg/L, while selenium

concentrations in the effluent were 0.056 to 0.067 mg/L, respectively (slightly above the primary groundwater standard).

Total arsenic and iron were not detected above laboratory reporting limits in seep and groundwater column influent samples but were detected in the 25 and 50 PV effluent samples from the columns (Tables 5-2 and 5-3). In addition, manganese was detected in the 25 and 50 PV effluent samples from the seep and groundwater columns at concentrations that were one to two orders of magnitude higher than the influent concentrations. These results indicate that these constituents may be mobilized by reducing conditions generated by the treatment media. However, it is anticipated that as the treated water mixes oxygenated groundwater downgradient of the groundwater PRB (and conditions become less reducing) these constituents will become immobile. Section 7 describes how the sampling will allow for monitoring of arsenic, iron, and manganese mobilization.

Simplot doubled the HRT of the seep columns to 24 hours after the 50 PV samples were collected to evaluate whether additional residence time would reduce total selenium concentrations in the column effluent to below 0.05 mg/L. However, total selenium concentrations in the effluent of the two seep columns remained slightly above the groundwater standard at concentrations of 0.0513 and 0.0572 mg/L after an additional 7 PV at the reduced flow rate. This indicates that an HRT of more than 24 hours may be required to achieve the groundwater standard when influent total selenium concentrations are near 9 mg/L.

5.2 Field-Scale Treatability Study Approach

Considering the efficacy of the treatment media in reducing selenium concentrations in both NES-5 seep water and groundwater, Simplot proposes to evaluate a two-stage treatment system (Appendix D) for the field-scale study. The proposed two-stage system would remove the seep-pond exposure pathway and would also allow for greater HRT for the treatment of the shallow groundwater. The two-stage treatment system includes the following:

1. Reactive media installed in the NES-5 Seep Collection Pond and adjacent sedimentation basins (Seep Treatment Cell).
2. A PRB constructed in unconsolidated deposits and weathered bedrock downgradient of the NES-5 Seep Pond to treat shallow groundwater (Groundwater Treatment PRB).

The NES-5 Seep Pond and adjacent sedimentation basins will be filled with treatment media and covered to provide treatment of the seep water. Effluent from the Seep Treatment Cell, anticipated to be at or below the selenium MCL, will be infiltrated into the downgradient groundwater. The downgradient PRB will provide treatment of the shallow groundwater/re-infiltrated seep mix. Based on the results of the bench-scale studies (Appendix C), it is anticipated that effluent from the PRB will be below the MCL for selenium. The proposed approach for the

treatability study is shown in conceptual drawings provided in Appendix D and described further below.

Simplot believes that the sediment basins have served their purpose and sediment transport from the Pedro NTCRA is limited due to the effective vegetation cover. Continued inspection of the NTCRA will document the amount of sediments that are being deposited in the check-dams and dissipation structures.

5.2.1 Treatment Media

Based on the results of the bench-scale studies (Appendix C), the proposed treatment media for the field-scale study will consist of the following materials (percent by volume):

- 50 percent granular support media (well graded sand obtained from Jack B Parson Company in Soda Springs, Idaho)
- 12.5 percent chopped alfalfa hay
- 37.5 percent wood chips/shavings.

A test mix of the treatment media was submitted to a material testing laboratory to confirm the hydraulic conductivity of the media is higher than the anticipated range of conductivities for the surrounding native material (0.3 ft/day [silty sands] to 50 ft/day [possible for gravelly matrix above water table]). Results of the analysis (provided in Appendix D) indicate that the treatment media will have a hydraulic conductivity of approximately 65.2 ft/day.

5.2.2 Seep Treatment Cell

The NES-5 Seep Pond and Northeast Sedimentation Basin will be converted to a seep treatment cell to evaluate the treatment of water with elevated selenium concentrations, such as the groundwater discharging at the NES-5 seep.[3] As shown on the conceptual drawings in Appendix D, the berm that separates the NES-5 seep collection basin from the sedimentation basin will remain in place to provide initial treatment of the seep water. The treatment media in the Seep Treatment Cell will be covered with Dinwoody Formation material, a minimum of 18-inches thick. The cover, together with the fact that the treatment mix directly below the contact with the cover will be unsaturated (considering the elevation of the effluent culvert) (Sheet 4, Appendix D) will ensure that freezing in the saturated part of the cell will not be a concern. Treated effluent from the seep pond will flow into the sedimentation-basin for additional treatment. The compacted clay liner of the NES-5 Seep Pond will remain in place. The existing sedimentation basin spillway will be modified to allow for treated water from the Seep Treatment Cell to be conveyed to an

[3] Treatment media will be added to the basins without altering of structural features, such that the basins can be returned to intended functions if the media cannot treat selenium to levels below MCL.

infiltration gallery which is tied into the downgradient Groundwater Treatment PRB. The modified spillway will allow for the measurement of the effluent flow rate prior to discharging into the infiltration gallery. The infiltration gallery will extend from the base of the sedimentation basin spillway to the Groundwater PRB and will be approximately 2 to 10 feet deep, filled with clean gravel with minimal fines, and enclosed by non-woven geotextile covered with Dinwoody material (Sheet 4, Appendix D). The non-woven geotextile allows for water to seep out of the bottom of the drain, beginning the process of re-infiltrating the treated seep water for treatment in the PRB. The infiltration gallery will have a higher permeability then the PRB media, causing the water to get distributed within the gallery and reducing the potential for short-circuited flow across the PRB.

The North Chute and North Channel that currently route runoff from the Pedro Creek ODA to the Northeast Sedimentation Basin will be rerouted to direct runoff to the Pedro Creek drainage. In May 2017, surface water samples were collected from the runoff in the North Chute and North Channel. Total selenium concentrations in the runoff samples ranged from 0.0016 mg/L to 0.018 mg/L (Table 5-4). Selenium concentrations at the mouths of both the North Chute and North Channel were below the Ambient Water Quality Criterion (AWQC) (Table 5-4). The runoff, as well as any treated seep or groundwater discharging into the creek bed would be orders of magnitude lower in selenium concentration then the seep and runoff mix overflowing from the sedimentation basin (6.3 and 8.6 mg/L in 2017).

5.2.3 Groundwater Treatment PRB

The Groundwater Treatment PRB will be constructed downgradient of the Seep Treatment Cell and aligned perpendicular to the general groundwater flow direction. The final dimensions of the Groundwater Treatment PRB (length and depth) will be determined during construction based on field conditions encountered (e.g., extent of water producing zones vertically and laterally). The trench will be vertically keyed into silty/clayey weathered-Dinwoody-Formation material to prevent groundwater flow from bypassing the PRB. Laterally, the trench will extend into dry silty/clayey material (if present), or simply dry unconsolidated/consolidated deposits. Treatment media will be placed in the trench to a depth of approximately 2 feet bgs to accommodate anticipated seasonal fluctuation in groundwater elevations, and additional volume from the Seep Treatment Cell effluent, as well as minimize freezing of the near-surface water in the media. Groundwater levels in monitoring wells recently installed in the area ranged from approximately 9 to 20 feet bgs in October 2017 and 2 to 23 feet bgs in May 2018. However, groundwater elevations in upgradient monitoring well GW-41-MA have fluctuated by as much as 13 feet between spring and late summer/early fall.

The hydraulic conductivity of the shallow water bearing zone in the area of the proposed Groundwater Treatment PRB will control flux (flow) into and out from the treatment media. There are a range of estimates of hydraulic conductivity in the shallow water bearing zone which leads to a range of estimates of the rate of groundwater flux through the PRB. Slug test results suggest that fine-grained sediments in the area have a hydraulic conductivity as low as 0.3 ft/day, while

coarser-grained alluvium channel deposits (such as observed above the water table in the PRB-area borings) may have hydraulic conductivity as high as 50 ft/day (Freeze and Cherry 1979).

Using the range of hydraulic conductivity estimates, groundwater flux into the PRB can be estimated using Darcy's Law:

$$\boldsymbol{Q = K\,i\,A}$$

Where: K = hydraulic conductivity = 0.29 ft/day to 50 ft/day

i = observed hydraulic gradient = 0.09

A =cross sectional area = estimated at 10 ft x 150 ft = 1500 ft^2

Q = 39 ft^3/day to 6,750 ft^3/day

The HRT of the PRB is calculated as:

$$\boldsymbol{HRT = PRBV \div Q}$$

Where: $PRBV$ = saturated volume of the PRB

Q = 39 ft^3/day to 6,760 ft^3/day

Based on a minimum PRB width of 10 feet and these estimated Qs, the HRT could range from 2 to 385 days. As discussed in Section 5.1.2, an HRT of slightly more than 24 hours is anticipated to reduce influent total selenium concentrations of up to 9 mg/L to less than the Idaho groundwater standard (0.05 mg/L). Given the low end of the estimated HRT range for the field-scale PRB is longer than 24 hours, an even greater reduction in selenium concentrations may occur.

5.3 Monitoring and Process Control Measurements

The pilot treatment system will rely on passive technology, and therefore, will have limited operational requirements. Simplot will monitor groundwater conditions upgradient and downgradient of the treatment system to evaluate system performance, as well as within the treatment system. Existing monitoring wells GW-41-MA, GW-42-MD, and GW-58-MA through GW-62-MA will be used for this purpose, if not consumed during construction of the PRB. Monitoring wells damaged or destroyed during construction will be replaced, and new wells will be installed to better suit the final PRB orientation, if necessary. Influent and effluent water from the Seep Treatment Cell will also be monitored. Refer to Section 6 for additional details.

The lifespan of the treatment media is uncertain, but it may last up to 15 to 20 years based on current literature (Robertson 2010, USEPA 2014). Injection points may be installed in the Seep Treatment Cell and PRB if monitoring results indicate that selenium concentrations in shallow groundwater downgradient of the PRB do not meet the groundwater MCL. Injection points may

also be installed if an increasing selenium concentration trend is present in downgradient groundwater (indicating that available carbon in the treatment media has been consumed). Liquid carbon amendments would be injected into the treatment media to enhance the performance of the Seep Treatment Cell and Groundwater PRB and/or extend their useful life. Agency approval would be obtained prior to installing the injection points and amendment injection.

The Groundwater PRB will be installed below ground and the Seep Treatment Cell will include a soil cover, which will insulate the media against freezing conditions. Microbial reduction of selenium is temperature dependent and will be slower during colder temperatures. However, flows to the Seep Treatment Cell and Groundwater PRB will be also be lower during winter months. This will result in longer residence times that may potentially offset the effects of the colder temperatures. The effects of colder temperatures on the performance of the media will be monitored during the study.

6.0 STUDY IMPLEMENTATION PROCEDURES

This section describes the approach for implementing the Field-Scale PRB Pilot Study.

6.1 Construction

It is anticipated that the Field-Scale PRB construction will begin in September 2018 when surface water and groundwater are at their lowest flow or elevation, respectively. It is anticipated that the construction will require three to four weeks to complete. Weather conditions could increase or decrease the required time necessary to complete the construction. Best Management Practices (BMP) will be implemented during and following construction to minimize erosion.

6.1.1 Site Preparation Activities

Site preparatory activities were begun in September 2017 to facilitate the supplemental hydrogeological characterization activities. Activities included the construction of an access road and clearing and grubbing in the proposed Groundwater Treatment PRB area. Ground cover vegetation and topsoil was left in place as much as possible, to minimize the potential for sediment transport into the Pedro Creek drainage. Silt fences were installed during the clearing and grubbing process alongside some of the slash and tree trunks that were placed at the downslope edge for use as erosion control. The silt fences will be inspected for integrity prior to commencing excavation activities. In addition, the stormwater diversion channel will be constructed to a functional level, prior to commencing excavation activities.

6.1.2 Cultural Resource Survey

No cultural resources were identified in the area during the site preparation work for the NTCRA construction. However, if any paleontological or archaeological objects are discovered during the construction, work will be immediately halted in the area of the discovery. A professional archaeologist will be summoned to the site to assess the value of any object encountered and make recommendations to the State Historic Preservation Office (SHPO). If the archeologist determines that the find is an actual cultural resource, at the direction of the SHPO, the construction will be suspended in the area of the discovery until it is appropriately documented or removed. Construction will resume when authorized by the appropriate professionals and Agencies.

6.1.3 Construction of the Pilot Study

All stormwater BMPs will be in place prior to commencing any earth work activities. The BMPs are presented and discussed in Section 6.2 and in Appendix E. The drawings for the construction of the pilot study are presented in Appendix D.

As previously mentioned, the pilot study will be field fitted to conditions encountered. Therefore, the depicted alignment and dimensions of the PRB may change based on conditions encountered during excavation. A geologist will be present during the excavation of the Groundwater PRB to evaluate the lithology encountered and work with the engineer to determine the lateral and vertical extent of the PRB. The vertical extent of the PRB will be based on the thicknesses of the silty-clayey Dinwoody lenses encountered. The objective is to maximize the thickness of the PRB, while having the bottom of the PRB terminate in material with the most clay content. The depth of the PRB may vary across the length of the PRB. The length of the PRB will depend on the extent of the saturated conditions in the unconsolidated deposits, with the trench extending 5 feet into dry deposits (unconsolidated or consolidated). As built drawings will document final dimensions and alignments of all features, as well as volumes of reactive media used.

The reactive media will be batch-mixed following procedures described in SOP 30 (Appendix E) and visually evaluated for uniformity of distribution between the sand and organic material, prior to being hauled and placed inside the PRBs. In addition the treatment mix will be tested for hydraulic conductivity at a rate of one per 1,000 cubic yard. An excavator will be used to dig the trench for the Groundwater Treatment PRB. If unstable wall conditions are encountered, the trench will be either over-excavated to facilitate the installation of the treatment media, or a trench box will be used. The trench will be backfilled with the treatment media as the excavation progresses, to limit the potential for cave-in of the excavation walls, as well as the area of open excavation where water can pool. A portion of the excavation will remain open to keep media out of the area where the excavator is working.

The infiltration gallery, allowing treated seep water to infiltrate into the shallow groundwater for further treatment by the PRB, will extend from below the basin embankment to the Groundwater PRB (Sheets 3 and 4, Appendix D). The infiltration gallery will be constructed using coarse drain rock, similar to the subsurface NES-5 seep collection drain. Minimum dimensions of the infiltration gallery will be at least as large as the NES-5 seep collection drain, which is the source of influent into the Seep Treatment Cell, and therefore will be capable of conveying flows exiting the Seep Treatment Cell. The overflow drain from the Seep Treatment Cell (Sheet 5, Appendix D) will be constructed to accept and convey 100 percent of the discharge from the Seep Treatment Cell into the infiltration gallery.

The NES-5 Seep Pond, and the Northeast Sedimentation Basin central and north cells will be dewatered as much as possible prior to placement of the treatment media. Water from these features will be pumped into the infiltration gallery for the Groundwater Treatment PRB. If the volume of water pumped out the pond and sedimentation basin and into the infiltration basin is insufficient to adequately lower the water levels to allow for the placement of the treatment media, the remainder of the water will be pumped into temporary storage tanks. Any water stored in storage tanks will be fed back into the Seep Treatment Cell prior to construction of the cover. As previously described, the NES-5 Seep Pond embankment and compacted clay lining will be left in place.

Non-woven geotextile will be placed over the treatment media to prevent the entrainment of fines into the PRB. The textile will be anchored at the edges of the treatment material using manufacturer approved staples. The textile will be overlapped shingle style perpendicular to the top grade of the treatment material. Dinwoody Formation material will be placed over the non-woven geotextile. The Dinwoody Formation cover will be a minimum of 18-inches thick and will be carefully placed to minimize disturbance of the non-woven geotextile.

The North Chute and North Channel will be re-routed into a diversion channel lined with a high-density polyethylene (HDPE) textured liner (Sheet 3, Appendix D). The diversion channel will by-pass the Seep Treatment Cell, and discharge into an energy dissipation structure prior to conveying runoff into the Pedro Creek drainage below the Groundwater Treatment PRB.

Changes to the approved final design identified as necessary will be documented with Engineering Change Orders (ECOs) and submitted to the Agencies for review, prior to construction. If the Agencies determine that the ECO does not constitute a significant design change, comments (if any) will be provided to Simplot. Simplot will incorporate the Agencies' comments, issue a final ECO, and implement the change. If the Agencies determine that the ECO constitutes a significant design change, comments on the draft ECO may be submitted to Simplot. Simplot will address and/or incorporate the comments and will submit a final ECO to the Agencies for signature prior to implementing the changes noted in the ECO. Simplot will work with the Agency representative(s) to collaboratively resolve any substantive design changes identified as necessary during the construction process.

6.2 Best Management Practices

BMPs will be implemented during construction to minimize the transport of fines and sediments to Pedro Creek. BMPs will primarily include the placement of silt fence downgradient of the construction site and re-routing any active flow from the Northeast Sedimentation Basin away from the work area. As previously mentioned, the construction will be planned for late summer/ early fall when the area is relatively dry. Once construction has been completed, the area will be hydromulched, seeded with native species, and straw wattles will be placed where needed to reduce erosion. BMPs will inspected daily during construction. Following construction, inpections will occur during the monthly sampling and will be documented on field forms (Appendix E) and in field notebooks.

6.3 Monitoring and Treatment Optimization

The PRB is a passive treatment system and it is anticipated there will only be limited operational needs. Treatment monitoring and optimization will include the following.

Visual Inspections – The Seep Treatment Cell, Infiltration Gallery, and Groundwater PRB and associated features will be inspected monthly for operation as intended. The diversion channel

berms, culvert, channel, and EDS will be inspected for integrity. The erosion controls will be inspected to ensure that they remain functional while the vegetation gets established. The diversion channel berms, areas downgradient of the diversion channel discharge, and erosion-control BMPs will also be inspected following a 10-year, 24-hour rainfall event, which would entail events generating 2" of precipitation or greater over a 24-hr period (NOAA 2006). If conditions indicate excessive erosion of the diversion berms and area downgradient of the EDS, Simplot will work with the Agencies to evaluate corrective actions. In addition, the groundsurface in the areas of the Infiltration Gallery, and Groundwater PRB will be surveyed for expressions of moisture, which would indicate disruption of flow through the reactive media.

Groundwater- and Seep-Treatment Monitoring – Groundwater monitoring will be performed monthly using wells installed within and around the treatment system (Figure 6-1 and Sheet 3, Appendix D). Monitoring wells placed to the side of the Groundwater Treatment PRB will be used to evaluate whether contaminated groundwater is circumventing the PRB (Figure 6-1).

The Seep Treatment Cell influent and effluent will be monitored to assess the changes in concentrations. The Seep Treatment Cell influent will be monitored using a piezometer installed into the top two feet of the seep's subsurface drain (Figure 6-1 and Sheet 3, Appendix D). If it proves difficult to advance a boring into the subsurface drain, a boring will be advanced immediately adjacent to the drain and a piezometer completed within. The water will be sampled to confirm that it is representative of the NES-5 seep. The Seep Treatment Cell effluent (water quality and flow) will be monitored at the modified sedimentation basin spillway discharge point, prior to entering the infiltration gallery. Additional details on the proposed construction of these monitoring points is shown on the design drawings (Appendix D). Wells will also be installed within the treatment system to assess treatment progress (Figure 6-1).

One new well will be constructed downgradient of the Groundwater PRB (Figure 6-1 and Sheet 3, Appendix D). Well GW-59-MA will be sampled at discrete intervals to evaluate whether selenium concentrations differ between the water-producing intervals identified at this location. This information will be used to inform the monitoring interval for the new well to be installed downgradient of the Groundwater PRB. In addition, if conditions encountered during excavation warrant adjustments to the PRB alignment and dimensions, then new wells will be installed as necessary. The new wells will be completed as piezometers (2-inch schedule 40 PVC), with the well screens (2-inch schedule 40 PVC 0.02" slot) spanning the encountered water producing intervals and anticipated spring groundwater elevations (based on the spring 2018 water levels). Wells will be installed in accordance with SOPs included in the Agency-approved Hydrogeological Characterization Work Plan (Formation 2017c) and included in Appendix E.

Sampling and inspections will be conducted monthly following construction, except if snow conditions preclude safe access and sampling. If visual inspections identify the presence of surface flow in the Infiltration Gallery or Groundwater PRB areas due to them reaching capacity to receive Seep Treatment Cell effluent, flow measurement, field paramers and samples for

laboratory analysis will be collected. Samples submitted to the laboratories will be analyzed for the parameters specified in Table 7-1. If visual inspections indicate that the BMPS .

Groundwater levels will be monitored in the monitoring wells using in well data loggers and manual measurements on a monthly basis until access is limited by snow.

6.4 Investigation-Derived Waste Management

The Investigation Derived Waste (IDW) will consist of excavated trench material (with water) and decontamination water. The excavated trench material will be consolidated in the NTCRA Water and Sediment Management Cell. The decontamination water will be disposed on-site. Spent treatment media will be analyzed as described in Section 7 to determine the proper course of disposal in accordance with regulations. All disposable sampling materials and personal protective equipment, such as disposable scoops, filters, gloves, and other items used in sample processing will be disposed of as municipal waste at a Subtitle D Landfill. Drilling and well development IDW, including drill cuttings, will be managed as close to the drill site as practicable and consolidated on Simplot property.

7.0 SAMPLING AND ANALYSIS PLAN

This section details the procedures for sampling and data collection to be conducted during the Field-Scale PRB Pilot Study.

7.1 Water Sampling and Analysis

Sampling to evaluate the pilot's performance will occur at the groundwater and surface water locations depicted on Figure 6-1. Surface water samples collected during baseflow conditions in Pedro Creek, when groundwater discharge is the source of water in the creek, will also be used to evaluate treatment. If there is moisture expressing at the surface of the Groundwater Infiltration Gallery or Groundwater PRB, in sufficient quantities to allow for sampling, samples will be collected.

Groundwater and surface water samples will be collected by methods found in SOP 4 and SOP 6 (Appendix E). Groundwater level and total well depth measurements will be obtained prior to purging the well, and water level measurements will be repeated immediately following sampling to estimate groundwater recharge. Wells will be purged and sampled using low pumping rates to minimize pumping-developed gradients and decrease residence times across the treatment media.

A flow-through cell will be used to measure pH, specific conductance, temperature, dissolved oxygen (DO) and oxidation-reduction potential (ORP) during the sampling. Samples will be analyzed for total and dissolved metals as well as the parameters listed on Table 7-1. Water will be pumped through a 0.45 micrometer in-line, high-capacity filter for the filtered sample volumes. The in-line filter will be purged with approximately 50 milliliters (mL) of sample water before the laboratory container is filled. Filters and tubing will be used for only one sample. Samples will be submitted to a laboratory for analysis using the methods listed in Table 7-1. These methods are consistent with those specified in the RI/FS Work Plan (New Fields 2008) but have been revised to reflect any updated laboratory methods. Laboratory analyses will be performed in accordance with QA/QC procedures specified in Section 7.5. The laboratory methods selected provide quantitative data for direct comparison to Idaho groundwater quality standards. These methods will also provide useful data for tracking COPC concentration trends and persistence of reducing conditions[4] at individual monitoring locations, if any are observed.

As previously mentioned, samples will be collected monthly.

[4] To evaluate whether COPCs mobilized due to reducing conditions remain present.

7.2 Reactive Media Sampling and Analysis

Eight-point composite samples of the treatment media mix will be collected at a rate of one per 1,000 cubic yards and submitted to a material testing laboratory for measurement of the hydraulic conductivity using ASTM Method D 5856 (ASTM 2015b). Prior to testing, each composite sample will be compacted to approximately 83 percent of maximum dry density (as measured by ASTM Method D 698 [ASTM 2012]) to approximate field compaction efforts. A minimum of three composite samples will be collected from treatment-mix batches designated for the Seep Treatment Cells (Seep Pond and Sedimentation Cells) and Groundwater PRB, each.

To evaluate the potential longevity of the treatment media, Simplot will collect reactive media and water quality samples at the start of the study and again at the end of the study.[5] If the system is determined to be effective, an additional six core samples will be collected from the Seep Treatment Cell and Groundwater PRB, each, at the end of the study. The core samples from the Seep Treatment Cell and the Groundwater PRB will be composited into single containers and homogenized (i.e., one composite media sample will be generated for the Seep Treatment Cell and one composite sample will be generated for the Groundwater PRB). As shown in Table 7-2, the above-mentioned media samples will be analyzed for the following constituents:

- Total carbon to determine the rate of change of the organic material in the media.
- Total sulfur to determine the amount of carbon in the media used to reduce sulfur in the influent water. Increases in total sulfur will indicate the accumulation of sulfur by carbon metabolism.
- Mineralogy (by x-ray diffraction and scanning electron microscopy) to evaluate the nature and stability of adsorbed and precipitated compounds in the media.

In addition, water quality samples will be collected from the influent, effluent, and center of the Seep Treatment Cell and Groundwater PRB. A pre-packed well screen will be installed in the center of the Seep Treatment Cell and Groundwater PRB for the purpose of collection of water quality samples from within the treatment cell and PRB. The water quality samples will be collected immediately following the initiation of the study and at the end of the study. As shown in Table 7-2, the samples will be analyzed for biochemical and chemical oxygen demand to evaluate changes in oxygen consumption in the reactive media with time. Total and dissolved organic carbon will also be analyzed to help assess the rate of carbon (organic material) consumption in the media.

The core samples collected at the completion of the study will also be analyzed by the Toxicity Characteristic Leaching Procedure (TCLP) to determine the leached concentrations of the 8

[5] If it is determined that the treatment system is not effective, then there will be no need to resample the media to evaluate longevity. If the system is effective, and the Agencies determine that it can remain operational while the CERCLA process of evaluating its inclusion as a component of the remedy proceeds, then Simplot will work with the Agencies to determine the best timeframe for resampling the media to allow for evaluating its longevity.

Resource Conservation and Recovery Act (RCRA) metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) and to support the process of determining appropriate disposal alternatives (if necessary) in accordance with regulations.

7.3 Sampling Equipment and Procedures

Sampling equipment will include peristaltic pumps, tubing, water quality meters, a water level indicator, as well as others.

7.3.1 Equipment Testing and Calibration Procedures

A water quality meter will be used in conjunction with a flow-through cell to monitor field parameters during the purging and sampling of each well. A water level indicator will be used to measure the water level before, during, and after sampling.

The water quality meter will be calibrated each day prior to use to ensure that the accuracy and reproducibility of the results are consistent with the manufacturer's specifications and the project's data needs. The water level indicator and peristaltic pump will be examined to certify that they are in good operating conditions. This includes checking the manufacturer's operating manual and the instructions for each instrument to ensure that maintenance requirements are being met. A water quality meter with an optical DO sensor will be used due to the potential for sulfur compounds to interfere with membrane DO sensors.

7.3.2 Equipment Decontamination

The sampling program minimizes potential for cross-contamination by using clean disposable equipment and by drawing the samples directly from the water sources. Each groundwater monitoring well will have dedicated tubing that will remain within the casing to further minimize the potential for cross-contamination. The water quality meter will be decontaminated as outlined in SOP 13 (Equipment Decontamination, Appendix E).

7.3.3 Sampling Containers, Preservation and Storage

Sample containers will be pre-cleaned and will be provided by the laboratory. Samples will be preserved immediately following collection in order to prevent or minimize chemical changes that could occur during transit and storage. Preservation and storage requirements are listed in Tables 7-1 and 7-2.

7.4 Sample Documentation and Handling

Sample collection activities will be documented in field notebooks and on field forms according to methods outlined in SOP 1 (Appendix E). Field-notebook and field-form entries will, at a minimum, include the information listed below:

- Project name and number;
- Location of sample;
- Data and time of sample collection;
- Sample identification numbers;
- Field measurements;
- Observations and weather conditions; and
- Personnel present.

Changes or deletions in the field book or on the data sheets will be recorded with a single strike mark through the changed entry, with the sampler's initials and the date recording the new entry. All entries must remain legible. Additional instructions on field documentation procedures can be found in SOP 1 (Appendix E).

During each sampling event, field personnel will record conditions as observed on the field form provided in Appendix E.

7.4.1 Sample Designation

Samples will be assigned unique sample identification numbers. These numbers are required for tracking the handling, analysis, and reporting status of all samples collected during monitoring. Each identification number will provide date, location, type, and media information for the individual sample.

The first field in the identification number identifies the Site and sampling month and year. For example, samples collected at Conda during the pilot study in October 2018 will all have the prefix "CD1018".

The second field in the identification number identifies the location of the sample. For example, "GW60MA" would be groundwater monitoring well GW-60-MA.

The third field identifies the sample matrix type and includes a numerical digit describing the intended sample use. The matrix types are defined as:

GW: Groundwater

SW: Surface Water

RM: Reactive Media

The numerical digits are defined as:

0 - Primary sample;

2 - Field duplicate sample;

3 - Equipment rinsate or QA/QC blank sample; and

4 – Split primary sample.

Note that additional codes may be added as the project proceeds. The additions will be communicated immediately to the field staff, data management team and project chemist.

The last two-digit number is unique to the specific sample. Numbers will begin with 01 and increase consecutively as sampling tasks are implemented. For example:

CD1018-GW60MA-GW001, is a primary water sample collected in October 2018 and is the first sample collected from that location;

CD1018-GW59MA-GW202, is a field duplicate water sample collected from GW-59-MA in October 2018 and is from the second sampling round in that month; and

CD1018-PC9-SW001, is a surface water sample collected in October 2018.

Sample labels will be filled out as completely as possible using waterproof ink. At a minimum, each label will contain the following information:

- Site location;
- Sample identification number;
- Date and time of sample collection;
- Analyses required;
- Preservative; and
- Sample type.

Site-specific samples to be used for the matrix spike/matrix spike duplicates (MS/MSDs) will be identified on the sample label and chain-of-custody forms.

7.4.2 Sample Custody, Handling and Shipping

All the collected soil samples will be handled according to SOP 5 (Appendix E) and analyzed for the COPC parameters by the laboratory methods summarized in Tables 7-1 and 7-2. Samples will be placed on ice in an insulated cooler, together with packing material to prevent breakage during shipment. Samples will be maintained under strict chain-of-custody (COC) protocols. A

COC record form will be completed for each shipping container (i.e., cooler, ice chest or other container) of samples to be delivered to the laboratory for analysis.

7.5 Quality Assurance and Quality Control

This section describes the QA/QC that will be implemented as part of the study to ensure the best quality data possible.

7.5.1 Data Quality Indicators

The data quality indicators (DQIs) for data collected in support of the Field-Scale PRB Pilot Study are accuracy, precision, completeness, representativeness and comparability. The DQI control limits are provided below along with the acceptance criteria for data collected in support of the Pilot Study.

7.5.1.1 Accuracy

Accuracy is the degree of difference between the measured or calculated value and the true value. Data accuracy or analytical bias may be evaluated by the analysis of laboratory control samples (LCS) and/or MS samples for inorganic analytes, with results expressed as a percentage recovery measured relative to the true (known) concentration. The percentage recovery for LCS samples is given by:

$$Recovery(\%) = \frac{A}{T} \times 100$$

Where:

- A = measured concentration of the LCS; and
- T = known concentration.

The percentage recovery for MS samples is given by:

$$Recovery(\%) = \frac{A - B}{T} \times 100$$

Where:

- A = measured concentration of the spiked sample;
- B = measured concentration of un-spiked sample; and
- T = concentration of spike added.

Field equipment blanks and laboratory blanks may be analyzed to quantify artifacts introduced during sampling, transport or analysis that may affect the accuracy of the data. In addition, initial and continuing calibration verification samples (ICV and CCVs) and initial and continuing

calibration blanks (ICB and CCB) may be used to verify that the sample concentrations are accurately measured by the analytical instrument throughout the analytical run.

The acceptance criteria for accuracy of analyte measurements for the COPC for each of the sample types to be analyzed are summarized in Tables 7-1 and 7-2. For this project, acceptable limits for LCS recovery are between 80 and 120 percent for groundwater and surface water samples. Acceptable MS recovery limits range from 75 to 125 percent. Control limits may change based on the laboratory that performs the analysis, and a particular laboratory's control limits may also be used for the LCS recovery.

7.5.1.2 Precision

Precision is the level of agreement among repeated measurements of the same characteristic. Data precision is assessed by determining the agreement between replicate measurements of the same sample and/or measurements of duplicate samples, which may include LCS and LCS duplicate (LCSD) samples, MS and MSD samples, laboratory duplicate sample pairs or field duplicate sample pairs.

Precision is evaluated by calculating the relative percent difference (RPD) as given by:

$$RPD(\%) = \frac{|2\ (S_1 - S_2)|}{S_1 + S_2} \times 100$$

Where:

- S1 = measured sample concentration; and
- S2 = measured duplicate concentration.

When analytes are present at concentrations below or near the quantitation limit, precision may be evaluated using LCS/LCSD or MS/MSD RPD results.

A measurement of precision is required for all sample types and analyses. An analytical duplicate is the preferred measure of analytical method precision. The acceptance criteria for precision of analyte measurements for the COPCs for each of the sample types to be analyzed are summarized in Tables 7-1 and 7-2. For this project, acceptable control limits for surface water and groundwater samples are MS/MSDs with RPD less than 30 percent, analytical duplicates with RPD below 20 percent, and field duplicates with RPD below 30 percent. Control limits are subject to change based on the laboratory that performs the analyses.

7.5.1.3 Completeness

Completeness is a measure of the number of valid results obtained from a measurement system compared to the number of results projected to be obtained under normal conditions. Valid

sample results are those that are in compliance with project QC objectives. Completeness is affected by such factors as sample bottle breakage, acceptance/non-acceptance of analytical results and compliance with QA/QC elements of the project.

Percentage completeness is given by:

$$C(\%) = \frac{V}{P} \times 100$$

Where:

- C = percentage completeness;
- V = number of valid measurements/data points obtained; and
- P = number of measurements/data points planned.

It should be noted that, occasionally, certain data are more critical to successful completion of a project than others; therefore, while attainment of an overall completeness goal is important, it is equally important that various subsets of the data be appropriately characterized. The project's completeness goals are 95 percent.

7.5.1.4 Representativeness

Representativeness is a qualitative objective, defined as the degree to which data accurately and precisely represent the characteristic of a population, the parameter variations at a sampling point, the process condition, or an environmental condition. Representativeness is achieved by collecting a sufficient number of unbiased samples and implementing a QC program for the sample analyses and data interpretation. The sampling approaches developed for a project should provide samples that are representative of actual site conditions. Representativeness of analytical results may be evaluated based on blank results (field and laboratory), laboratory QC results, sampling locations and methodologies, and sampling frequencies.

Representativeness of individual sample analyses will be described on the basis of results obtained from associated field and laboratory QC samples. The representativeness of sample analyses will be considered acceptable as long as any detectable concentrations of analytes in associated blanks are less than 5 times the method detection limit reported by the laboratory.

7.5.1.5 Comparability

Comparability is the confidence with which one data set can be compared to another. Comparability is achieved by the use of appropriate and consistent sampling methods and analytical methods and performing data evaluations. Comparability is also dependent on similar QA objectives. All data should be calculated and reported in units consistent with standard

reporting procedures so that the results of the analyses can be compared with those of other laboratories, if necessary.

7.5.2 Field Quality Control Samples

The field QC will consist of the collection of QC samples, decontamination of field sampling equipment, and adherence to SOPs. These elements are described below.

Equipment rinsates samples and field duplicate samples will be collected to evaluate the accuracy and reproducibility of the field sampling methods. Data collected in the field may lack reproducibility due to natural variability and/or the field sampling methods. One duplicate and one equipment blank sample will be collected for every 20 primary samples to evaluate the reproducibility of field sampling methods and assess any influence from sample equipment and sample containers. Field duplicates are useful in documenting combined field and laboratory precision.

7.5.2.1 Field Duplicate Samples

Field duplicates are collected to measure the sampling and analytical variability associated with the sample results. A duplicate sample is usually collected simultaneously with or immediately after the corresponding original sample has been collected. The field duplicates are analyzed for the same suite of analytical parameters as the original sample but are placed in different bottles and labeled appropriately for separate analysis. There are no EPA criteria for evaluation of field duplicate sample comparability; however, the RPD between the original sample and field duplicate can be calculated for each parameter and compared to the project's precision goal. Field duplicate RPDs greater than the project-specified precision goal indicate a high variability associated with the sampling and analysis methods used.

Field duplicates will be collected at a rate of one per 20 primary samples, or no less than one per sample event if the number of samples collected in a sampling event is less than 20 samples

7.5.2.2 Equipment Rinsate Blank Samples

An equipment rinsate consists of analyte-free reagent water (i.e., ASTM Type II) poured through the sampling device or filtration equipment, collected in a clean sampling bottle, preserved as needed, and analyzed blindly as a field sample. Equipment rinsate samples may be used to demonstrate that sampling devices have been adequately cleaned between uses and provide for representative samples. Analysis of an equipment rinsate quantifies any artifacts introduced into the sample during collection. Potential sources of bias or cross-contamination include sampling gloves and sampling equipment that may incidentally come into contact with the sample.

Equipment rinsates are analyzed for the same suite of analytical parameters as the associated samples.

Equipment rinsate samples will be collected at a rate of 1 per 20 samples, or 1 per sampling event (if less than 20 samples are collected).

7.5.3 Laboratory Quality Control Samples

The analytical methods selected will ensure that laboratory analysis is sufficiently sensitive, accurate and precise to meet the objectives of the sampling. The laboratories used will perform the requested analyses in accordance with referenced EPA methods and will operate under an internal QA Management Plan. The laboratory will provide the following information to support their analysis results for each parameter analyzed:

- Sample preparation method reference;
- Analytical method reference;
- Method detection limit;
- Reporting or practical quantitation limit;
- Units;
- Shipment temperature;
- Analysis date;
- Method blank result;
- Laboratory duplicate results and relative percent difference;
- Laboratory control standard recovery;
- Matrix spike (MS) recovery;
- Matrix spike duplicate (MSD) recovery;
- MS/MSD relative percent difference;
- Initial and continuing calibration verification results (dated);
- Chain of custody record; and
- Sample condition upon receipt.

The accuracy of laboratory analysis results will be evaluated using the results for recovery from LCSs and MS samples. The precision of laboratory analyses will be evaluated using results from duplicate analyses of LCSs and MS samples and review of duplicate results.

The appropriate type and frequency of laboratory QC samples will be dependent on the sample matrix, analytical method, and the laboratory's SOP. Laboratory QC samples will be analyzed in addition to the calibration samples with each QC batch.

The data will be reviewed and evaluated along with the sample results (including field duplicate and bottle/preservation blank and/or equipment blank results) to confirm that the data meet the DQOs. Any data not meeting the quality requirements of this plan will be flagged to identify them to data users and appropriately qualified.

7.5.3.1 Method Blank Samples

Project target analytes should not be detected in laboratory blanks at concentrations greater than the method detection limit (MDL). Blank contamination, if found, will be evaluated using USEPA Contract Laboratory Program National Functional Guidelines for Data Review (USEPA 2017a, USEPA 2017b). The guidelines specify that sample concentrations less than five times the amount detected in associated blanks should be qualified as non-detected ("U").

7.5.3.2 Matrix Spike Samples

Laboratory MS samples are used to evaluate potential sample matrix effects on the accurate quantitation of an analyte using the prescribed analytical method. Percent recoveries of target analytes from MS samples should fall within the prescribed control limits. However, if other QA/QC results are acceptable, there is no requirement to qualify sample results. Matrix interference and other effects may cause low or high percent recoveries in samples.

7.5.3.3 Laboratory Instrument Calibration

Instruments used by the laboratory will be calibrated in accordance with the laboratory's QA Plan, Method SOPs, instrument manufacturer's guidelines, and any specified EPA-method requirements. When laboratory measurement instruments do not meet the calibration criteria of the laboratory QA Plan, Method SOP or EPA method, then the instrument will not be used for analysis of samples submitted under this plan. Calibration records and demonstration of acceptable calibration results will be required elements of the laboratory's data reporting. Calibration records shall be available for review during internal or external performance and system audits of the laboratory.

7.5.3.4 Quality Assessment and Corrective Actions

Field and laboratory procedures will be reviewed by persons having no direct responsibilities for the activities being performed to determine conformance with technical and QA procedures. Corrective actions will be implemented for each nonconformance identified.

The Field Team Leader will be responsible for taking and reporting required corrective action during field activities. A description of deviations from the SAP and any corrective action will be entered in the field notebook. The Laboratory QA Manager will be responsible for taking required corrective actions in response to any problems with data quality during laboratory activities.

7.5.4 Data Review

Field measurements will be checked for errors and compared to prior measurements for accuracy. Anomalous or suspect values will be noted, and an explanation provided. Laboratory results will be checked for completeness, in order to assure that all the requested analyses were performed along with the correct methodologies and detection limits.

Complete raw data packages from the laboratory will be evaluated to assess compliance with DQIs. Data will also be evaluated to assess whether the measurement performance criteria for accuracy and precision have been achieved. Laboratory method blanks, MS samples, laboratory duplicate samples, LCS, and holding times will be validated in accordance with USEPA Contract Laboratory Program National Functional Guidelines for Organic Superfund Method Data Review (USEPA 2017a) and USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA 2017b). The laboratory will provide a QC summary suitable for this level of review.

Data review will include but will not be limited to:

- Reviewing COC forms and laboratory data sheets to verify that samples were analyzed within specified holding times. Samples which do not satisfy holding time and preservation requirements will be noted and the reliability of the data assessed.
- Reviewing whether the calibration requirements were met.
- Evaluating the accuracy of chemical data using results from LCS and MS samples prepared by the laboratory. The laboratory will calculate the percent recoveries for these results. If the recoveries are outside the limits presented in this plan, action will be taken by the laboratory to improve the precision of analytical results.
- Evaluating the precision of the chemical data by comparing original and duplicate sample results. The laboratory will calculate RPD values for the laboratory duplicate samples. If RPD values are outside the limits presented in this plan, action will be taken by the laboratory to improve the precision of the analytical results.

- Reviewing all of the data for potential transcription errors, detection limit discrepancies (laboratory only), data omissions, and suspect or anomalous values. If such errors or deficiencies are found, the laboratory and/or field sampler will be contacted and the appropriate corrective action taken.

The validated data will be evaluated and compared against the measurement and data quality objectives, and the data's usability with respect to addressing the Pilot Study objectives will be determined. Adherence to field and laboratory protocols will be reviewed to establish the effectiveness. All data will be summarized in tables and trends and relationships evaluated and presented to determine if the data provides strong evidence for a particular action.

7.5.5 Data Management

When the review is completed and it is determined that the data are complete and reasonable, final entry of the information into the database will be completed. The analytical laboratory will report data by paper copy and in electronic file format. Paper laboratory reports and associated field documentation will be filed, and the electronic data will be stored in a computer database.

8.0 DATA ANALYSIS AND REPORTING

The data collected as part of this Pilot Study will be evaluated to determine if the DQOs are met and to evaluate and report the effectiveness of the treatment system.

8.1 Data Evaluation

Laboratory reports will document sample custody, analytical results and QA/QC, adherence to prescribed protocols, nonconformity events, corrective measures, and/or data deficiencies. The laboratory data will be reviewed and evaluated for accuracy and precision to ensure that the data are of sufficient quality to assess the treatment's performance. The review will confirm that all requested analyses were performed using the procedures specified in Section 7 of this plan. The review will also include evaluation of data quality using results from the laboratory's data quality analyses, including analytical duplicates, MSDs, and control samples or standards. Any deviations from this plan or concerns regarding data quality will be resolved by working with the laboratory, which may include request for reanalysis of samples.

Field measurements will also be reviewed before those data are reported. The field notes, measurement entries, and any calculations will be subject to a peer review. Errors identified during the review will be corrected by the field staff with documentation of the correction date.

8.2 Data Validation

Data validation will be performed by a third party using the general protocols and processes described in the following documents, as applicable to the method calibration and QC limits specified in Section 6 of this plan and to the extent possible when non-Contract Laboratory Program (CLP) methods are used:

- Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (NFG; USEPA 2017); and
- Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (USEPA 2009).

Data validation will be performed using a "tiered" approach. One-hundred percent (100 percent) of the data packages will be evaluated and qualified for all quantitative QC elements (e.g., spike recoveries, method and field blank contamination, duplicate sample percent Relative Standard Deviation (RSD), and instrument stability and performance [e.g., initial and continuing calibration results, instrument tuning and internal standard areas]) using hard-copy summary forms. This validation of 100 percent of the data is considered Tier 1, and it is equivalent to a "Stage 2B

Validation," as defined in the USEPA guidance for labeling externally validated data (USEPA 2009).[6]

Tier 2 of the project's data validation is equivalent to an "USEPA CLP Level IV" validation and essentially the same as "Stage 4 Validation" (USEPA 2009).[7] The Tier 2 validation includes all of the Tier 1 elements as well as a complete evaluation of all the raw data. A minimum 10% of the data packages will undergo Tier 2 validation. The data packages selected for Tier 2 validation will be representative of the pilot study samples as a whole.

The selected laboratory will be required to provide a USEPA Level IV data report for the sample sets targeted by Simplot for Tier 2/Level IV validation.

For the remaining data sets the laboratory will provide the following information in their data reports:

- Field and laboratory sample identification;
- Sample result, method detection limit, and reporting limit, with appropriate units;
- Sample collection and receipt dates;
- Sample preparation and analysis date/time;
- Dilution factor;
- Preparation and analysis batch numbers or identification;
- Sample matrix;
- Analytical method(s) references;
- Percent moisture determination; and
- For solid-matrix samples, identify basis of reporting (i.e., wet-weight or dry-weight basis).

The following additional information will also be provided, as applicable for the reported analytical methods:

- Case narrative;
- Copies of the signed COCs;
- Laboratory method/preparation blank;
- ICV, and CCV;
- ICB, and CCB;
- Interference check sample, if applicable;

[6] EPA, 2009. Page 6: "A verification and validation based on completeness and compliance checks of sample receipt conditions and BOTH sample-related and instrument-related QC results…"
[7] Ibid, page 7: "A verification and validation based on completeness and compliance checks of sample receipt conditions, both sample-related and instrument-related QC results, recalculation checks, AND the review of actual instrument outputs…"

- MS, and when applicable MSD, sample recovery and, when applicable, MS/MSD RPD;
- Post-digest spike sample recovery;
- Laboratory duplicate;
- LCS recovery;
- Inductively coupled plasma mass spectrometry (ICP-MS) serial dilution percent differences;
- MDLs;
- ICP inter-element correction factors;
- ICP and ICPMS linear ranges;
- Preparation log;
- Analysis run Log;
- ICPMS tunes;
- ICPMS internal standards relative intensity summary;
- Sample log-in sheet; and
- Deliverables inventory sheet.

The tiered data validation approach will be applied for at least one year following installation of the PRB. After one year of data validation completed as described by this plan, validation findings may be evaluated to determine whether any changes to the tiered approach are warranted. Both increased and decreased levels of effort for ongoing data validation may be considered. Any change in the level of effort associated with ongoing data validation will be identified by Simplot and proposed to the Agencies for approval before adoption under this plan.

8.3 Reporting

Weekly email updates on the Field-Scale PRB Pilot Study construction and implementation will be provided to the Agencies in the form of an email every Friday, or as soon as possible early the next week. The weekly updates will include descriptions and photographs of the past week's activities, and the upcoming week's planned activities.

A construction summary report (CSR) will be submitted 90 days after the completion of the PRB construction. The CSR will include a narrative description of the construction activities, photographs, and final as-built drawings.

During Year 1 of the Field-Scale PRB Pilot Study implementation, technical memoranda will be provided 60 days after sampling events to provide field and laboratory data, along with a summary of the observed PRB performance.

Within 90 days after completion of the last sampling event of Year 1, Simplot will prepare a Treatability/Pilot Study Report documenting the findings of the study. Following the Agencies' review of the report, Simplot will address comments and prepare and submit a final Treatability/Pilot Study Report.

Ongoing monitoring of the Field-Scale PRB Pilot Study will continue after Year 1 under the Pedro Creek NTCRA PRSC Plan. Annual performance of the PRB will be discussed in the Pedro Creek NTCRA Annual Maintenance and Monitoring Report (AMMR). The lifespan of the treatment media is uncertain but may last up to 15 to 20 years based on current literature (Robertson 2010; USEPA 2014). The ongoing monitoring will evaluate both treatment efficiency, the need for carbon amendment, and the timing of the breakthrough curve.

9.0 ROLES AND SCHEDULE

The construction will be performed by NewFields LLC. As the constructor, NewFields will be responsible for the Construction Quality Control (CQC) as well as for conformance with the final PRB requirements. The Construction Quality Assurance (CQA) inspection and testing will be performed by Simplot, to certify that the PRB is being constructed in accordance with this implementation plan. Project duties and responsibilities are described below and illustrated in an organizational chart (Figure 9-1).

Project Management – NewFields' Project Manager (Matthew Wright) , with support from Formation Environmental (Robbert-Paul Smit), is responsible for overall management and construction of the PRB. Simplot's Project Manager's (Jeffrey Hamilton) responsibilities include scheduling, personnel management and management of various subcontractors. Formation Environmental will support Simplot with the regulatory requirements. Simplot's and Formation Environmental's Project Managers will serve as the primary contacts with the Agencies.

Project Engineer - The NewFields Project Engineer (Kevin Jennings) will be registered as a Professional Engineer in the State of Idaho. The Project Engineer will be independent of the construction contractor(s), but directly accountable for the successful completion of the PRB.

Construction Manager - The onsite Construction Manager (Brandon Hammond) will have overall responsibility for managing the construction of the PRB and implementing the CQC program, including providing daily construction reports documenting testing and construction activities. The daily reports will be provided to the Project Engineer and the CQA Manager.

CQC Manager - The CQC Manager (Brandon Hammond) is responsible for overseeing all CQC testing and supporting the Construction Manager. The CQC Manager will ensure that the equipment operators are properly following design specifications on the final drawings.

CQA Manager - The CQA Manager (Nick Owens) will report directly to the Project Engineer (Kevin Jennings). The CQA Manager will ensure that the PRB is properly constructed to design specifications.

Regulatory Oversight – The Agencies will be responsible for providing oversight of the PRB implementation activities. EPA, IDEQ, and BLM, or their designated representatives, will make periodic inspections of the construction activities to assure that the PRB construction is proceeding in substantial compliance with the approved final implementation plan. Simplot will provide full and complete access to EPA, IDEQ, and BLM or their designated representatives during periodic inspections, and as much as practicable, accompany them during these inspections.

Table 9-1 presents a general schedule of events. A summary of the construction schedule and work products that will be submitted are included in the schedule.

10.0 REFERENCES

American Society for Testing and Materials (ASTM). 2015a. ATSM Standard D4044/4044M, Standard Test Method for (Field Procedure) for Instantaneous Change in Head (Slug) Tests for Determining Hydraulic Properties of Aquifers, West Conshohocken, PA, 2015, DOI: 1-.1520/D4044_D4044M-15.

ASTM. 2015b. Method D 5856-15. Standard Test Method for Measurement of Hydraulic Conductivity of Porous Material Using a Rigid-Wall, Compaction-Mold Permeameter, West Conshohocken, PA, 2015, DOI: 10.1520/D5856-15.

ASTM. 2012. Method D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3), West Conshohocken, PA, DOI: 10.1520/D0698-12E02.

Bouwer, H. and R.C. Rice, 1976. A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells, Water Resource Research, vol 12, no. 3, pp. 423-428.

Hvorslev, M.J., 1951. Time Lag and Soil Permeability in Ground-Water Observations, Bull. 26, Waterways Exper. Sta. Corps of Engrs, U.S. Army, Vicksburg, Mississippi, pp. 1-50.

Freeze, R.A., and Cherry, J.A., 1979, Groundwater: Englewood Cliffs, NJ, Prentice-Hall, p. 604.

Formation Environmental, LLC, 2017a. Conda/Woodall Mountain Mine, Draft Final Feasibility Study, Development and Screening of Remedial Alternatives – Technical Memorandum #1. Prepared for J.R. Simplot Company, November 2017.

Formation Environmental, LLC, 2017b Conda/Woodall Mountain Phosphate Mine, Pedro Creek Sub-Basin Non-Time-Critical Removal Action, Final 2016 Post-Removal Site Control Annual Maintenance and Monitoring Report. Prepared for J.R. Simplot Company, November 2017.

Formation Environmental, LLC, 2017c Conda/Woodall Mountain Phosphate Mine, Permeable Reactive Barrier Pilot Study, Final Site Preparation and Hydrogeological Characterization Work Plan. Prepared for J.R. Simplot Company, September 2017

Formation Environmental, LLC, 2016 Conda/Woodall Mountain Mine, Final Remedial Investigation Report. Prepared for Prepared for J.R. Simplot Company, December 2016.

Formation Environmental, LLC, 2015. Conda/Woodall Mountain Mine, Pedro Creek – Non-Time-Critical Removal Action (NTCRA), Final Construction Summary. Prepared for J.R. Simplot Company, July 2015.

Interstate Technology & Regulatory Council (ITRC), 2011. Technical/Regulatory Guidance, Permeable Reactive Barrier: Technology Update. Prepared by the PRB: Technology Update Team. June 2011.

NewFields Companies, LLC, 2016. Remedial Design and Implementation Plan, Horseshoe Overburden Area, South Rasmussen Mine, Caribou County, Idaho. Prepared for P4 Production, LLC. Revised January.

NewFields Companies, LLC, 2008. Final Conda\Woodall Mountain Remedial Investigation and Feasibility Study Work Plan. Prepared for J.R. Simplot Company. December 2008.

North American Metals Council (NAMC), 2010. Review of Available Technologies for the Removal of Selenium from Water. June 2010.

National Oceanic and Atmospheric Administration (NOAA), 2006. Precipitation Frequency Atlas of the Western United States, NOAA Atlas II Idaho, U.S. Weather Service.

Roberston, W.D., 2010. Nitrate removal rates in woodchip media of varying age. Ecological Engineering, 36(2010): 1581-1587.

USEPA, 2017. National Functional Guidelines for Inorganic Superfund Methods Data Review. Office of Superfund Remediation and Technology Innovation, Washington DC. January 2017.

USEPA, 2014. Reference Guide to Treatment Technologies for Mine-Influenced Water, Office of Superfund Remediation Technology Innovation, Washington D.C.

USEPA, 2009. Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use, January 2009.

U.S. Environmental Protection Agency (USEPA), 1998. Permeable Reactive Barrier Technologies for Contamination Remediation. EPA/600/R-98/125. September 1998.

U.S. Environmental Protection Agency USEPA, 1992. Guidance for Conducting Treatability Studies under CERCLA. http://www.epa.gov/superfund/policy/remedy/pdfs/540r-92071a-s.pdf.

TABLES

FIGURES

APPENDIX A

Well Boring Logs

(Provided Electronically)

APPENDIX B

Slug Test Results

(Provided Electronically)

APPENDIX C

Bench-Scale Report

(Provided Electronically)

APPENDIX D

Design Approach and Drawings

(Provided Electronically)

APPENDIX E

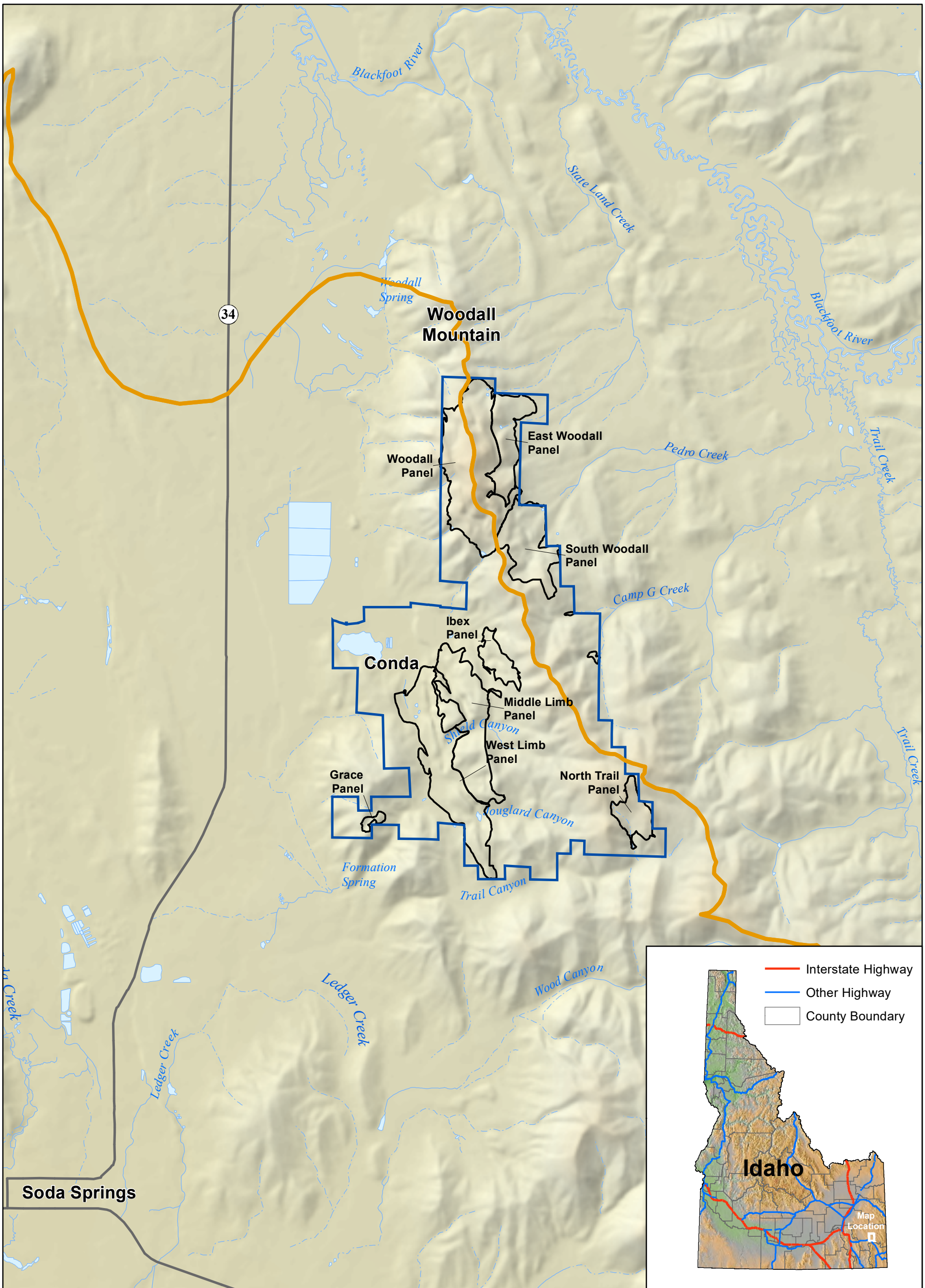
Standard Operating Procedures

(Provided Electronically)

APPENDIX F

Comments Responses and Resolutions

(Provided Electronically)



Legend

- Primary Road
- Intermittent Stream
- Perennial Stream
- Pond or Lake
- Mine Panels
- Blackfoot / Bear River Drainage Divide
- Mine Boundary

N

Feet

0 4,000 8,000

J.R. SIMPLOT COMPANY
CONDA/WOODALL MOUNTAIN MINE
FIELD-SCALE PRB PLAN

FIGURE 1-1

CONDA / WOODALL MOUNTAIN PHOSPHATE MINE LOCATION

DATE: SEP 06, 2018
BY: CRL
FOR: RPS

FORMATION ENVIRONMENTAL

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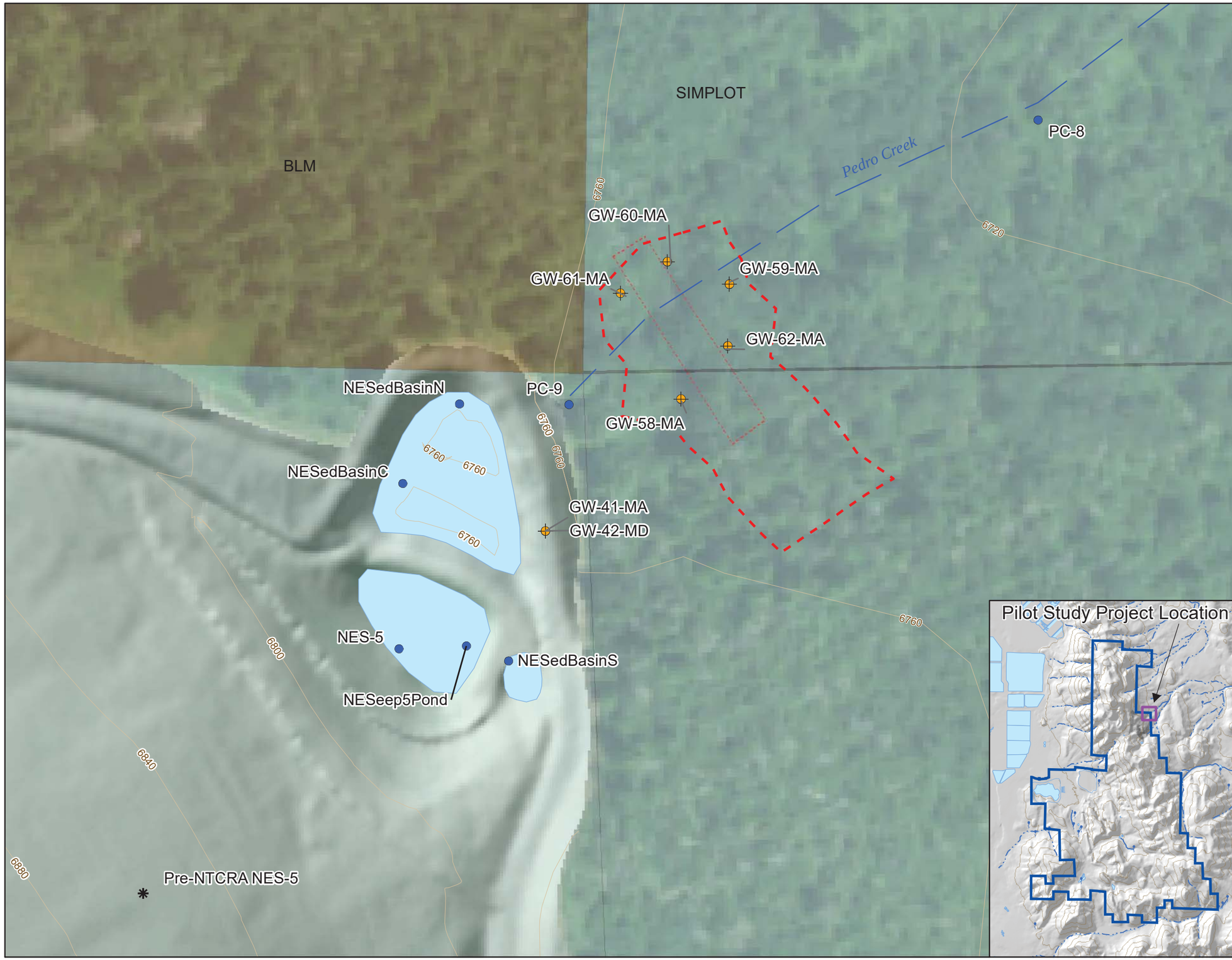

Legend

- PRB Groundwater Monitoring Locations
- Surface Water and Sediment Monitoring Locations
- Pre-NTCRA NES-5 Location
- Potential Alignment of PRB
- Limits of Clearing and Grubbing
- Simplot
- BLM
- 40 ft Contour

0 50 100
Feet

N

J.R. SIMPLOT COMPANY
CONDA/WOODALL MOUNTAIN MINE
FIELD-SCALE PRB PLAN

FIGURE 1-2

PERMEABLE REACTIVE BARRIER PILOT STUDY PROJECT LOCATION

DATE: SEP 06, 2018
BY: LJM FOR: RPS/LLV

FORMATION ENVIRONMENTAL

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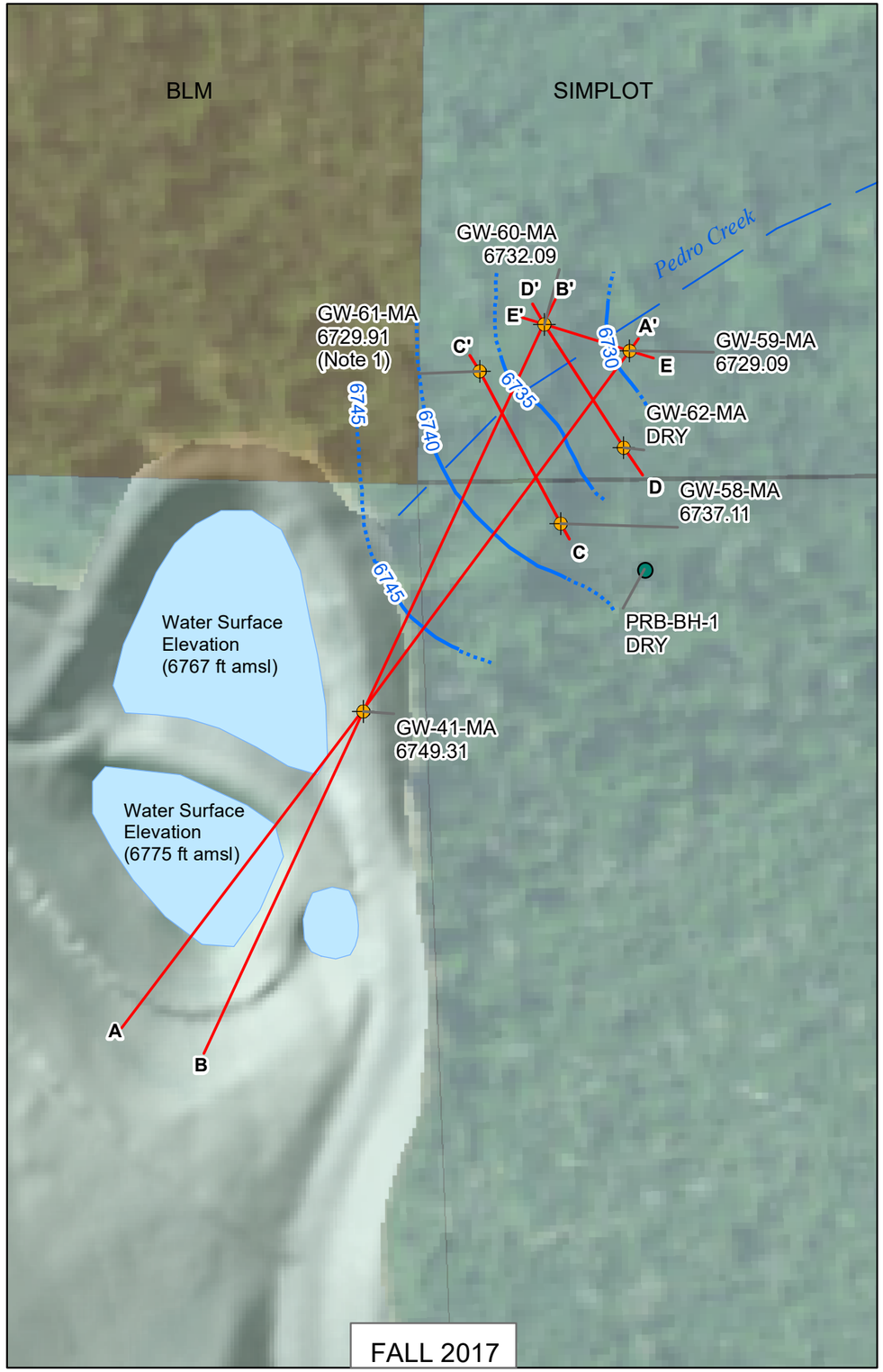

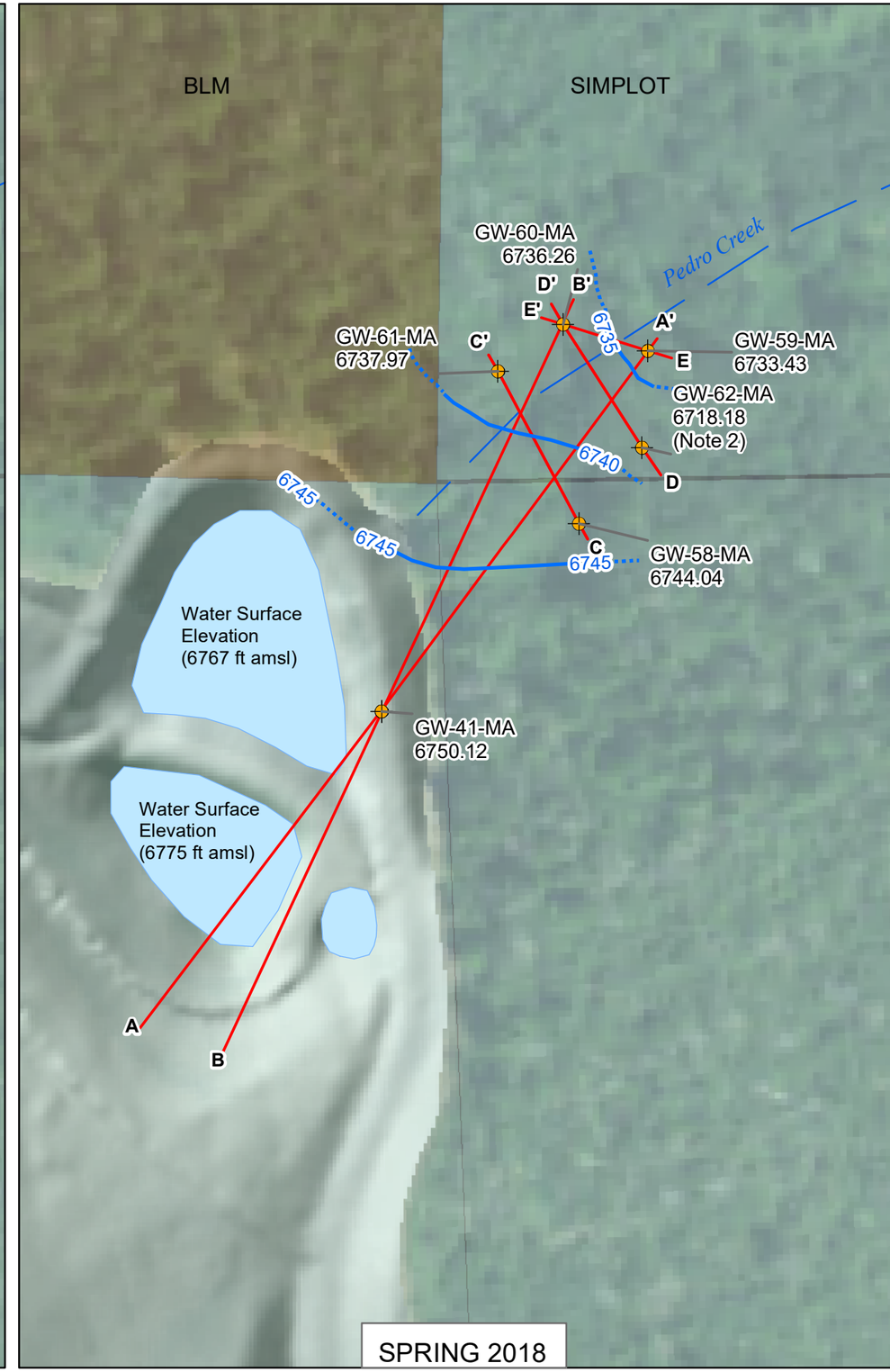

Legend

- Groundwater Monitoring Locations
- Boring Location
- Hydrogeologic Cross Section Line
- Estimated Potentiometric Surface Contour
- Inferred Potentiometric Surface Contour
- Simplot
- BLM

Notes:
1 - Groundwater elevation not used in contouring. Well is slow to recover and water level may not be equilibrated at time of measurement.
2 - Groundwater elevation not used in contouring. Well was installed dry, and water present may be from perched zones, seperate from the main alluvial groundwater system.

0 50 100
Feet

N

J.R. SIMPLOT COMPANY
CONDA/WOODALL MOUNTAIN MINE
FIELD-SCALE PRB PLAN

FIGURE 3-1

UNCONSOLIDATED DEPOSITS POTENTIOMETRIC SURFACE MAP

DATE: SEP 06, 2018
BY: LJM FOR: RPS/LLV
FORMATION ENVIRONMENTAL

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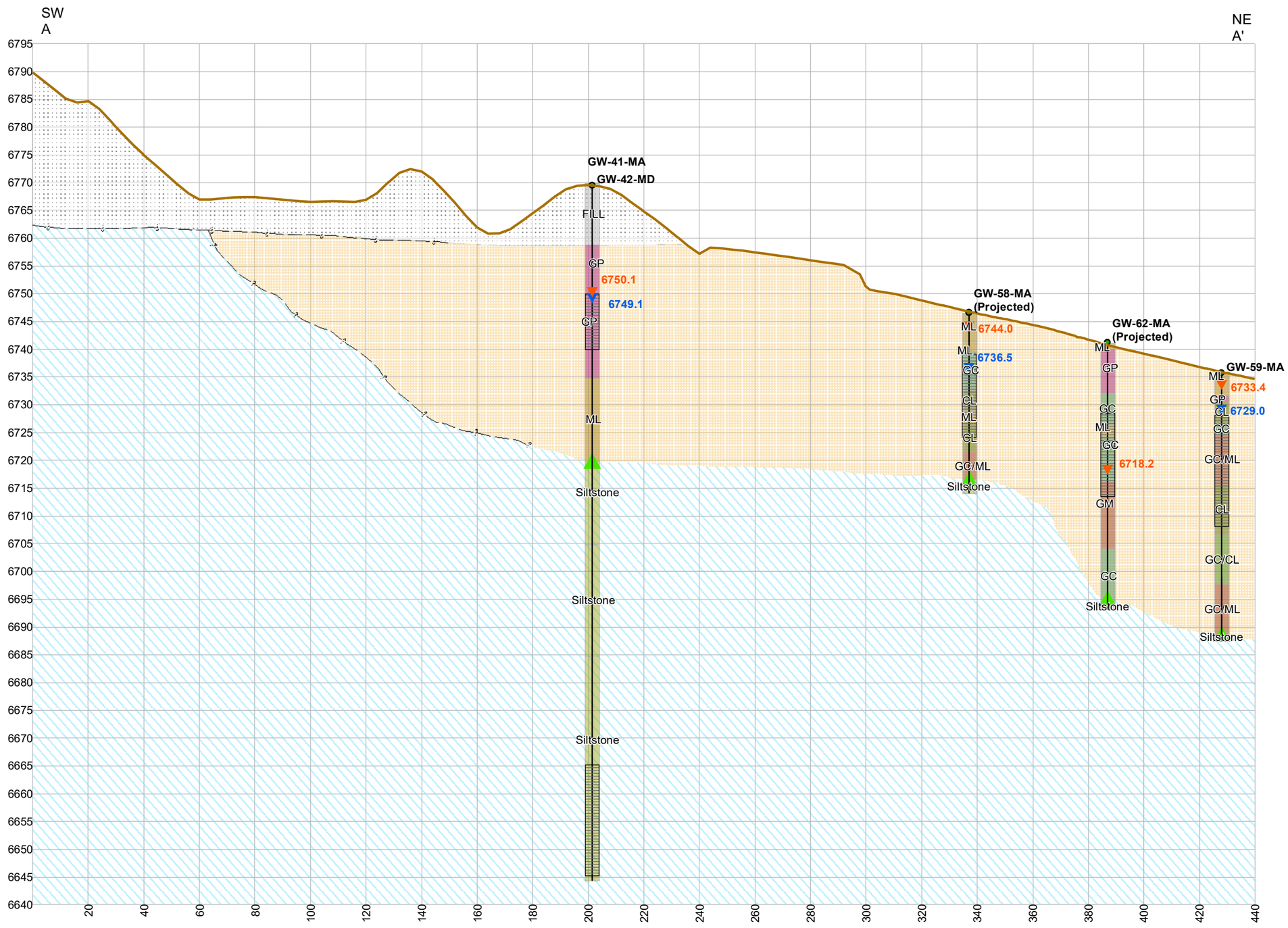

Note:
GW-62-MA was dry on 10-31-2017.

2x Vertical Exaggeration

Legend

- Groundwater Elevation (10-31-17)
- Groundwater Elevation (5-24-18)
- Approximate Weathered/Unweathered Transition
- Well Screen

Generalized Borehole Lithology

- FILL
- Gravel (GP)
- Gravelly Clay/Silt (GC/ML)
- Gravelly Clay (GC)
- Gravelly Clay/Clay (GC/CL)
- Silt (ML)
- Clay (CL)
- Siltstone

Generalized Cross-Section Lithology

- Fill
- Unconsolidated Alluvium/Colluvium/Weathered Dinwoody Formation
- Unweathered Dinwoody Formation (TRd)

0 50 100
Feet

J.R. SIMPLOT COMPANY
CONDA/WOODALL MOUNTAIN MINE
FIELD-SCALE PRB PLAN

FIGURE 3-2

GENERALIZED HYDROGEOLOGIC CROSS SECTION A - A'

DATE: OCT 02, 2018
BY: LJM
FOR: RPS

FORMATION ENVIRONMENTAL

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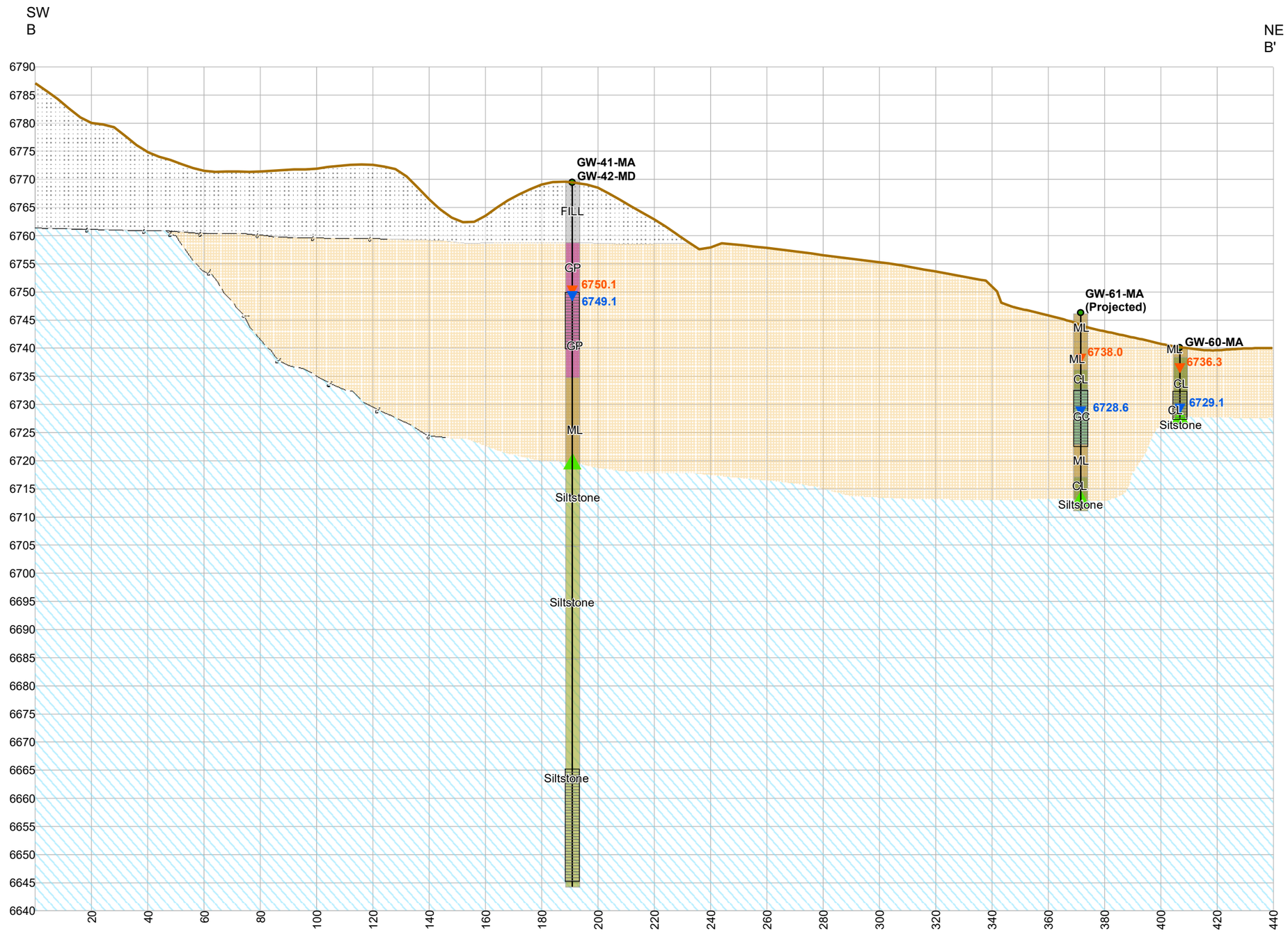

2x Vertical Exaggeration

Legend

- Groundwater Elevation (10-31-17)
- Groundwater Elevation (5-24-18)
- Approximate Weathered/Unweathered Transition
- Well Screen

Generalized Borehole Lithology

- FILL
- Gravel (GP)
- Gravelly Clay/Silt (GC/ML)
- Gravelly Clay (GC)
- Gravelly Clay/Clay (GC/CL)
- Silt (ML)
- Clay (CL)
- Siltstone

Generalized Cross-Section Lithology

- Fill
- Unconsolidated Alluvium/Colluvium/Weathered Dinwoody Formation
- Unweathered Dinwoody Formation (TRd)

0 50 100
Feet

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CONDA/WOODALL MOUNTAIN MINE
FIELD-SCALE PRB PLAN

FIGURE 3-3

GENERALIZED CROSS SECTION B-B'

DATE: OCT 02, 2018
BY: LJM
FOR: RPS

FORMATION ENVIRONMENTAL

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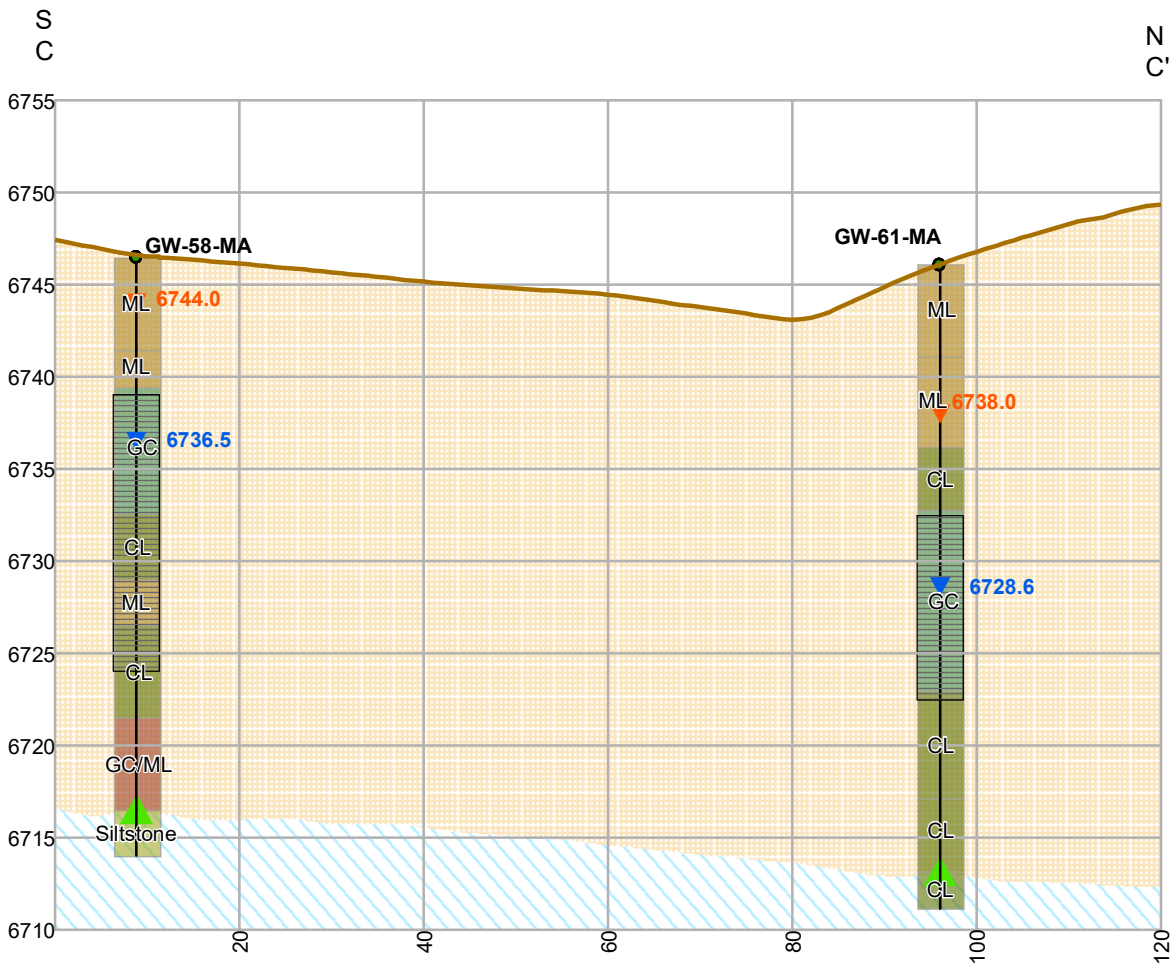

2x Vertical Exaggeration

Legend

- Groundwater Elevation (10-31-17)
- Groundwater Elevation (5-24-18)
- Approximate Weathered/Unweathered Dinwoody Contact
- Well Screen

Generalized Borehole Lithology

- FILL
- Gravel (GP)
- Gravelly Clay/Silt (GC/ML)
- Gravelly Clay (GC)
- Gravelly Clay/Clay (GC/CL)
- Silt (ML)
- Clay (CL)
- Siltstone

Generalized Cross-Section Lithology

- Fill
- Unconsolidated Alluvium/Colluvium/Weathered Dinwoody Formation
- Unweathered Dinwoody Formation (TRd)

0 25 50
Feet

J.R. SIMPLOT COMPANY
CONDA/WOODALL MOUNTAIN MINE
FIELD-SCALE PRB PLAN

FIGURE 3-4

GENERALIZED CROSS SECTION C-C'

DATE: OCT 02, 2018
BY: LJM
FOR: RPS

FORMATION ENVIRONMENTAL

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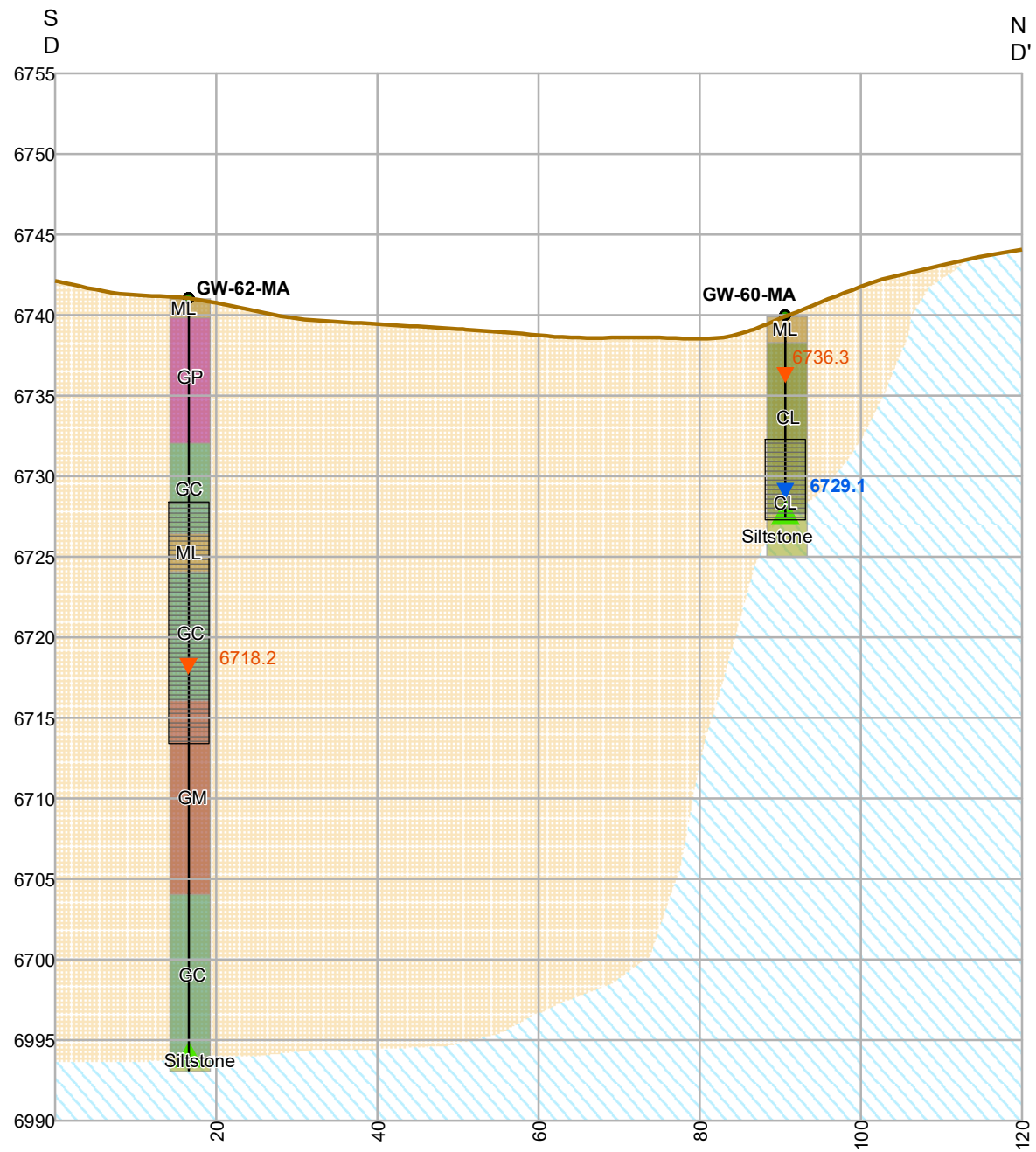

Note:

GW-62-MA dry on 10-31-2017.

2x Vertical Exaggeration

Legend

- Groundwater Elevation (10-31-17)
- Groundwater Elevation (5-24-18)
- Approximate Weathered/Unweathered Transition
- Well Screen

Generalized Borehole Lithology

- FILL
- Gravel (GP)
- Gravelly Clay/Silt (GC/ML)
- Gravelly Clay (GC)
- Gravelly Clay/Clay (GC/CL)
- Silt (ML)
- Clay (CL)
- Siltstone

Generalized Cross-Section Lithology

- Fill
- Unconsolidated Alluvium/Colluvium/Weathered Dinwoody Formation
- Unweathered Dinwoody Formation (TRd)

0 25 50

Feet

J.R. SIMPLOT COMPANY

CONDA/WOODALL MOUNTAIN MINE
FIELD-SCALE PRB PLAN

FIGURE 3-5

GENERALIZED CROSS SECTION D-D'

DATE: OCT 02, 2018

BY: LJM FOR: RPS

FORMATION ENVIRONMENTAL

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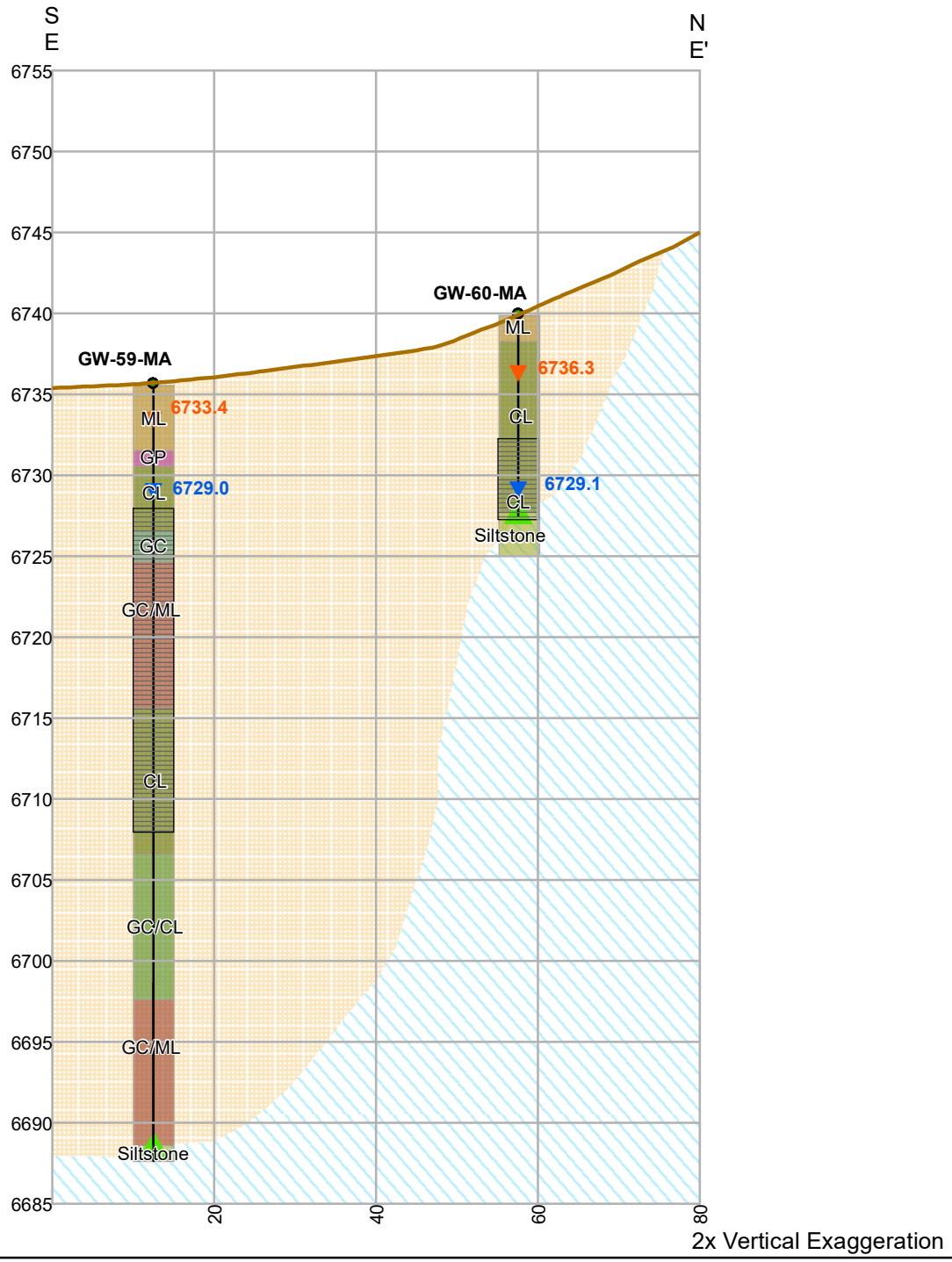


Legend

- Groundwater Elevation (10-31-17)
- Groundwater Elevation (5-24-18)
- Approximate Weathered/Unweathered Transition
- Well Screen

Generalized Borehole Lithology

- FILL
- Gravel (GP)
- Gravelly Clay/Silt (GC/ML)
- Gravelly Clay (GC)
- Gravelly Clay/Clay (GC/CL)
- Silt (ML)
- Clay (CL)
- Siltstone

Generailzed Cross-Section Lithology

- Fill
- Unconsolidated Alluvium/Colluvium/Weathered Dinwoody Formation
- Unweathered Dinwoody Formation (TRd)

0 25 50
Feet

J.R. SIMPLOT COMPANY
CONDA/WOODALL MOUNTAIN MINE
FIELD-SCALE PRB PLAN

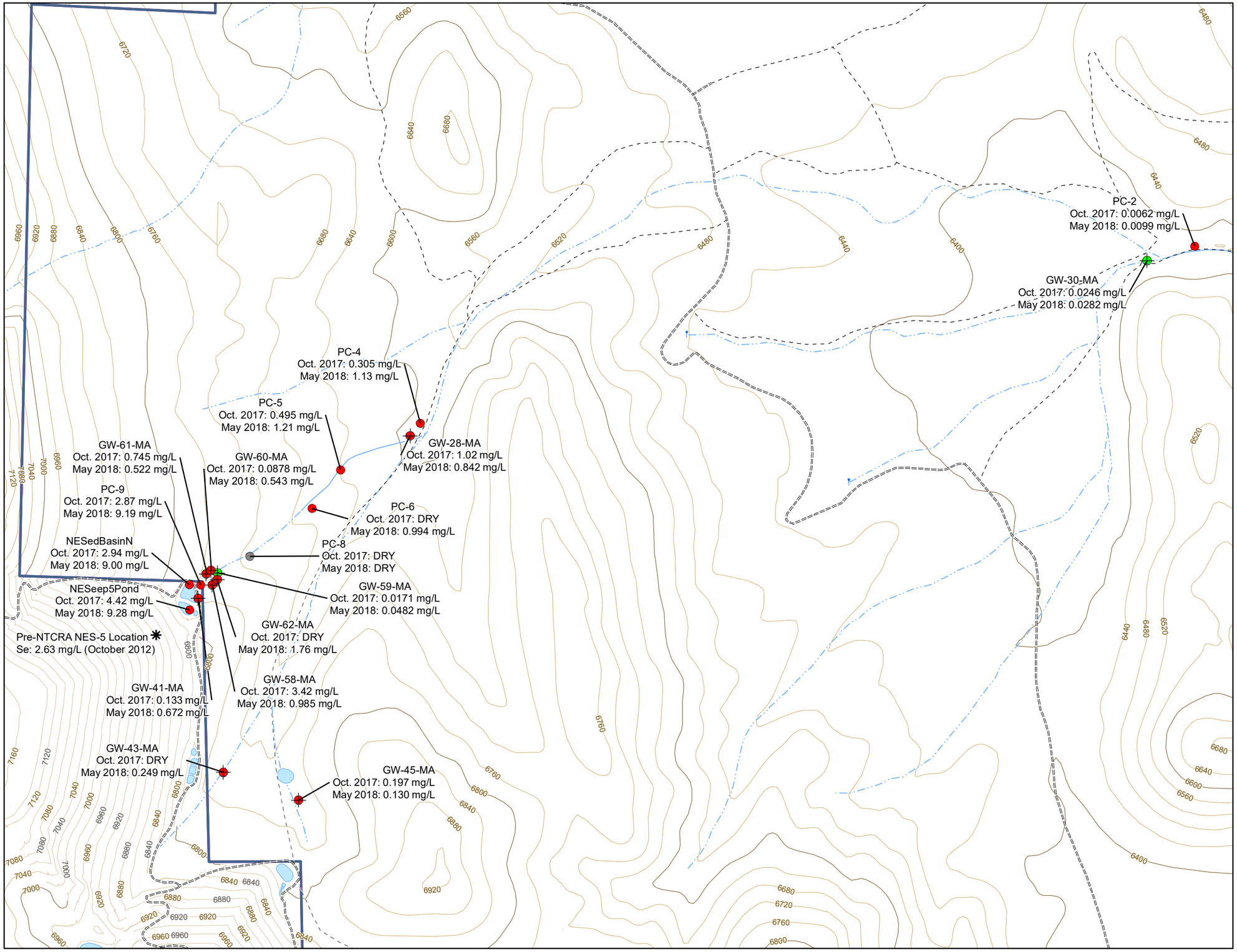
FIGURE 3-6

GENERALIZED CROSS SECTION E-E'

DATE: OCT 02, 2018
BY: LJM
FOR: RPS

FORMATION ENVIRONMENTAL

S:\GIS\arcprj2\010139\plt\PRB\Fig3-6_XsectE.mxd



Legend

- Unimproved Road
- Trail (4WD)
- Trail (Other than 4WD)
- Railroad
- Intemittent Stream
- Perennial Stream
- Lake/Pond
- Reservoir
- Mine Area
- Non-Mine Area
- 20 ft Index Contour
- 40 ft Index Contour
- 200 ft Index Contour

Groundwater Locations

- Total Se > 0.05 mg/L
- Total Se < 0.05 mg/L

Surface Water Locations

- Total Se > 0.005 mg/L
- Dry Location
- Pre-NTCRA NES-5 Location

0 500 1,000
Feet

N

J.R. SIMPLOT COMPANY
CONDA/WOODALL MOUNTAIN MINE
FIELD-SCALE PRB PLAN

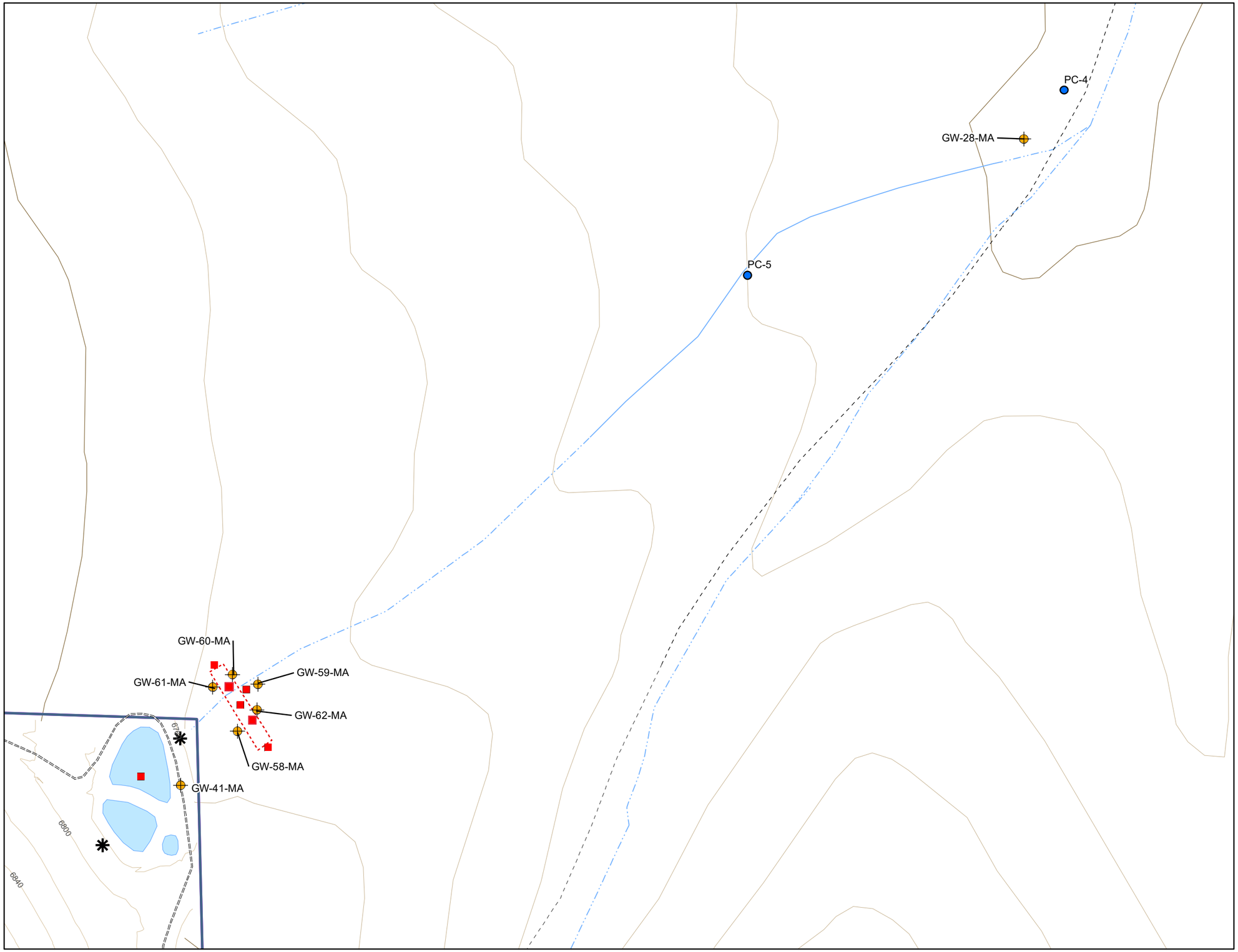
FIGURE 3-7

SURFACE WATER AND GROUNDWATER TOTAL SELENIUM

DATE: SEP 06, 2018
BY: LLV
FOR: RPS

FORMATION ENVIRONMENTAL

S:\GIS\arcprj2\010139\plt\PRB\Fig3-7_SeGW.mxd



Legend

- Unimproved Road
- Trail (4WD)
- Trail (Other than 4WD)
- Railroad
- Intemittent Stream
- Perennial Stream
- Lake/Pond
- Reservoir
- Mine Area
- Non-Mine Area
- Groundwater Sampling Locations
- Approximate Location of Proposed Additional Wells
- Seep Treatment Cell Influent and Effluent Sampling Locations
- Surface Water Sampling Locations
- Potential Alignment of PRB

0 150 300
Feet

N

J.R. SIMPLOT COMPANY
CONDA/WOODALL MOUNTAIN MINE
FIELD-SCALE PRB PLAN

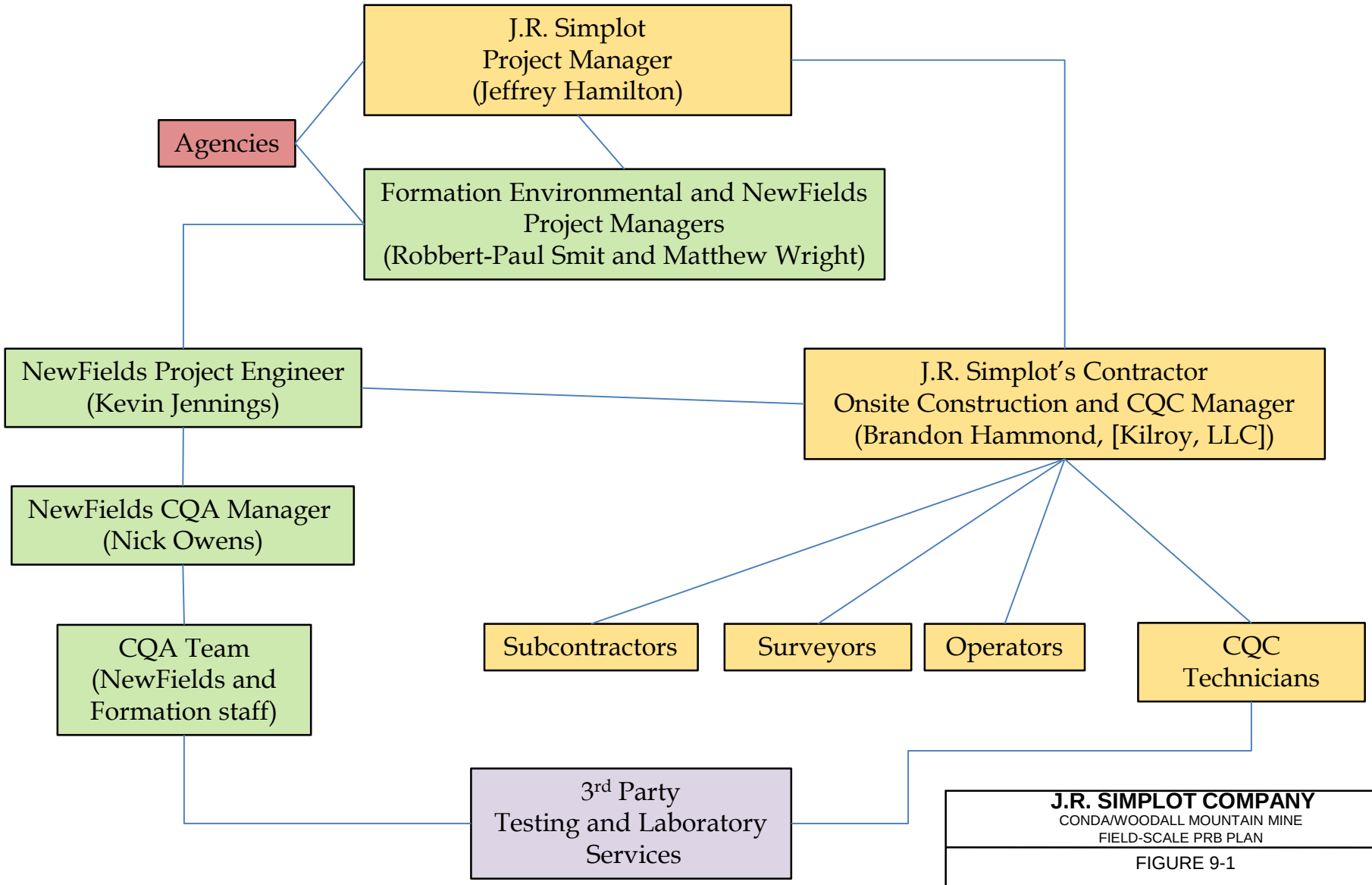
FIGURE 6-1

GROUNDWATER AND SURFACE WATER SAMPLE LOCATIONS

DATE: SEP 06, 2018
BY: LLV
FOR: RPS

FORMATION ENVIRONMENTAL

S:\GIS\arcprj2\010139\plt\PRB\Fig6-1_SampleLocs.mxd



J.R. SIMPLOT COMPANY
CONDA/WOODALL MOUNTAIN MINE
FIELD-SCALE PRB PLAN

FIGURE 9-1

PROJECT DUTIES AND RESPONSIBILITIES

DATE: SEPT 2018

BY:LJM | FOR: RPS

FORMATION ENVIRONMENTAL

S:\S:\JOBS\0442-001-900-SIMPLOT-CONDA\PEDROCREEK_EARLYACTIONDESIGNANDIMPLEMENTATION\FINALDESIGN\IMLPLAN\FIGURES\FIG7-1_ROLES.PPTX

Table 3-1
Meterological Data From the Blackfoot Bridge Mine

	2012	2013	2014	2015	2016	2017
January	4.2	2.8	4.2	2.3	3.8	5.5
February	4.5	1.8	7.8	2.7	2.7	10.4
March	2.1	2.5	4.5	1.5	5.5	5.2
April	2.6	4.1	2.3	2.9	2.8	4.5
May	2.9	2.2	1.5	7.9	4.5	2.2
June	0.2	0	1.3	1.8	0.8	0.9
July	1.2	1.5	0.7	1.8	0.4	0.6
August	0.1	0.9	4.7	1.8	0	0.4
September	0.5	4	4.8	2.5	3.4	4.4
October	2.4	2.4	1.5	1.5	6.9	0.7
November	2.7	2.5	5.2	3.8	2.2	6.7
December	5.3	3.3	4.2	4	8.2	n/a
Total Precip (in)	28.7	28	42.7	34.5	41.2	41.5

Table 3-2
Groundwater Well Construction Details

Well ID	Northing	Easting	Formation Screened	Surface Elevation (ft amsl)	TOC Elevation (ft amsl)	Total Depth of Well (ft btoc)	Well Screen Interval (ft btoc)	Well Screen Interval (ft amsl)	Well Completion Date	Depth to Water During Drilling (ft bgs)	GW Elevation During Drilling (ft amsl)	GW Elevation 10/31/2017 (ft amsl)	GW Elevation 5/24/18 (ft amsl)
GW-41-MA	395222	833568	Alluvium/Colluvium	6769.8	6769.5 [a]	30.1	19.7 - 29.7	6739.8 - 6749.8	11/5/2013	19	6750.8	6749.1	6750.1
GW-42-MD	395222	833568	Dinwoody	6769.8	6769.5 [a]	125.1	104.7 - 124.7	6644.8 - 6664.8	11/5/2013	105	6664.8	6682.0	6701.0
GW-58-MA	395317	833668	Alluvium/Colluvium	6746.5	6748.6	24.9	9.6 - 24.6	6724 - 6739	10/10/2017	10	6736.5	6736.5	6744.0
GW-59-MA	395404	833703	Alluvium/Colluvium	6735.7	6737.9	30.2	9.9 - 29.9	6708 - 6728	10/11/2017	9	6726.7	6729.0	6733.4
GW-60-MA	395418	833660	Alluvium/Colluvium	6740	6742.7	15.7	10.4 - 15.4	6727.3 - 6732.3	10/12/2017	Dry	Dry	6729.1	6736.3
GW-61-MA	395394	833627	Alluvium/Colluvium	6746.2	6748.8	26.6	16.3 - 26.3	6722.5 - 6732.5	10/12/2017	20	6726.2	6728.6	6738
GW-62-MA	395355	833700	Alluvium/Colluvium	6741.1	6743.7	30.6	15.3 30.3	6713.4 6728.4	10/11/2017	22	6719.1	Dry	6718.2

Notes:
- Northing and Easting coordinates are in NAD 83 Idaho State Plane East.
- Wells constructed out of 2" schedule 40 PVC

[a] Flush mount completed wells

Acronyms:
ft amsl = feet above mean sea level; ft bgs = feet below ground surface; ft btoc = feet below top of casing; TOC = top of casing
NA = Information not available

Table 3-3
Groundwater Elevation Data

Station	Analyte >> / Unit >> / Date	Total Well Depth	TOC Elevation	DTW	Groundwater Elevation
		Feet BTOC	Feet AMSL	Feet BTOC	Feet AMSL
GW-41-MA	4/23/2015	30.1	6769.53	16.98	6752.55
	7/15/2015			18.71	6750.82
	10/18/2015			19.64	6749.89
	5/7/2016			15.09	6754.44
	7/19/2016			19.29	6750.24
	10/5/2016			20.10	6749.43
	5/23/2017			18.49	6751.04
	7/18/2017			19.51	6750.02
	10/3/2017			20.09	6749.44
	10/13/2017			20.26	6749.27
	10/31/2017			20.44	6749.09
	5/24/2018			19.41	6750.12
GW-42-MD	4/23/2015	125.08	6769.48	74.32	6695.16
	7/15/2015			74.26	6695.22
	10/18/2015			84.67	6684.81
	5/7/2016			66.30	6703.18
	7/19/2016			78.32	6691.16
	10/5/2016			87.57	6681.91
	5/23/2017			62.15	6707.33
	7/18/2017			75.11	6694.37
	10/3/2017			86.72	6682.76
	10/13/2017			87.50	6681.98
	5/24/2018			68.46	6701.02
GW-58-MA	10/13/2017	25.25	6748.64	11.66	6736.98
	10/31/2017			12.12	6736.52
	5/24/2018			4.60	6744.04
GW-59-MA	10/13/2017	30.28	6737.89	9.36	6728.53
	10/31/2017			8.89	6729.00
	5/24/2018			4.46	6733.43
GW-60-MA	10/11/2017	15.28	6742.70	Dry	NA
	10/31/2017			13.57	6729.13
	5/24/2018			6.44	6736.26
GW-61-MA	10/11/2017	27.08	6748.79	Dry	NA
	10/31/2017			20.22	6728.57
	5/24/2018			10.82	6737.97
GW-62-MA	10/11/2017	30.57	6743.68	Dry	NA
	10/31/2017			Dry	NA
	5/24/2018			25.50	6718.18

Notes:
AMSL - Above Mean Sea Level
BTOC - Below Top of Casing
DTW - Depth to Water
NA - Value not available
TOC - Top of Casing

Table 3-4
Slug Test Summary and Hydraulic Conductivity Estimates

Location	Aquifer Test Method	Test Start Date	Slug Length (Feet [ft])	Slug Diameter (ft)	Aquifer Model	Solution Method	Estimated Hydraulic Conductivity (ft/day)
GW-41-MA	Rising Head	10/13/2017	3	0.13	Unconfined	Bouwer - Rice	0.52
						Hvorslev	0.74
GW-58MA	Rising Head	11/13/2017	3	0.13	Unconfined	Bouwer - Rice	0.29
						Hvorslev	0.42
GW-59-MA	Rising Head	10/13/2017	5	0.13	Unconfined	Bouwer - Rice	0.76
						Hvorslev	0.97

Notes:
Slug test were analyzed using Aqtesolv software.

Table 3-5
Shallow Groundwater and Seep Analytical and Field Data, 2015 - May 2018

			Station	GW-41-MA																									
			Sample	CD0415-GW41MA-GW001			CD0715-GW41MA-GW001			CD1015-GW41MA-GW001			CD0516-GW41MA-GW001			CD0716-GW41MA-GW001			CD1016-GW41MA-GW001			CD0517-GW41MA-GW001			CD0717-GW41MA-GW001			CD1017-GW41MA-GW001		
			Date	4/23/2015			7/15/2015			10/18/2015			5/7/2016			7/19/2016			10/5/2016			5/23/2017			7/18/2017			10/3/2017		
			Time	12:06			15:30			9:10			12:32			11:01			15:43			16:44			12:02			9:10		
Analyte	**Units**	**Human Health**	**Livestock**	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ
Field Parameters																														
DTW	Feet			16.98			18.71			19.64			15.09			19.29			20.1			18.49			19.51			20.09		
ORP	mV			116.8			229.3			133.9			198.7			135.1			-58.2			114.9			172.9			153.2		
pH	SU			5.2			7.98			7.06			6.82			6.91			7			6.32			6.63			6.35		
Oxygen, Dissolved	mg/L			7.07			5.09			0.31			0.41			2.65			0.43			0.95			0.22			0.49		
Temperature	C			8.7			10.45			12.29			6			11.56			12.28			7.63			10			11.4		
Turbidity	NTU			228			4.03			1.89			0.76						0.88			0.78			4.2			23.8		
Conductivity at 25 C	umhos/cm			2565			1622			3464			2783			2921			4139			2512			3157			3113		
Metals and Metaloids																														
Aluminum, Dissolved	mg/L			0.036	U		0.036	U	UJ	0.036	U		0.036	U		0.055	U		0.055	U										
Aluminum, Total	mg/L	2	5	***5.05***			0.036	U	UJ	0.036	U		0.036	U		0.055	U		0.055	U										
Antimony, Dissolved	mg/L			0.00053	J		0.0009	J	UJ	0.00071	J		0.00048	J		0.00058	J		0.00056	J	U									
Antimony, Total	mg/L	0.006		0.00074	J		0.0008	J	J-	0.0007	J		0.00045	J		0.00056	J		0.00056	J	U									
Arsenic, Dissolved	mg/L			0.0024	J		0.0026	J	J-	0.0015	J		0.00087	J		0.00098	J		0.001	J		0.00067	J		0.00074	J		0.00099	J	
Arsenic, Total	mg/L	0.01	0.2	0.003	J		0.0026	J	J-	0.0014	J		0.00085	J		0.0011	J		0.001	J		0.00068	J		0.00077	J	J-	0.00099	J	
Barium, Dissolved	mg/L			0.0434			0.0424		J-	0.0425			0.0366			0.0414			0.0548											
Barium, Total	mg/L	2	0.2	0.0803			0.0428		J-	0.0432			0.0387			0.0425			0.0543											
Beryllium, Dissolved	mg/L			0.00094	U		0.00094	U	UJ	0.00094	U		0.00099	U		0.00099	U		0.00099	U										
Beryllium, Total	mg/L	0.004	0.1	0.00094	U		0.00094	U	UJ	0.00094	U		0.00099	U		0.00099	U		0.00099	U										
Boron, Dissolved	mg/L			0.0497			0.0741		J-	0.0659			0.0491			0.0732			0.0742											
Boron, Total	mg/L	0.4	5	0.0552			0.0788		J-	0.0664			0.0521			0.0742			0.0743											
Cadmium, Dissolved	mg/L			0.0028			0.0041		J-	0.001			0.0063			0.0054			0.0082			0.00484			0.00591			0.0157		
Cadmium, Total	mg/L	0.005	0.05	**0.0085**			**0.0057**		J-	0.0043			**0.0067**			**0.0063**			**0.0078**			**0.00574**			**0.00638**			**0.0161**		
Chromium, Dissolved	mg/L			0.0022	J		0.001	U	UJ	0.0021	J		0.001	J		0.0015	U		0.0015	U		0.0019	U		0.0022	J		0.0026	J	
Chromium, Total	mg/L	0.1	1	0.0237			0.0024	J	J-	0.0028	J		0.0014	J		0.0015	U		0.0015	U		0.0019	U		0.0019	U		0.0019	U	
Cobalt, Dissolved	mg/L			0.0011	J		0.0019	U	UJ	0.0019	U		0.0019	U		0.001	U		0.001	U										
Cobalt, Total	mg/L	0.001	1	**0.0022**	J		**0.0019**	U	UJ	**0.0019**	U		**0.0019**	U		0.001	U		0.001	U										
Copper, Dissolved	mg/L			0.0023	U		0.0023	U	UJ	0.0023	U		0.0022	U		0.0026	U		0.0026	U										
Copper, Total	mg/L	1.3	0.5	0.0023	U		0.0023	U	UJ	0.0023	U		0.0022	U		0.0026	U		0.0026	U										
Iron, Dissolved	mg/L			0.026	U		0.048	U	UJ	0.1			0.048	U		0.039	U		0.039	U										
Iron, Total	mg/L	3.13	2	***4.33***			0.048	U	UJ	0.0901			0.048	U		0.039	U		0.039	U										
Lead, Dissolved	mg/L			0.0038	U		0.003	U	UJ	0.0073	J		0.0036	U		0.0036	U		0.0036	U										
Lead, Total	mg/L	0.015	0.1	0.0045	J		0.003	U	UJ	0.0062	J		0.0042	J		0.0036	U		0.0036	U										
Manganese, Dissolved	mg/L			0.0023	U		0.0023	U	UJ	0.15			0.458			0.514			0.854											
Manganese, Total	mg/L	0.25	0.05	*0.185*		J	0.0023	U	UJ	*0.155*			***0.484***			***0.506***			***0.766***											
Mercury, Dissolved	mg/L			0.00004	U		0.00004	U	UJ	0.00004	U		0.000053	U	UJ	0.000053	U		0.000053	U										
Mercury, Total	mg/L	0.002	0.01	0.00004	U		0.00004	U	UJ	0.00004	U		0.000053	U	UJ	0.000053	U		0.000053	U										
Molybdenum, Dissolved	mg/L			0.0675			0.0408		J-	0.0579			0.0358			0.0337			0.0402											
Molybdenum, Total	mg/L	0.01	0.3	**0.0662**			**0.0471**		J-	**0.0584**			**0.0498**			**0.0329**			**0.0404**											
Nickel, Dissolved	mg/L			0.0408			0.0581		J-	0.114			0.0886			0.116			0.151											
Nickel, Total	mg/L	0.209	1	0.0595			0.0596		J-	0.117			0.0943			0.117			0.152											
Selenium, Dissolved	mg/L			6.25			7.35		J-	0.263			4.89		J	0.992			1.29			2.45			0.442			0.129		
Selenium, Total	mg/L	0.05	0.05	***6.84***			***7.18***		J-	***0.298***			***4.98***			***0.994***			***1.38***			***2.44***			***0.44***			***0.133***		
Silver, Dissolved	mg/L			0.0018	U		0.0021	U	UJ	0.0021	U		0.0024	J		0.0025	J		0.0016	U										
Silver, Total	mg/L	0.052		0.0018	U		0.0021	U	UJ	0.0021	U		0.0032	J		0.0024	J		0.0016	U										
Thallium, Dissolved	mg/L			0.000026	U		0.000069	J	J-	0.000026	U		0.000034	U		0.000042	J		0.000049	J	U									
Thallium, Total	mg/L	0.002		0.00014	J	U	0.000048	J	J-	0.000036	J	U	0.000034	U		0.000055	J		0.000048	J	U									
Uranium, Dissolved	mg/L			0.022			0.0339		J-	0.026			0.022			0.023			0.023											
Uranium, Total	mg/L	0.03	0.2	**0.052**			**0.031**		J-	0.026			0.023			0.023			0.023											
Vanadium, Dissolved	mg/L			0.0023	J		0.0071		J-	0.0024	J		0.0051			0.0046			0.0053			0.0037			0.0043			0.0029	J	
Vanadium, Total	mg/L	0.0086	0.1	**0.019**			0.0064		J-	0.0025	J		0.0047			0.0046			0.0054			0.0036			0.0042			0.0031		
Zinc, Dissolved	mg/L			0.075		J	0.0317		J-	0.02			0.026			0.028			0.035			0.019			0.037			0.069		
Zinc, Total	mg/L	3.13	25	0.082			0.077		J-	0.029			0.026			0.034			0.033			0.022			0.037	B		0.0689		

Table 3-5
Shallow Groundwater and Seep Analytical and Field Data, 2015 - May 2018

			Station	GW-41-MA																									
			Sample	CD0415-GW41MA-GW001			CD0715-GW41MA-GW001			CD1015-GW41MA-GW001			CD0516-GW41MA-GW001			CD0716-GW41MA-GW001			CD1016-GW41MA-GW001			CD0517-GW41MA-GW001			CD0717-GW41MA-GW001			CD1017-GW41MA-GW001		
			Date	4/23/2015			7/15/2015			10/18/2015			5/7/2016			7/19/2016			10/5/2016			5/23/2017			7/18/2017			10/3/2017		
			Time	12:06			15:30			9:10			12:32			11:01			15:43			16:44			12:02			9:10		
Analyte	**Units**	**Human Health**	**Livestock**	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ
Cations																														
Calcium, Dissolved	mg/L			525			610		J-	596			512			555			581			467			508			539		
Calcium, Total	mg/L			555			574		J-	604			545			553			578			467			498			542		
Magnesium, Dissolved	mg/L			245			263		J-	255			222			241			252			197			225			219		
Magnesium, Total	mg/L			264			250		J-	261			236			244			254			197			222			223		
Potassium, Dissolved	mg/L			4.92			5.65		J-	5.48			4.65			5.26			7.1			4.71			4.94			5.86		
Potassium, Total	mg/L			6.4			5.65		J-	5.62			4.82			5.36			7.04			4.71			4.83			5.83		
Sodium, Dissolved	mg/L			24			26.6		J-	27.9			22.8			25.3			26.5			21.3			22.8			25.1		
Sodium, Total	mg/L			24			25.2		J-	28.5			24.1			25.3			26.6			21.3			22.4			25		
General Chemistry																														
Alkalinity, Total as CaCO3	mg/L			230			329		J-	290			241			295			322			241			253			209		
Bicarbonate, as CaCO3	mg/L			230			329		J-	290			241			295			322			241			253			209		
Carbonate, as CaCO3	mg/L			1	U		1	U	UJ	1	U		1	U		1	U	UJ	1	U		1	U		1	U		1	U	
Hardness, as CaCO3	mg/L			2470			2460		J-	2580			2330			2380			2490			1980			2160			2270		
Chloride	mg/L			13			15.5		J-	11.4			11.2			12.5			11.6			8.69			10.5			11.7		
Fluoride	mg/L			2.24			2.53		J-	1.62			1.5			1.84			0.828			0.982			0.557			2.05		
Gross Alpha	pCi/L			42.5		J	40.8			26.8			21			4.5	U		32			12.9			15			11.3	U	
Gross Beta	pCi/L			2.6	U		-10	U		9.7	U		8.5	U		-8	U		14.8	U		7.3	U		5.8	U		6.2	U	
Deuterium Excess	ppt												3.2			-0.13						4.42			1.44			-5.94		
Hydrogen-Deuterium Stable Isotope	ppt												-16.1			-15.3						-16.26			-15.67			-13.7		
O18 Stable Isotope	ppt												-125.88			-122.49						-125.6			-123.9			-115.5		
Ammonia, as N	mg/L			0.03	U		0.03	U	UJ	0.031			0.037			0.03			0.03	U		0.03	U		0.03		J-	0.059		
Nitrate + Nitrite, as N	mg/L			2.45			3.25		J-	0.076			1.44			0.05	U		0.452			0.598			0.081			0.05	U	
Phosphorus, Total	mg/L			1.88			0.51		J-	0.259			0.201			0.302			0.307			0.21			0.267			0.265		
Sulfate	mg/L			2090			2160		J-	2050			1700			2140			2200			1870			2050			2140		
TDS	mg/L			3120			3410		J-	3380			2990			3150			3460			2660			3060			3200		
TOC	mg/L			8.88			7.43		J-	4.45			3.78			3.7			4.03			3.29			3.07		J-	4.25		
TSS	mg/L			1740		J	20		J-	6			5	U		5	U		5	U		5	U		5	U		5	U	

Table 3-5
Shallow Groundwater and Seep Analytical and Field Data, 2015 - May 2018

			Station	GW-41-MA (continued)						GW-58-MA						GW-59-MA						GW-60-MA					
			Sample	CD1017-GW41MA-GW003			CD0518-GW41MA-GW001			CD1017-GW58MA-GW003			CD0518-GW58MA-GW001			CD1017-GW59MA-GW003			CD0518-GW59MA-GW001			CD1017-GW60MA-GW003			CD0518-GW60MA-GW001		
			Date	10/31/2017			5/24/2018			10/31/2017			5/24/2018			10/31/2017			5/24/2018			10/31/2017			5/24/2018		
			Time	9:55			14:20			11:38			10:25			12:51			12:04			14:07			12:30		
Analyte	**Units**	**Human Health**	**Livestock**	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ
Field Parameters																											
DTW	Feet			20.44			19.41			12.12			4.6			8.89			4.46			13.57			6.44		
ORP	mV			61.9			159.4			92.2			107.3			71.8			-84.4			55.5			59.7		
pH	SU			6.03			6.43			5.75			6.29			6.87			6.47			6.86			6.75		
Oxygen, Dissolved	mg/L			1.27			0.12			8.23			0.53			11.51			0			7			4.4		
Temperature	C			11.1			7			7.59			7.2			9.7			8.9			9.8			12.9		
Turbidity	NTU			0.54			26.43			51.4			158.64			24			4.76			9.65			4.77		
Conductivity at 25 C	umhos/cm			3195			2824			3131			2924			3222			3141			2687			2593		
Metals and Metaloids																											
Aluminum, Dissolved	mg/L			0.04	U					0.04	U		0.05	U		0.04	U		0.05	U		0.04	U		0.05	U	
Aluminum, Total	mg/L	2	5	0.04	U					1.92			**4.79**			1.81			0.05	U		0.04	U		0.05	U	
Antimony, Dissolved	mg/L			0.00027	J					0.00042	J		0.00037	J		0.00014	J		0.00023	U		0.00037	J		0.00025	J	
Antimony, Total	mg/L	0.006		0.00022	J					0.00017	U		0.00066	J		0.00017	U		0.00023	U		0.00017	U		0.00026	J	
Arsenic, Dissolved	mg/L			0.00095	J		0.00065	J		0.00078	J		0.00073	J		0.00088	J		0.00124	J		0.00251	J		0.00098	J	
Arsenic, Total	mg/L	0.01	0.2	0.00096	J		0.00064	J		0.00141	J		0.00212	J		0.00169	J		0.00137	J		0.00245	J		0.00101	J	
Barium, Dissolved	mg/L			0.0502						0.0413			0.0335			0.0402			0.0354			0.0663			0.0323		
Barium, Total	mg/L	2	0.2	0.0473						0.0552			0.0686			0.0492			0.0352			0.0703			0.0325		
Beryllium, Dissolved	mg/L			0.001	U					0.001	U		0.0017	U		0.001	U		0.0017	U		0.001	U		0.0017	U	
Beryllium, Total	mg/L	0.004	0.1	0.001	U					0.001	U		0.0017	J		0.001	U		0.0017	U		0.001	U		0.0017	U	
Boron, Dissolved	mg/L			0.062						0.055			0.041			0.05			0.056			0.047			0.035	J	
Boron, Total	mg/L	0.4	5	0.059						0.059			0.047			0.055			0.055			0.047			0.035	J	
Cadmium, Dissolved	mg/L			0.0154			0.00577			0.00313			0.00261			0.00234			0.00022			0.00033			0.00022		
Cadmium, Total	mg/L	0.005	0.05	**0.0152**			**0.00577**			0.00325			0.00342			0.00281			0.00483			0.00043	J		0.0004		
Chromium, Dissolved	mg/L			0.0019	U		0.002	U		0.0019	U		0.002	U		0.0019	U		0.002	U		0.0019	U		0.002	U	
Chromium, Total	mg/L	0.1	1	0.0019	U		0.002	U		0.0073			0.0234			0.0092			0.002	U		0.0019	U		0.002	U	
Cobalt, Dissolved	mg/L			0.0028	J					0.0013	U		0.0016	U		0.0026	J		0.0025	J		0.0088			0.0089		
Cobalt, Total	mg/L	0.001	1	**0.0021**	J					**0.0013**	U		**0.0016**	U		**0.0024**	J		**0.0025**	J		**0.0115**			**0.009**		
Copper, Dissolved	mg/L			0.0024	J					0.0044	J		0.0027	U		0.0025	J		0.0027	U		0.0023	U		0.0027	U	
Copper, Total	mg/L	1.3	0.5	0.0023	J					0.0052	J		0.0068	J		0.0043	J		0.0027	U		0.0023	U		0.0027	U	
Iron, Dissolved	mg/L			0.045	U		0.056	U		0.045	U		0.066	J		0.045	U		0.307			0.045	U		0.073	J	
Iron, Total	mg/L	3.13	2	0.045	U		0.056	U		1.41			***3.68***			1.55			0.296			0.151			0.121		
Lead, Dissolved	mg/L			0.0052	U					0.0052	U		0.0049	U		0.0052	U		0.0049	U		0.0052	U		0.0049	U	
Lead, Total	mg/L	0.015	0.1	0.0052	U					0.0052	U		0.0064	J		0.0052	U		0.0049	U		0.0052	U		0.0049	U	
Manganese, Dissolved	mg/L			7.64			1.1			0.091			0.0192			6.1			4.01			4.03			4.96		
Manganese, Total	mg/L	0.25	0.05	***6.94***						*0.133*			*0.0889*			***6.2***			***4.1***			***5.08***			***4.92***		
Mercury, Dissolved	mg/L			0.000076	U					0.000076	U		0.000093	U		0.000076	U		0.000093	U		0.000076	U		0.000093	U	
Mercury, Total	mg/L	0.002	0.01	0.000076	U					0.000076	U		0.000093	U		0.000076	U		0.000093	U		0.000076	U		0.000093	U	
Molybdenum, Dissolved	mg/L			0.022						0.029			0.013			0.059			0.03			0.008			0.003	J	
Molybdenum, Total	mg/L	0.01	0.3	**0.021**						**0.029**			**0.013**			**0.062**			**0.031**			0.007	J		0.003	J	
Nickel, Dissolved	mg/L			0.18						0.0556			0.0524			0.101			0.0879			0.0154			0.0163		
Nickel, Total	mg/L	0.209	1	0.172						0.0586			0.0632			0.108			0.0902			0.0158			0.0161		
Selenium, Dissolved	mg/L			0.104			0.694			3.31			0.975			0.0157			0.0775			0.12			0.545		
Selenium, Total	mg/L	0.05	0.05	***0.11***			***0.672***		J	***3.42***			***0.985***		J	0.0171			0.0482		J	***0.0878***			***0.543***		J
Silver, Dissolved	mg/L			0.0024	U					0.0024	U		0.0019	U		0.0024	U		0.0019	U		0.0024	U		0.0019	U	
Silver, Total	mg/L	0.052		0.0024	U					0.0024	U		0.0019	U		0.0024	U		0.0019	U		0.0024	U		0.0019	U	
Thallium, Dissolved	mg/L			0.000092	J					0.000059	J		0.00008	U		0.000083	J		0.00008	U		0.00003	U		0.00008	U	
Thallium, Total	mg/L	0.002		0.00015	U					0.00015	U		0.000084	J		0.00015	U		0.00008	U		0.00015	U		0.00008	U	
Uranium, Dissolved	mg/L			0.00779						0.0231			0.0158			0.0266			0.0135			0.0185			0.0143		
Uranium, Total	mg/L	0.03	0.2	0.00849						0.0233			0.0172			0.0271			0.0126			0.0157			0.0137		
Vanadium, Dissolved	mg/L			0.0026	J		0.0034			0.0032			0.0031			0.0022	J		0.0005	J		0.0027	J		0.0006	J	
Vanadium, Total	mg/L	0.0086	0.1	0.0027	J		0.0034			**0.0091**			**0.0173**			**0.0088**			0.0005	J		0.0029	J		0.0007	J	
Zinc, Dissolved	mg/L			0.0657			0.0204			0.0157			0.0121			0.0195			0.0027	U		0.0105			0.0073		
Zinc, Total	mg/L	3.13	25	0.0646			0.0194			0.0267			0.0406			0.0528			0.0227			0.0095			0.007		

Table 3-5
Shallow Groundwater and Seep Analytical and Field Data, 2015 - May 2018

			Station	GW-41-MA (continued)						GW-58-MA						GW-59-MA						GW-60-MA					
			Sample	CD1017-GW41MA-GW003			CD0518-GW41MA-GW001			CD1017-GW58MA-GW003			CD0518-GW58MA-GW001			CD1017-GW59MA-GW003			CD0518-GW59MA-GW001			CD1017-GW60MA-GW003			CD0518-GW60MA-GW001		
			Date	10/31/2017			5/24/2018			10/31/2017			5/24/2018			10/31/2017			5/24/2018			10/31/2017			5/24/2018		
			Time	9:55			14:20			11:38			10:25			12:51			12:04			14:07			12:30		
Analyte	**Units**	**Human Health**	**Livestock**	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ
Cations																											
Calcium, Dissolved	mg/L			527			447		J	492			462		J	492			493		J	423			412		J
Calcium, Total	mg/L			502			451			511			478			499			493			437			406		
Magnesium, Dissolved	mg/L			214			183			204			185			223			224			147			169		
Magnesium, Total	mg/L			205			185			212			188			225			227			148			167		
Potassium, Dissolved	mg/L			5.81			4.23			4.92			4.13			5.15			4.44			10.3			4.32		
Potassium, Total	mg/L			5.55			4.12			5.54			5.14			5.71			4.37			10.9			4.13		
Sodium, Dissolved	mg/L			23.4			21.7			21.9			21.3			23.3			22.6			26.2			40.1		
Sodium, Total	mg/L			22.2			21.4			22.7			21.4			23.5			22.1			26.2			38.9		
General Chemistry																											
Alkalinity, Total as CaCO3	mg/L			213			227			272			246			223			163			241			211		
Bicarbonate, as CaCO3	mg/L			213			227			272			246			223			163			241			211		
Carbonate, as CaCO3	mg/L			0	U		1	U		0	U		1	U		0	U		1	U		0	U		1	U	
Hardness, as CaCO3	mg/L			2100			1890			2150			1970			2170			2170			1700			1700		
Chloride	mg/L			10.9			8.15			10.3			8.06			11.3			8.45			11.6			10		
Fluoride	mg/L			0.499			0.728			0.611			0.759			0.733			0.894			0.132			0.106		
Gross Alpha	pCi/L																										
Gross Beta	pCi/L																										
Deuterium Excess	ppt																										
Hydrogen-Deuterium Stable Isotope	ppt																										
O18 Stable Isotope	ppt																										
Ammonia, as N	mg/L			0.082			0.03	U		0.021	J		0.03	U		0.092			0.056		U	0.069			0.065		U
Nitrate + Nitrite, as N	mg/L			0.01	U		0.439			1.45			0.329			0.031	J		0.05	U		0.032	J		0.333		
Phosphorus, Total	mg/L			0.265			0.217			0.44			1.56			1.39			0.263			0.113			0.055		
Sulfate	mg/L			2150			1730			2070			1770			2210			2080			1620			1610		
TDS	mg/L			3060			2580			2980			2640			3080			2990			2480			2440		
TOC	mg/L			3.83			2.91			2.98			3.3			3.64			3.86			7.24			2.91		
TSS	mg/L			1	J		5	U		68			128			10			7			5			5	U	

Table 3-5
Shallow Groundwater and Seep Analytical and Field Data, 2015 - May 2018

			Station	GW-61-MA						GW-62-MA			NES-5																				
			Sample	CD1017-GW61MA-GW003			CD0518-GW61MA-GW001			CD0518-GW62MA-GW001			CD0415-NES5-SW001			CD0715-NES5-SW001			CD0516-NES5-SW001			CD0716-NES5-SW001			CD1016-NES5-SW001			CD0517-NES5-SW001			CD0717-NES5-SW001		
			Date	10/31/2017			5/24/2018			5/24/2018			4/22/2015			7/16/2015			5/7/2016			7/19/2016			10/5/2016			5/23/2017			7/18/2017		
			Time	15:06			13:20			10:55			9:00			10:10			11:50			12:05			17:05			11:00			9:25		
Analyte	**Units**	**Human Health**	**Livestock**	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ
Field Parameters																																	
DTW	Feet			20.22			10.82			25.5																							
ORP	mV			76.8			145.2						360.5			210			175.5			182.3			94.9			211.5			178.2		
pH	SU			6.55			6.77						7.41			8.2			7.25			7.37			8.06			7.06			8.05		
Oxygen, Dissolved	mg/L			7.28			4.29						7.66			14.14			7.33			9.62			8.09			6.04			13.24		
Temperature	C			8.14			10.8						9.4			17.38			10.8			19.82			9			16.68			22.4		
Turbidity	NTU			45.3			14.51						1.2			15.3			2.21						0.72			5.86			11.1		
Conductivity at 25 C	umhos/cm			1654			1235						2949			2126			3069			3183			3976			3325			3460		
Metals and Metaloids																																	
Aluminum, Dissolved	mg/L			0.04	U		0.05	U		0.05	U		0.036	U		0.036	U	UJ	0.036	U		0.055	U		0.055	U							
Aluminum, Total	mg/L	2	5	1.29			0.05	J		0.25			0.036	U		0.036	U	UJ	0.036	U		0.55			0.055	U							
Antimony, Dissolved	mg/L			0.00041	J		0.00023	U		0.00023	U		0.0014	J		0.0012	J	J-	0.0013	J		0.0015	J		0.001	J	U						
Antimony, Total	mg/L	0.006		0.00017	U		0.00023	U		0.00023	U		0.0014	J	U	0.001	J	J-	0.0012	J		0.0014	J	U	0.0011	J	U						
Arsenic, Dissolved	mg/L			0.00112	J		0.00046	J		0.0004	J		0.0016	J		0.002	J	J-	0.0013	J		0.0012	J		0.0016	J		0.00144	J		0.00112	J	
Arsenic, Total	mg/L	0.01	0.2	0.00221	J		0.00049	J		0.00048	J		0.0029	J		0.0021	J	J-	0.0014	J		0.0017	J		0.0015	J		0.00153	J		0.00121	J	
Barium, Dissolved	mg/L			0.0883			0.0293			0.0231			0.0287			0.0313		J-	0.0223			0.0262			0.0243								
Barium, Total	mg/L	2	0.2	0.105			0.0299			0.0265			0.029			0.0317		J-	0.0236			0.0284			0.0243								
Beryllium, Dissolved	mg/L			0.001	U		0.0017	U		0.0017	U		0.00094	U		0.00094	U	UJ	0.00099	U		0.00099	U		0.00099	U							
Beryllium, Total	mg/L	0.004	0.1	0.001	U		0.0017	U		0.0017	U		0.00094	U		0.00094	U	UJ	0.00099	U		0.00099	U		0.00099	U							
Boron, Dissolved	mg/L			0.03	J		0.018	J		0.022	J		0.0656			0.0691		J-	0.0615			0.0699			0.0664								
Boron, Total	mg/L	0.4	5	0.031	J		0.02	J		0.022	J		0.0672			0.0674		J-	0.0642			0.0705			0.0638								
Cadmium, Dissolved	mg/L			0.00037	J		0.000068	J		0.0047			0.018			0.0063		J-	0.02			0.015			0.015			0.0202			0.00102		
Cadmium, Total	mg/L	0.005	0.05	0.00032	J		0.000093	J		0.00484			**0.0208**			**0.0127**		J-	**0.02**			**0.016**			**0.014**			**0.0205**			**0.00898**		
Chromium, Dissolved	mg/L			0.0019	U		0.002	U		0.002	U		0.0048	J		0.0028	J	J-	0.0061			0.0032	J		0.0034	J		0.008			0.0056	J	
Chromium, Total	mg/L	0.1	1	0.0096			0.002	U		0.002	U		0.0047	J		0.0036	J	J-	0.0065			0.0202			0.0041	J		0.0125			0.0066		
Cobalt, Dissolved	mg/L			0.0013	U		0.0016	U		0.0016	U		0.00075	U		0.0019	U	UJ	0.0019	U		0.001	U		0.001	U							
Cobalt, Total	mg/L	0.001	1	**0.0013**	U		**0.0016**	U		**0.0016**	U		0.00075	U		**0.0019**	U	UJ	**0.0019**	U		0.001	U		0.001	U							
Copper, Dissolved	mg/L			0.0023	U		0.0027	U		0.0027	U		0.0023	U		0.0023	U	UJ	0.0022	U		0.0067	J		0.0026	U							
Copper, Total	mg/L	1.3	0.5	0.0043	J		0.0027	U		0.0027	U		0.0023	U		0.0023	U	UJ	0.0022	U		0.0291			0.0026	U							
Iron, Dissolved	mg/L			0.045	U		0.056	U		0.143			0.026	U		0.048	U	UJ	0.048	U		0.039	U		0.039	U							
Iron, Total	mg/L	3.13	2	1.44			0.064	J		0.412			0.026	U		0.048	U	UJ	0.106			0.85			0.039	U							
Lead, Dissolved	mg/L			0.0052	U		0.0049	U		0.0049	U		0.0038	U		0.003	U	UJ	0.0036	U		0.0036	U		0.0036	U							
Lead, Total	mg/L	0.015	0.1	0.0052	U		0.0049	U		0.0049	U		0.0038	U		0.003	U	UJ	0.0036	U		0.0036	U		0.0036	U							
Manganese, Dissolved	mg/L			0.456			0.0236			0.424			0.014			0.0052		J-	0.0024	U		0.0272			0.0024	U							
Manganese, Total	mg/L	0.25	0.05	***0.444***			***0.0525***			***0.425***			0.0147			0.006		J-	0.0024	U		0.0303			0.0024	U							
Mercury, Dissolved	mg/L			0.000076	U		0.000093	U		0.000093	U		0.00004	U		0.00004	U	UJ	0.000053	U		0.000053	U		0.000053	U							
Mercury, Total	mg/L	0.002	0.01	0.000076	U		0.000093	U		0.000093	U		0.00004	U		0.00004	U	UJ	0.000053	U		0.00006	J		0.000053	U							
Molybdenum, Dissolved	mg/L			0.003	U		0.003	U		0.003	U		0.0615			0.0508		J-	0.0781			0.0561			0.0578								
Molybdenum, Total	mg/L	0.01	0.3	0.003	U		0.003	U		0.003	U		**0.0601**			**0.0503**		J-	**0.0647**			**0.0576**			**0.0567**								
Nickel, Dissolved	mg/L			0.0053	J		0.0023	U		0.0209			0.468			0.476		J-	0.561			0.496			0.373								
Nickel, Total	mg/L	0.209	1	0.0096	J		0.0023	U		0.0212			**0.459**			**0.488**		J-	**0.571**			**0.503**			**0.374**								
Selenium, Dissolved	mg/L			0.815			0.517			1.74			5.96			7.88		J-	8.7			6.6			5.25			8.3			8.08		
Selenium, Total	mg/L	0.05	0.05	***0.745***			***0.522***		J	***1.76***		J	***6.83***			***7.8***		J-	***8.65***			***6.21***			***5.47***			***8.21***			***8.33***		
Silver, Dissolved	mg/L			0.0024	U		0.0019	U		0.0019	U		0.0018	U		0.0021	U	UJ	0.0025	J		0.0028	J		0.0016	U							
Silver, Total	mg/L	0.052		0.0024	U		0.0019	U		0.0019	U		0.0018	U		0.0021	U	UJ	0.0032	J		0.0034	J		0.0039	J							
Thallium, Dissolved	mg/L			0.00015	U		0.00008	U		0.00008	U		0.00013	U		0.00012	J	J-	0.00022	J		0.00024	J		0.0002	J							
Thallium, Total	mg/L	0.002		0.00015	U		0.00008	U		0.00008	U		0.00026	J		0.00021	J	J-	0.00023	J		0.00025	J		0.0002	J							
Uranium, Dissolved	mg/L			0.00486			0.003			0.00272			0.023	J		0.0253		J-	0.024			0.025			0.024								
Uranium, Total	mg/L	0.03	0.2	0.00503			0.00288			0.00269			0.0248	J	U	0.023		J-	0.024			0.027			0.025								
Vanadium, Dissolved	mg/L			0.0021	J		0.0009	J		0.0006	J		0.024			0.0289		J-	0.028			0.024			0.024			0.0325		J	0.0274		
Vanadium, Total	mg/L	0.0086	0.1	**0.0088**			0.0011	J		0.0011	J		**0.023**	J	J-	**0.0267**		J-	**0.029**			**0.029**			**0.023**			**0.0336**			**0.0272**		
Zinc, Dissolved	mg/L			0.0095	J		0.0027	U		0.0177			1.53			1.44		J-	1.56			1.42			0.879			1.41			1.04		
Zinc, Total	mg/L	3.13	25	0.0238			0.0035	J		0.0174			1.63		J	1.69		J-	1.6			1.47			0.868			1.48			1.2		

Table 3-5
Shallow Groundwater and Seep Analytical and Field Data, 2015 - May 2018

			Station	GW-61-MA						GW-62-MA			NES-5																				
			Sample	CD1017-GW61MA-GW003			CD0518-GW61MA-GW001			CD0518-GW62MA-GW001			CD0415-NES5-SW001			CD0715-NES5-SW001			CD0516-NES5-SW001			CD0716-NES5-SW001			CD1016-NES5-SW001			CD0517-NES5-SW001			CD0717-NES5-SW001		
			Date	10/31/2017			5/24/2018			5/24/2018			4/22/2015			7/16/2015			5/7/2016			7/19/2016			10/5/2016			5/23/2017			7/18/2017		
			Time	15:06			13:20			10:55			9:00			10:10			11:50			12:05			17:05			11:00			9:25		
Analyte	**Units**	**Human Health**	**Livestock**	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ
Cations																																	
Calcium, Dissolved	mg/L			259			187		J	500		J	539			555		J-	558			584			564			540			547		
Calcium, Total	mg/L			250			186			498			540			564		J-	568			586			570			554			556	B	
Magnesium, Dissolved	mg/L			62.6			49.8			193			258			275		J-	259			274			268			258			255		
Magnesium, Total	mg/L			58.3			50.1			193			258			278		J-	263			276			268			255			258		
Potassium, Dissolved	mg/L			7.12			1.26			2.29			5.04			4.83		J-	4.56			4.76			5.52			4.26			4.48		
Potassium, Total	mg/L			9.05			1.28			2.32			5.1			5.07		J-	4.6			4.8			5.66			4.33			4.83		
Sodium, Dissolved	mg/L			14.4			12.3			41			23.9			26.3		J-	23.1			27.7			28.1			23.6			26.1		
Sodium, Total	mg/L			14.2			12.2			40.3			24			26.4		J-	23.4			27.6			27.7			22.9			26.6		
General Chemistry																																	
Alkalinity, Total as CaCO3	mg/L			242			226			169			311			281		J-	282			333			335			287			278		
Bicarbonate, as CaCO3	mg/L			242			226			169			311			281		J-	282			333			335			287			278		
Carbonate, as CaCO3	mg/L			0	U		1	U		1	U		1	U		1	U	UJ	1	U		1	U		1	U		1	U		1	U	
Hardness, as CaCO3	mg/L			865			671			2040			2410			2550		J-	2500			2600			2530			2430			2450		
Chloride	mg/L			8.25			9.02			11.6			12.2			11.9		J	9.51			12.6			11.7			9.62			11.5		
Fluoride	mg/L			0.123			0.117			0.1	U		3.29			2.49		J-	2.07			2.9			1.23			1.39			1.05		
Gross Alpha	pCi/L																																
Gross Beta	pCi/L																																
Deuterium Excess	ppt																																
Hydrogen-Deuterium Stable Isotope	ppt																																
O18 Stable Isotope	ppt																																
Ammonia, as N	mg/L			0.091			0.03	U		0.033		U	0.03	U		0.128		J-	0.033			0.03	U	UJ	0.03	U		0.03	U		0.03	U	
Nitrate + Nitrite, as N	mg/L			2.72			2.96			0.313			3.62			1.77		J-	4.48			3.63		J	3.7			4.69			1.31		
Phosphorus, Total	mg/L			0.386			0.074			0.12			0.247			0.129		J-	0.17			0.444			0.047		J	0.368		J	0.115		
Sulfate	mg/L			692			456			1960			2210			2180		J-	1870			2170			2310			2150			2270		
TDS	mg/L			1260			893			2910			3240			3450		J-	3260			3540			3420			3340			3400		
TOC	mg/L			3.09			1.16		U	3.69			3.19			12		J-	3.03			4.97			3.27			2.99			8.98		J-
TSS	mg/L			23			5	U		11			32			34		J-	5	U		12			5	U		16			36		

Table 3-5
Shallow Groundwater and Seep Analytical and Field Data, 2015 - May 2018

			Station	NES-5 (continued)						NESeep5Pond																	
			Sample	CD1017-NES5-SW001			CD0518-NES5-SW001			CD0415-NESeep5Pond-SW001			CD0715-NESeep5Pond-SW001			CD1015-NESeep5Pond-SW001			CD0516-NESeep5Pond-SW001			CD0716-NESeep5Pond-SW001			CD1016-NESeep5Pond-SW001		
			Date	10/3/2017			5/24/2018			4/22/2015			7/16/2015			10/16/2015			5/4/2016			7/19/2016			10/5/2016		
			Time	11:25			13:40			8:45			9:50			9:50			16:55			12:35			17:10		
Analyte	**Units**	**Human Health**	**Livestock**	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ
Field Parameters																											
DTW	Feet																										
ORP	mV			208			187.5			356.8			200.6			197.1			-51.7			205.7			99.3		
pH	SU			8.14			6.91			7.86			8.17			7.28			8.01			8.09			7.89		
Oxygen, Dissolved	mg/L			8.75			5.92			18.36			14.91			14.04			20.5			19.86			11.97		
Temperature	C			8.46			14.7			10.3			17.25			10.7			14.5			20.88			9.44		
Turbidity	NTU			3.29			36			16.7			15.7			34			4.64						20.3		
Conductivity at 25 C	umhos/cm			3440			3434			2770			2080			3203			3402			3162			3995		
Metals and Metaloids																											
Aluminum, Dissolved	mg/L									0.036	U		0.036	U	UJ	0.036	U		0.036	U		0.055	U		0.055	U	
Aluminum, Total	mg/L	2	5							0.036	U		0.036	U	UJ	0.036	U		0.036	U		0.055	U		0.0565	J	
Antimony, Dissolved	mg/L									0.0017	J		0.0012	J	J-	0.0012	J	U	0.0013	J		0.0014	J		0.0012	J	
Antimony, Total	mg/L	0.006								0.0014	J	U	0.0012	J	J-	0.0011	J	J	0.0013	J		0.0011	J	U	0.0011	J	
Arsenic, Dissolved	mg/L			0.00114	J		0.00123	J		0.0014	U		0.0023	J	J-	0.0013	J		0.0011	J		0.0013	J		0.0012	J	
Arsenic, Total	mg/L	0.01	0.2	0.00142	J		0.00162	J		0.0028	J		0.0022	J	J-	0.0015	J		0.0013	J		0.0013	J		0.0014	J	
Barium, Dissolved	mg/L									0.0435			0.0314		J-	0.0287			0.0235			0.0261			0.0267		
Barium, Total	mg/L	2	0.2							0.044			0.0314		J-	0.0295			0.0239			0.0266			0.0313		
Beryllium, Dissolved	mg/L									0.00094	U		0.00094	U	UJ	0.00094	U		0.00056	U		0.00099	U		0.00099	U	
Beryllium, Total	mg/L	0.004	0.1							0.00094	U		0.00094	U	UJ	0.00094	U		0.00056	U		0.00099	U		0.00099	U	
Boron, Dissolved	mg/L									0.063			0.066		J-	0.0622			0.0677			0.0734			0.0684		
Boron, Total	mg/L	0.4	5							0.0652			0.0665		J-	0.0615			0.0642			0.0721			0.0731		
Cadmium, Dissolved	mg/L			0.0151			0.0189			0.0035	J		0.0095		J-	0.0014			0.018			0.0022			0.00091		J
Cadmium, Total	mg/L	0.005	0.05	**0.0157**			**0.0204**			**0.0083**			**0.0139**		J-	**0.008**			**0.019**			**0.0057**			0.0049		
Chromium, Dissolved	mg/L			0.0036	J		0.0055	J		0.0036	J		0.0031	J	J-	0.0035	J		0.0067		J-	0.0035	J		0.0021	J	
Chromium, Total	mg/L	0.1	1	0.0042	J		0.0126			0.0041	J		0.0037	J	J-	0.003	J		0.006			0.0039	J		0.0016	J	
Cobalt, Dissolved	mg/L									0.00075	U		0.0019	U	UJ	0.0019	U		0.0019	U		0.001	U		0.001	U	
Cobalt, Total	mg/L	0.001	1							0.00075	U		**0.0019**	U	UJ	**0.0019**	U		**0.0019**	U		0.001	U		0.001	U	
Copper, Dissolved	mg/L									0.0023	U		0.0023	U	UJ	0.0023	U		0.0023	U		0.0026	U		0.0026	U	
Copper, Total	mg/L	1.3	0.5							0.0023	U		0.0023	U	UJ	0.0023	U		0.0023	U		0.0026	U		0.0026	U	
Iron, Dissolved	mg/L						0.056	U		0.026	U		0.048	U	UJ	0.048	U		0.048	U		0.039	U		0.039	U	
Iron, Total	mg/L	3.13	2				0.571			0.026	U		0.048	U	UJ	0.048	U		0.048	U		0.039	U		0.092	J	
Lead, Dissolved	mg/L									0.0038	U		0.003	U	UJ	0.007	J	U	0.0025	U		0.0036	U		0.0036	U	
Lead, Total	mg/L	0.015	0.1							0.0038	U		0.003	U	UJ	0.004	J		0.0025	U		0.0036	U		0.0036	U	
Manganese, Dissolved	mg/L						0.0064	J		0.0242			0.004	J	J-	0.0023	U		0.0084			0.0133			0.17		
Manganese, Total	mg/L	0.25	0.05							0.0254			0.0054		J-	*0.0533*			0.0088			0.0178			*0.185*		
Mercury, Dissolved	mg/L									0.00004	U		0.00004	U	UJ	0.00004	U	UJ	0.000053	U	UJ	0.000053	U		0.000053	U	
Mercury, Total	mg/L	0.002	0.01							0.00004	U		0.00004	U	UJ	0.00004	U	UJ	0.000053	U		0.000053	U		0.000053	U	
Molybdenum, Dissolved	mg/L									0.0449			0.0492		J-	0.054			0.062			0.0591			0.0561		
Molybdenum, Total	mg/L	0.01	0.3							**0.0459**			**0.0496**		J-	**0.0541**			**0.063**			**0.0586**			**0.0597**		
Nickel, Dissolved	mg/L									0.404			0.478		J-	0.39			0.602			0.486			0.339		
Nickel, Total	mg/L	0.209	1							**0.409**			**0.487**		J-	**0.401**			**0.6**			**0.502**			**0.374**		
Selenium, Dissolved	mg/L			5.39			6.89			6.33			7.81		J-	4.02			9.68			7.53			3.94		
Selenium, Total	mg/L	0.05	0.05	***5.21***			***7.25***			***6.36***			***7.51***		J-	***4.61***			***9.64***			***7.04***			***3.98***		
Silver, Dissolved	mg/L									0.0018	U		0.0021	U	UJ	0.0021	U		0.0021	U		0.0029	J		0.0016	U	
Silver, Total	mg/L	0.052								0.0018	U		0.0021	U	UJ	0.0021	U		0.0021	U		0.0036	J		0.0016	U	
Thallium, Dissolved	mg/L									0.00013	U		0.00016	J	J-	0.00014	J		0.00023	J		0.00021	J		0.000047	J	
Thallium, Total	mg/L	0.002								0.00023	J		0.00023	J	J-	0.00016	J	J	0.00022	J		0.00019	J		0.00007	J	
Uranium, Dissolved	mg/L									0.017	J		0.0248		J-	0.023			0.023			0.024			0.023		
Uranium, Total	mg/L	0.03	0.2							0.0164	J	U	0.0238		J-	0.021		J	0.022			0.024			0.023		
Vanadium, Dissolved	mg/L			0.0237			0.0276			0.018			0.0298		J-	0.021			0.031			0.025			0.019		
Vanadium, Total	mg/L	0.0086	0.1	**0.0242**			**0.0325**			**0.0178**	J	J-	**0.0272**		J-	**0.021**			**0.029**			**0.024**			**0.019**		
Zinc, Dissolved	mg/L			0.889			1.33			0.796			1.58		J-	0.978			1.65			1.16			0.538		J
Zinc, Total	mg/L	3.13	25	0.844			1.54			0.968		J	1.73		J-	1.07			1.6			1.23			0.615		

Table 3-5
Shallow Groundwater and Seep Analytical and Field Data, 2015 - May 2018

			Station	NES-5 (continued)						NESeep5Pond																	
			Sample	CD1017-NES5-SW001			CD0518-NES5-SW001			CD0415-NESeep5Pond-SW001			CD0715-NESeep5Pond-SW001			CD1015-NESeep5Pond-SW001			CD0516-NESeep5Pond-SW001			CD0716-NESeep5Pond-SW001			CD1016-NESeep5Pond-SW001		
			Date	10/3/2017			5/24/2018			4/22/2015			7/16/2015			10/16/2015			5/4/2016			7/19/2016			10/5/2016		
			Time	11:25			13:40			8:45			9:50			9:50			16:55			12:35			17:10		
Analyte	**Units**	**Human Health**	**Livestock**	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ
Cations																											
Calcium, Dissolved	mg/L			562			551			477			564		J-	553			546			575			542		
Calcium, Total	mg/L			575			562			473			560		J-	552			523			592			587		
Magnesium, Dissolved	mg/L			265			260			251			277		J-	261			268			286			259		
Magnesium, Total	mg/L			267			260			248			274		J-	261			254		J	289			272		
Potassium, Dissolved	mg/L			5.38			4.07			4.91			4.92		J-	5.14			4.28			5.49			5.31		
Potassium, Total	mg/L			5.42			4.32			5.17			5.06		J-	5.27			4.72			5.5			5.71		
Sodium, Dissolved	mg/L			27.9			24.2			24.5			26.2		J-	27.6			24.2		J	28.6			27.1		
Sodium, Total	mg/L			28.1			24.3			24.8			26.2		J-	27.6			23.5			28.8			28.2		
General Chemistry																											
Alkalinity, Total as CaCO3	mg/L			325			269			173			287		J-	280			268			271			286		
Bicarbonate, as CaCO3	mg/L			325			269			151			287		J-	280			268			271			286		
Carbonate, as CaCO3	mg/L			1	U	UJ	1	U		21.4		J	1	U	UJ	1	U		1	U		1	U		1	U	
Hardness, as CaCO3	mg/L			2540			2470			2200			2530		J-	2450			2350			2670			2580		
Chloride	mg/L			12.5			9.52			11.8			11		J	10.3			9.28			12.6			11.9		
Fluoride	mg/L			3.66			1.73		J-	1.52			2.55		J-	2.07			1.72		J	1.99			1.55		
Gross Alpha	pCi/L																										
Gross Beta	pCi/L																										
Deuterium Excess	ppt																										
Hydrogen-Deuterium Stable Isotope	ppt																										
O18 Stable Isotope	ppt																										
Ammonia, as N	mg/L			0.03	U		0.03	U		0.039			0.03	U	UJ	0.03	U	UJ	0.051			0.049		J	0.03	U	
Nitrate + Nitrite, as N	mg/L			2.77			2.89			0.688			1.88		J-	0.92			3.46			1.61		J	0.298		
Phosphorus, Total	mg/L			0.24			0.4			0.174			0.12		J-	0.071			0.115			0.084			0.198		
Sulfate	mg/L			2130			2210			2120			2330		J-	1950			2000			2200			2350		
TDS	mg/L			3340			3340			3110			3440		J-	3340			3330			3490			3290		
TOC	mg/L			3.34			2.86			11			12.4		J-	7.38			6.97			12.2			7.93		
TSS	mg/L			6			20			37			31		J-	23			14			34			52		J

Table 3-5
Shallow Groundwater and Seep Analytical and Field Data, 2015 - May 2018

			Station	NESeep5Pond (continued)																	
			Sample	CD0417-NESeep5Pond-SW001			CD0517-NESeep5Pond-SW001			CD0717-NESeep5Pond-SW001			CD1017-NESeep5Pond-SW001			CD1017-NESeep5Pond-SW002			CD0518-NESeep5Pond-SW001		
			Date	4/25/2017			5/23/2017			7/18/2017			10/3/2017			11/1/2017			5/19/2018		
			Time	9:05			10:55			9:38			11:16			10:29			10:52		
Analyte	**Units**	**Human Health**	**Livestock**	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ
Field Parameters																					
DTW	Feet																				
ORP	mV			154.2			106.8			153.6			209						151.7		
pH	SU			8.11			8.43			7.68			8.18						8.29		
Oxygen, Dissolved	mg/L			18.69			24.43			27.32			13.35						28.56		
Temperature	C			8.02			11.99			16.6			7.11						12.2		
Turbidity	NTU			2			7.01			57.6			35						7.76		
Conductivity at 25 C	umhos/cm			3833			3252			3474			3080						3324		
Metals and Metaloids																					
Aluminum, Dissolved	mg/L															0.04	U				
Aluminum, Total	mg/L	2	5													0.04	U				
Antimony, Dissolved	mg/L															0.00119	J	U			
Antimony, Total	mg/L	0.006														0.00109	J	U			
Arsenic, Dissolved	mg/L						0.00124	J		0.00123	J		0.00122	J		0.0012	J		0.00118	J	
Arsenic, Total	mg/L	0.01	0.2	0.003	U		0.00131	J		0.00137	J		0.00149	J		0.00139	J		0.00122	J	
Barium, Dissolved	mg/L															0.0271					
Barium, Total	mg/L	2	0.2													0.0272					
Beryllium, Dissolved	mg/L															0.001	U				
Beryllium, Total	mg/L	0.004	0.1													0.001	U				
Boron, Dissolved	mg/L															0.065					
Boron, Total	mg/L	0.4	5													0.065					
Cadmium, Dissolved	mg/L						0.0161			0.00128			0.00251			0.00189			0.00991		
Cadmium, Total	mg/L	0.005	0.05	**0.022**			**0.0183**			**0.00815**			**0.0107**			**0.00967**			**0.0181**		
Chromium, Dissolved	mg/L						0.0077			0.0056	J		0.0024	J		0.0019	U		0.0056	J	
Chromium, Total	mg/L	0.1	1	0.0085			0.0083			0.0059	J		0.0033	J		0.0026	J		0.0054	J	
Cobalt, Dissolved	mg/L															0.0013	U				
Cobalt, Total	mg/L	0.001	1													**0.0013**	U				
Copper, Dissolved	mg/L															0.0023	U				
Copper, Total	mg/L	1.3	0.5													0.0027	J				
Iron, Dissolved	mg/L															0.045	U				
Iron, Total	mg/L	3.13	2													0.045	U				
Lead, Dissolved	mg/L															0.0052	U				
Lead, Total	mg/L	0.015	0.1													0.0052	U				
Manganese, Dissolved	mg/L															0.0456					
Manganese, Total	mg/L	0.25	0.05													*0.0501*					
Mercury, Dissolved	mg/L															0.000076	U				
Mercury, Total	mg/L	0.002	0.01													0.000076	U				
Molybdenum, Dissolved	mg/L															0.068					
Molybdenum, Total	mg/L	0.01	0.3													**0.068**					
Nickel, Dissolved	mg/L															0.383					
Nickel, Total	mg/L	0.209	1													**0.394**					
Selenium, Dissolved	mg/L						8.58			8.09			4.33			4.53			7.64		J
Selenium, Total	mg/L	0.05	0.05	***9.14***			***8.61***			***7.38***			***4.42***			***4.84***			***9.28***		J
Silver, Dissolved	mg/L															0.0024	U				
Silver, Total	mg/L	0.052														0.0024	U				
Thallium, Dissolved	mg/L															0.000039	J	U			
Thallium, Total	mg/L	0.002														0.00015	U				
Uranium, Dissolved	mg/L															0.0204					
Uranium, Total	mg/L	0.03	0.2													0.0213					
Vanadium, Dissolved	mg/L						0.0348		J	0.0274			0.0222			0.0227			0.0305		
Vanadium, Total	mg/L	0.0086	0.1	**0.0313**			**0.0341**			**0.0282**		J+	**0.0218**			**0.0234**			**0.0301**		J
Zinc, Dissolved	mg/L						1.34			1.15			0.54			0.519			1.21		J
Zinc, Total	mg/L	3.13	25	1.46			1.41			1.24			0.925			0.827			1.34		

Table 3-5
Shallow Groundwater and Seep Analytical and Field Data, 2015 - May 2018

			Station	NESeep5Pond (continued)																	
			Sample	CD0417-NESeep5Pond-SW001			CD0517-NESeep5Pond-SW001			CD0717-NESeep5Pond-SW001			CD1017-NESeep5Pond-SW001			CD1017-NESeep5Pond-SW002			CD0518-NESeep5Pond-SW001		
			Date	4/25/2017			5/23/2017			7/18/2017			10/3/2017			11/1/2017			5/19/2018		
			Time	9:05			10:55			9:38			11:16			10:29			10:52		
Analyte	**Units**	**Human Health**	**Livestock**	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ
Cations																					
Calcium, Dissolved	mg/L						533			564			622			506			545		
Calcium, Total	mg/L			528			549			465			597			515			549		
Magnesium, Dissolved	mg/L						259			257			289			252			267		
Magnesium, Total	mg/L			229			257			257			272			253			271		
Potassium, Dissolved	mg/L						3.85			4.57			5.42			5.02			3.82		
Potassium, Total	mg/L			4.05			4.12			4.7			5.54			5.5			3.98		
Sodium, Dissolved	mg/L						22.1			26.9			29.8			25.7			23.8		
Sodium, Total	mg/L			21.3			22.3			26.4			28.7			25.9			24		
General Chemistry																					
Alkalinity, Total as CaCO3	mg/L			259			300			292			306			228			235		
Bicarbonate, as CaCO3	mg/L			259			300			292			306			228			235		
Carbonate, as CaCO3	mg/L			1	U		1	U		1	U		1	U	UJ	0	U		1	U	
Hardness, as CaCO3	mg/L			2260			2430			2220			2610			2330			2490		
Chloride	mg/L			8.99			10.4			11.3			10.8			11		J-	8.85		
Fluoride	mg/L			1.5			2.67			1.07			2.86			1.17			1.6		
Gross Alpha	pCi/L																				
Gross Beta	pCi/L																				
Deuterium Excess	ppt																				
Hydrogen-Deuterium Stable Isotope	ppt																				
O18 Stable Isotope	ppt																				
Ammonia, as N	mg/L			0.03	U		0.03	U		0.03	U	UJ	0.03	U		0.01	J	U	0.03	U	
Nitrate + Nitrite, as N	mg/L			3.17			2.8			1.41			0.979			0.123			0.842		
Phosphorus, Total	mg/L			0.183			0.199		J	0.134			0.316			32			0.075		
Sulfate	mg/L			2000			2200			2250			2110			2220			2180		
TDS	mg/L			3120			3100			3420			3350			3230			3160		
TOC	mg/L						5.84			8.96		J-	7.98			8.29			6.52		J
TSS	mg/L			17		J	21			38			37			37			28		

Notes:

HH - Human Health

NA - Value not avaliable

Value exceeds human health risk comparison value.

Value exceeds Livestock risk coparison value.

ValQ - Validation qualifier

LabQ - Laboratory qualifier

Qualifiers defined as follows: J - The Result is an estimated quantity; U - Not detected at Detection Limit; UJ - Not detected above the level of the associated value (5 times the highest blank concentration).

A range of conservative human health screening levels are provided for preliminary comparison purposes only and do not constitute a risk evaluation. Screening levels ahown are based on maximum contaminant level (MCL), as per the Request Action Memorandum (IDEQ, 2011).

a - Acute Livestock comparison values are shown in parentheses where applicable.

Table 5-1
Batch Leach Test Results

Analyte	Blank	Alfalfa	Wood Chips	Wood Chips Dup	Sand
Selenium and Species (mg/L)					
Total Selenium (by Method SM 3114C)	3.21	0.0200 U	2.92	2.88	2.92
Selenium IV	1.12	0.0141	0.538	0.555	0.536
Selenium VI	2.20 U	0.0300 U	2.38	2.33	2.38
Dissolved Metals (mg/L)					
Aluminum	0.08 U	0.16 U	0.08 U	0.08 U	0.08 U
Antimony	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U
Arsenic	0.003 U	0.00344	0.003 U	0.003 U	0.0031
Barium	0.0243	0.167	0.413	0.45	0.0775
Beryllium	0.002 U	0.004 U	0.002 U	0.002 U	0.002 U
Boron	0.065	0.674	0.061	0.061	0.066
Cadmium	0.0002 U	0.0002 U	0.00077	0.00081	0.0002 U
Chromium	0.006 U	0.012 U	0.006 U	0.006 U	0.006 U
Copper	0.01 U	0.0629	0.01 U	0.01 U	0.01 U
Cobalt	0.006 U	0.012 U	0.006 U	0.006 U	0.006 U
Iron	0.1 U	0.209	0.1 U	0.1 U	0.1 U
Lead	0.0075 U	0.015 U	0.0075 U	0.0075 U	0.0075 U
Manganese	0.046	0.565	1.25	1.25	0.0824
Mercury	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Molybdenum	0.067	0.016 U	0.008 U	0.008 U	0.067
Nickel	0.343	0.336	0.155	0.154	0.242
Silver	0.005 U	0.01 U	0.005 U	0.005 U	0.005 U
Thallium	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Uranium	0.0213	0.00224	0.001 U	0.001 U	0.021
Vanadium	0.0179	0.01 U	0.005 U	0.005 U	0.0138
Zinc	0.395	0.59	0.165	0.159	0.039
Dissolved Cations/Anions (mg/L)					
Alkalinity, Total as $CaCO_3$	244 J	636 J	119 J	116 J	240 J
Alkalinity, Bicarbonate as $CaCO_3$	244	636	119	116	240
Alkalinity, Carbonate as $CaCO_3$	1 U	1 U	1 U	1 U	1 U
Chloride	11	87.5	11.5	11.3	11
Sulfate	2270	2390	2270	2300	2280
Phosphate	0.137	51.4 J	0.276 J	0.306 J	0.085 J
Fluoride	1.34 J-	223 J-	1.97 J-	1.98 J-	1.07 J-
Nitrate as N	0.05 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.056 J
Nitrite as N	0.05 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.05 UJ
Magnesium	256	308	258	259	263
Sodium	27.5	38	28.1	28	28.4
Potassium	4.95	1060	20.5	20.3	5.91
Field Parameters					
Dissolved Oxygen (mg/L)	7.3	0.2	0.5	0.4	8
Ferrous iron (mg/L)	< 0.02	0.3	0.03	< 0.02	< 0.02
ORP (mV)	168	-516	94	87	164
pH (s.u.)	7.56	5.31	6.43	6.38	7.76
Temperature (^{o}C)	27	28	28	29	27

Notes:
mV - millivolts; ^{o}C - degrees Celsius; su - standard units; mg/L - milligrams per liter;
J - Concentration is considered estimated. "+" indicates value may be biased high. "-" indicates value may be biased low.
U - Concentration is below the reporting limit, reporting limit shown.
Batch leach tests were conducted using NES-5 seep water collected on 1 November 2017.
All samples presented in this table were collected on 28 December 2017 at the completion of the batch leach tests.

Table 5-2
Summary of the 25 PV Effluent Data for Seep and Groundwater

Analyte	Units	Seep Influent	Seep Effluent Column A	Seep Effluent Column B	Groundwater Influent	Effluent Groundwater Column A	Effluent Groundwater Column B
Field Parameters							
Ferrous Iron	mg/L	0.05	0.66	0.74	0.04	1.2	1.68
ORP	mV	170	-183	-177	232	-183	-163
pH	SU	7.91	6.67	6.68	6.88	6.55	6.56
Oxygen, Dissolved	mg/L	4.5	0.4	0.6	4.3	0.5	0.5
Temperature	C	22.3	22.9	22.6	22.5	23	22.9
Conductivity at 25 C	mS/cm	3.28	3.23	3.16	3.04	2.94	3.04
Metals and Metalloids							
Aluminum, Dissolved	mg/L	0.08 UJ	0.08 U	0.08 U	0.08 UJ	0.08 U	0.08 U
Aluminum, Total	mg/L	0.08 UJ	0.1	0.09	0.08 UJ	0.11	0.12
Antimony, Dissolved	mg/L	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U
Antimony, Total	mg/L	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U
Arsenic, Dissolved	mg/L	0.00375 U	0.015	0.0157	0.00375 U	0.024	0.0237
Arsenic, Total	mg/L	0.00375 U	0.0164	0.0155	0.00375 U	0.0242	0.0255
Cadmium, Dissolved	mg/L	0.00025 U	0.00025 U	0.00025 U	0.00406	0.00025 U	0.00025 U
Cadmium, Total	mg/L	0.00054	0.00041	0.00037	0.00415	0.0002 U	0.0002 U
Calcium, Dissolved	mg/L	543	514	516	536	530	530
Calcium, Total	mg/L	533	553	549	535	545	545
Iron, Dissolved	mg/L	0.1 U	0.503	0.611	0.1 U	1.12	1.49
Iron, Total	mg/L	0.1 U	0.705	0.829	0.1 U	1.29	1.96
Magnesium, Dissolved	mg/L	257	255	251	208	215	215
Magnesium, Total	mg/L	258	273	272	221	222	227
Manganese, Dissolved	mg/L	0.0488	0.875	0.785	0.815	2.63	2.9
Manganese, Total	mg/L	0.0496	0.911	0.83	1.04	2.66	3.01
Potassium, Dissolved	mg/L	5.57	5.17	4.95	5.43	4.89	4.45
Potassium, Total	mg/L	5.72	5.51	5.36	5.76	4.98	4.68
Sodium, Dissolved	mg/L	32.2	31.3	30.9	24.5	24.7	24.7
Sodium, Total	mg/L	32.4	33.1	32.9	25.7	25.1	25.8
General Chemistry							
Alkalinity, Total as CaCO3	mg/L	255	351	346	217	385	378
Bicarbonate, as CaCO3	mg/L	255	351	346	217	385	378
Carbonate, as CaCO3	mg/L	1 U	1	1 U	1 U	1 U	1 U
Chloride	mg/L	11.7	13.6 J-	11.4 J-	11.5	10.2 J-	12 J-
Fluoride	mg/L	2.24	1.31	1.31	0.817	0.573	0.556
Nitrate as N	mg/L	0.05 U	0.05 U	0.05 UJ	0.388 J+	0.05 U	0.05 U
Nitrite as N	mg/L	0.05 U	0.05 U	0.05 UJ	0.05 U	0.05 U	0.05 U
Phosphate	mg/L	0.149 J	0.01 J	0.01 UJ	0.159 J	0.126 J	0.049 J
Sulfate	mg/L	2390	2600 J-	2270 J-	2140	2080 J-	1800 J-
Selenium and Species (mg/L)							
Total Selenium (by Method SM 3114C)	mg/L	10	0.186 J-	0.18 J-	1.09	0.0168 J-	0.0193 J-
Total Selenium (by Method EPA 200.8)	mg/L	9.05	0.0613 J-	0.0562 J-	0.913	0.0081 J-	0.0121 J-
Selenium IV	mg/L	2.62	0.0189 J-	0.017 J-	0.0724	0.0129 J-	0.0087 J-
Selenium VI	mg/L	7.42	0.167 J-	0.163 J-	1.01	0.00389 J-	0.0106 J-
Dissolved Selenium	mg/L	9.52 J-	0.0463 J-	0.0459 J-	0.926 J-	0.0082 J-	0.011 J-

Notes:

mS/cm - microSiemens per centimeter; mV - millivolts; ^{0}C - degrees Celsius; su - standard units; mg/L - milligrams per liter;

J - Concentration is considered estimated. "+" indicates value may be biased high. "-" indicates value may be biased low.

U - Concentration is below the reporting limit, reporting limit shown.

Table 5-3
Summary of the 50 PV Effluent Data for Seep and Groundwater

Analyte	Units	Seep Influent	Seep Effluent Column A	Seep Effluent Column B	Groundwater Influent	Effluent Groundwater Column A	Effluent Groundwater Column B
Field Parameters							
Ferrous Iron	mg/L	0.05	0.12	0.17	0.04	0.16	0.1
ORP	mV	170	-257	-247	232	-253	-273
pH	SU	7.91	7.06	7.31	6.88	6.79	6.85
Oxygen, Dissolved	mg/L	4.5	0.4	0.5	4.3	0.5	0.4
Temperature	C	22.3	22	22	22.5	22	22
Conductivity at 25 C	mS/cm	3.28	3.28	3.27	3.04	2.96	2.99
Metals and Metalloids							
Aluminum, Dissolved	mg/L	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
Aluminum, Total	mg/L	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U
Antimony, Dissolved	mg/L	0.005 U	0.003 U	0.003 U	0.005 U	0.003 U	0.003 U
Antimony, Total	mg/L	0.005 U	0.003 U	0.003 U	0.005 U	0.003 U	0.003 U
Arsenic, Dissolved	mg/L	0.0075 U	0.00909	0.0076	0.0075 U	0.011	0.0199
Arsenic, Total	mg/L	0.0075 U	0.00853	0.00765	0.0075 U	0.0111	0.0191
Cadmium, Dissolved	mg/L	0.0005 U	0.00025 U	0.00025 U	0.0005 U	0.00025 U	0.00025 U
Cadmium, Total	mg/L	0.0005 U	0.00025 U	0.00025 U	0.00066	0.00025 U	0.00025 U
Calcium, Dissolved	mg/L	539	580	561	537	559	562
Calcium, Total	mg/L	550	580	573	545	578	554
Iron, Dissolved	mg/L	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Iron, Total	mg/L	0.1 U	0.1 U	0.1 U	0.1 U	0.113	0.1 U
Magnesium, Dissolved	mg/L	276	272	265	227	229	227
Magnesium, Total	mg/L	281	275	270	233	233	218
Manganese, Dissolved	mg/L	0.0541	0.282	0.235	0.008 U	0.301	0.347
Manganese, Total	mg/L	0.0558	0.286	0.241	0.151	0.318	0.341
Potassium, Dissolved	mg/L	5.44	5.65	5.62	5.4	5.66	5.51
Potassium, Total	mg/L	5.52	5.62	5.63	5.45	5.88	5.25
Sodium, Dissolved	mg/L	33.8	34.3	33.6	26.3	26.7	26.8
Sodium, Total	mg/L	34.3	34.3	34	26.5	26.9	25.5
General Chemistry							
Alkalinity, Total as CaCO3	mg/L	259	305	293	218	301	339
Bicarbonate, as CaCO3	mg/L	259	305	293	218	301	339
Carbonate, as CaCO3	mg/L	1 U	1 U	1 U	1 U	1 U	1 U
Fluoride	mg/L	1.99	1.69	1.75	0.929	0.861	0.833
Nitrate as N	mg/L	0.05 U	0.05 U	0.05 U	0.348	0.05 U	0.05 U
Nitrite as N	mg/L	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Phosphate	mg/L	0.146 J	0.21 J	0.271 J	0.158 J	0.253 J	0.133 J
Sulfate as SO4	mg/L	2500	2280	2280	2190	1970	1950
Selenium and Species (mg/L)							
Total Selenium (by Method SM 3114C)	mg/L	8.81	0.103	0.0887	0.758	0.0142	0.0129
Total Selenium (by Method EPA 200.8)	mg/L	8.21	0.067	0.0645	0.843	0.0078	0.0074
Selenium IV	mg/L	2.79	0.0487	0.0288	0.075	0.0591	0.051
Selenium VI	mg/L	6.02	0.0544	0.0599	0.683	0.0033 U	0.0033 U
Dissolved Selenium	mg/L	9.2	0.0558 J-	0.0492 J-	0.846	0.0065 J-	0.0066 J-

Notes:

mS/cm - microSiemens per centimeter; mV - millivolts; ^{0}C - degrees Celsius; su - standard units; mg/L - milligrams per liter;

J - Concentration is considered estimated. "+" indicates value may be biased high. "-" indicates value may be biased low.

U - Concentration is below the reporting limit, reporting limit shown.

Table 5-4
Spring 2017 Runoff Sample Results

	Sample Location	NRunChannel1			NRunChannel2			NRunChute1			NRunChute2		
	Description	North Channel at ACM Transition to Riprap			North Channel at Road Swale Inlet to the Northeast Sedimentation Basin			North Chute at Outlet of 48-inch Culvert			North Chute at Inlet to the Northeast Sedimentation Basin		
	Sample Name	CD0517-NRunChannel1-SW001			CD0517-NRunChannel2-SW001			CD0517-NRunChute1-SW001			CD0517-NRunChute2-SW001		
	Date	5/23/2017			5/23/2017			5/23/2017			5/23/2017		
Analyte	**Units**	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ	Result	LabQ	ValQ
Field Parameters													
Conductivity at 25 C	umhos/cm	66			154			254			127		
ORP	mV	159.7			169.5			152.6			167.3		
Oxygen, Dissolved	mg/L	10.3			40.31			10.05			6.13		
pH	SU	8.45			8.58			8.26			8.15		
Temperature	C	13.06			0.95			14.69			22.79		
Turbidity	NTU	249			1000[a]			6.37			24.4		
General Chemistry													
Alkalinity, Total as CaCO3	mg/L	29.4			25.4			128			53.7		
Bicarbonate, as CaCO3	mg/L	29.4			25.4			128			53.7		
Carbonate, as CaCO3	mg/L	1	U		1	U		1	U		1	U	
Hardness, as CaCO3	mg/L	39.8			55			118			49.6		
Ammonia, as N	mg/L	0.03	U		0.03	U		0.03	U		0.03	U	
Nitrate + Nitrite, as N	mg/L	0.283			0.15			0.259			0.284		
Phosphorus, Total	mg/L	0.866			1.92			0.227			0.321		
Sulfate	mg/L	0.48			0.3	U		6.89			1.21		
Calcium, Total	mg/L	10.9			13			34.6			14.6		
Magnesium, Total	mg/L	3.04			5.49			7.65			3.23		
Potassium, Total	mg/L	3.29			6.29			0.99			1.23		
Sodium, Total	mg/L	0.27	J		0.35	J		4.68			1.51		
Chloride	mg/L	0.2	U		0.2	U		0.2	U		0.2	U	
Fluoride	mg/L	0.128			0.128			0.67			0.396		
TDS	mg/L	157		J	324		J	137		J-	65		J-
TSS	mg/L	8		J-	82		J-	5	U	UJ	10		J-
Metals and Metalloids													
Arsenic, Total	mg/L	0.00324			0.00687			0.00151	J		0.00204	J	
Cadmium, Total	mg/L	0.00092			0.00273			0.000071	J		0.00013	J	
Chromium, Total	mg/L	0.124			0.191			0.0019	U		0.003	J	
Selenium, Total	mg/L	0.0016	J		0.0025			0.018			0.0031		
Vanadium, Total	mg/L	0.0321			0.0628			0.0036			0.0071		
Zinc, Total	mg/L	0.121			0.279			0.138			0.0527		

Notes:

Qualifiers defined as follows: J - The Result is an estimated quantity; J- - Estimated quantity with a low bias; J+ - Estimated quantity with a high bias; U - Not detected at Detection Limit; UJ - Not detected above the level of the associated value (5 times the highest blank concentration).

a - Turbidity exceeded maximum value for meter (1,000 NTU).

Table 7-1
Groundwater and Surface Water Analyte List, Methods, Preservation, and Data Quality Indicators

Analyte	Method	MDL (mg/L)	RL (mg/L)	MCL (mg/L)	Preservation and Storage	Holding Time (days)
Aluminum, Dissolved	6010C	0.04	0.08	--	HNO_3 to pH < 2	180
Aluminum, Total				0.05 - 0.2a		
Barium, Dissolved		0.0016	0.002	--		
Barium, Total				2		
Beryllium, Dissolved		0.001	0.002	--		
Beryllium, Total				0.004		
Boron, Dissolved		0.007	0.04	--		
Boron, Total				--		
Calcium, Dissolved		0.04	0.1	--		
Calcium, Total				--		
Chromium, Dissolved		0.0019	0.006	--		
Chromium, Total				0.1		
Cobalt, Dissolved		0.0013	0.006	--		
Cobalt, Total				--		
Copper, Dissolved		0.0023	0.01	--		
Copper, Total				1.3		
Iron, Dissolved		0.045	0.06	--		
Iron, Total				0.3a		
Lead, Dissolved		0.0052	0.0075	--		
Lead, Total				0.015		
Magnesium, Dissolved		0.1	0.2	--		
Magnesium, Total				--		
Manganese, Dissolved		0.0049	0.004	--		
Manganese, Total				0.05a		
Molybdenum, Dissolved		0.003	0.008	--		
Molybdenum, Total				--		
Nickel, Dissolved		0.0027	0.01	--		
Nickel, Total				--		
Potassium, Dissolved		0.19	0.5	--		
Potassium, Total				--		
Silver, Dissolved		0.0024	0.005	--		
Silver, Total				0.1a		
Sodium, Dissolved		0.17	0.5	--		
Sodium, Total				--		
Antimony, Dissolved	6020A	0.003	0.006	--		
Antimony, Total				0.006		
Arsenic, Dissolved		0.00021	0.003	--		
Arsenic, Total				0.01		
Cadmium, Dissolved		0.000038	0.0002	--		
Cadmium, Total				0.005		
Selenium, Dissolved		0.0004	0.002	--		
Selenium, Total				0.05		
Thallium, Dissolved		0.00003	0.001	--		
Thallium, Total				0.002		
Uranium, Dissolved		0.000025	0.001	--		
Uranium, Total				--		
Vanadium, Dissolved		0.0001	0.003	--		
Vanadium, Total				--		
Zinc, Dissolved		0.0004	0.005	--		
Zinc, Total				5a		
Hardness	2340B	0.503	1.07	--		
Mercury, Dissolved	7470A	0.000076	0.0002	--	HNO_3 to pH < 2	28
Mercury, Total				0.002		
Alkalinity	SM 2320B	0.5	1	--	Cool to < 6ºC	14
Total Phosphorus	SM4500 PE	0.004	0.01	--	H_2SO_4 to pH < 2, Cool to < 6ºC	28
Nitrate+Nitrite (as N)	353.2	0.01	0.05	10/1		
Sulfate	300.0	0.13	0.3	250a	Cool to < 6ºC	28
Chloride		0.12	0.2	250a	none required	28
Fluoride		0.052	0.1	4		
TDS	SM 2540C	4	10	500a	Cool to < 6ºC	7
TSS	SM 2540D	4	5	--		
Ammonia as N	350.1	0.005	0.03	--	H_2SO_4 to pH < 2, Cool to < 6ºC	28
TOC	SM5310B	0.18	1	--		
DOC						

Data Quality Indicators	
Accuracy Measures and Control Limits[1]	
LCS Recovery:	80% to 120%
MS Recovery:	75% to 125%
Precision Measures and Control Limits[1]	
MS/MSD:	RPD < 30%
Analytical Duplicate:	RPD < 20%
Field Duplicate:	RPD < 30%

Notes:

[1] Specific methods, MDLs and control limits may change based on the laboratory that performs the analyses. The laboratory's control limits may be used for the LCS recovery.

[a] Secondary drinking water standard from Guidance for Nuisance Chemicals, EPA 2017.

Table 7-2
Treatment Media and Pore Water Analyte List, Methods, Preservation, and Data Quality Indicators

Analyte	Matrix	Method	MDL	Preservation and Storage	Holding Time (days)
Total Organic Carbon	Solids	9060 A	200 mg/kg	Cool at 4ºC	28
Total Sulfur		LECO	0.50%	none	none
Mineralogy		Rietveld X-ray Diffraction	---	none	none
MIneralogy		SEM	---	none	none
Biochemical Oxygen Demand (BOD)	Aqueous (pore water)	5210B	0.001	Cool at 4ºC	2
Chemical Oxygen Demand (COD)		410.4		H_2SO_4 to pH < 2, Cool at 4ºC	28
Total Organic Carbon		9060 A	0.007		28

Data Quality Indicators		
	Solids	**Aqueous**
Accuracy Measures and Control Limits[1]		
LCS Recovery:	75% to 125%	80% to 120%
MS Recovery:	75% to 125%	75% to 125%
Precision Measures and Control Limits[1]		
MS/MSD:	RPD < 50%	RPD < 30%
Analytical Duplicate:	RPD < 20%	RPD < 20%
Field Duplicate:	RPD < 50%	RPD < 30%

Notes:

[1] Specific methods, MDLs and control limits may change based on the laboratory that performs the analyses.

SEM - scanning elctron microscopy with electron dot mapping

LECO - sulfur is calculated using results from LECO furnace analysis of total sulfur and other sulfur forms after hydrochloric and nitric acid extraction.

Table 9-1
Permeable Reactive Barrier Pilot Study General Schedule

Task	Date
Installation of Stormwater Controls and Mixing of Treatment Media	Late September
Trenching for Groundwater PRB and placement of treatment media	Early October
Construction of overflow drain and infiltration gallery	Early - Mid October
Dewatering of the Northeast Seep 5 Pond and Northeast Sedimentation Basins	Mid October
Placement of treatment media in Seep Treatment Cell and Dinwoody cover	Mid - Late October
Installation and sampling of additional monitoring wells, if needed	Late October
Weekly construction reports	September through completion of construction
Construction Summary Report with as-built drawings	120 days after completion of construction
Performance monitoring	Monthly untill loss of access during winter
Year 1 Data Summary Report	March 2020