



# **In-Situ Treatment of Areas of Residual Contamination Phase II Report**

## **Boomsnub/Airco Superfund Site Hazel Dell, Washington**

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May 2021  
Revision: 1  
Projects Nos. 1524092/1524099

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## LIST OF ACRONYMS AND ABBREVIATIONS

3DME	3-D Microemulsion <sup>®</sup>
µg/L	Microgram(s) per liter
AOC	Area of concern
BDI	Bio-Dechlor INOCULUM PLUS <sup>®</sup>
COC	Contaminant of concern
COD	Chemical oxygen demand
CRS	Chemical Reduction Solution <sup>®</sup>
CVOC	Chlorinated volatile organic compound
DCE	Dichloroethene
DO	Dissolved oxygen
DOC	Dissolved organic carbon
EA	EA Engineering, Science, and Technology, Inc., PBC
EPA	U.S. Environmental Protection Agency
ESD	Explanation of significant difference
ft	Foot (feet)
lb	Pound(s)
ISCR	In-situ chemical reduction
MCL	Maximum contaminant level
Messer	Messer LLC
mg/L	Milligram(s) per liter
OU	Operable unit
PCE	Tetrachlorethylene
PlumeStop	PlumeStop <sup>®</sup> Liquid Activated Carbon <sup>™</sup>
PlumeStop-S	Sulfidated PlumeStop <sup>®</sup> Liquid Activated Carbon <sup>™</sup>
psi	Pound(s) per square inch
S-MicroZVI	Sulfidated MicroZVI <sup>™</sup>
Site	Boomsnub/Airco Superfund Site

**LIST OF ACRONYMS AND ABBREVIATIONS (continued)**

TCE	Trichloroethene
TOC	Total organic carbon
TOPPS	Toe-of-Plume Pilot Study
VFA	Volatile fatty acid
VOC	Volatile organic compound
ZVI	Zero valent iron

## 1. INTRODUCTION

This report presents the findings from the Phase II in-situ remediation of areas with residual groundwater contamination at the Boomsnub/Airco Superfund Site (Site) located in Hazel Dell, Washington (Figure 1). This remedial action is consistent with the 2000 Record of Decision (U.S. Environmental Protection Agency [EPA] 2000) for the Site and the September 2015 Explanation of Significant Differences (ESD) (EPA 2015), which allows for in-situ treatment to augment the contaminated groundwater extraction and treatment system. The remedial action is being performed by Messer LLC (Messer) under a 2007 Consent Decree (EPA 2007) that requires EPA oversight. Work was performed in accordance with the In-Situ Treatment of Areas of Residual Contamination Pilot Study Results and Full-Scale Treatment Plan (EA Engineering, Science, and Technology, Inc., PBC [EA] 2019). Messer's consultant is EA, who is responsible for implementing field efforts and cleanup at the Site on behalf of Messer.

### 1.1 BACKGROUND

The Site is divided into three operable units (OUs) to manage cleanup activities:

- OU-1, Boomsnub Soil;
- OU-2, BOC (Messer) trichloroethene (TCE) source; and
- OU-3, Site-Wide groundwater contaminated with volatile organic compounds (VOCs) and chromium in a solute plume that extends approximately 2,000 feet (ft) downgradient from source areas.

Soil related to OU-1 was removed during a series of Removal Actions, with chromium-contaminated soil left in place underneath Boomsnub property site structures. A portion of the chromium-contaminated soil left in place by the Removal Actions will be excavated after the OU-3 groundwater treatment system is removed. Regarding OU-2 and OU-3, the primary contaminants of concern (COCs) at the Site are TCE and hexavalent chromium. The COC plumes originally extended west approximately 4,500 ft downgradient of the source area. Significant efforts have been made to remediate the COCs. From 1990 to 2021, a groundwater extraction and treatment system was in operation. The groundwater extraction and treatment system was shut down on 3 January 2021 with EPA approval as the plume size and magnitude were remediated significantly and the remaining TCE (concentrations less than 150 µg/L) are in recalcitrant portions of the aquifer. The groundwater extraction and treatment system will remain in an operational-ready state until remediation and attainment monitoring is complete and the system can be decommissioned.

The Toe-of-Plume Pilot Study (TOPPS), an in-situ treatment test, was performed in 2006 to treat an area of recalcitrant TCE contamination at the downgradient extent of TCE contamination. During this Pilot Study, a reducing agent consisting of zero valent iron (ZVI) and a carbon source (EHC<sup>®</sup>, a carbon microemulsion by PeroxyChem) was injected in the contaminated zone of the aquifer using direct-push technology to determine its effectiveness at reducing residual TCE concentrations to below established cleanup levels. The TCE concentrations in the TOPPS monitoring wells have remained below the cleanup level since that time, indicating that the TOPPS treatment was effective (EA 2007).

To accelerate cleanup at the Site, EPA issued an Explanation of Significant Difference (ESD) to the Record of Decision in September 2015 allowing the use of in-situ remediation to treat areas of residual contamination. A Work Plan for the In-Situ Treatment of Areas of Residual Contamination (EA 2018) was submitted to EPA in March 2018; EPA approved this Work Plan in August 2018. The Work Plan describes two areas of concern (AOCs): (1) AOC-1, adjacent to the VOC source area associated with OU-2; and (2) AOC-2, which is located along the center of the plume in OU-3 (Figure 2). Both areas of residual contamination contain TCE at concentrations exceeding the site groundwater cleanup level of 5 micrograms per liter ( $\mu\text{g/L}$ ).

The Work Plan (EA 2018) prescribed a phased approach and methods for implementation of in-situ remediation of the two areas of residual TCE contamination. The three phases described by the Work Plan are: (1) design verification testing, (2) Phase I treatment (pilot testing), and (3) Phase II treatment (full-scale treatment). The results of the design verification testing were used to establish the locations, depths, and quantities for the Phase I treatment conducted in October 2018. The Phase I treatment was a field-scale pilot test that targeted small portions of the plume in AOC-1 and AOC-2 with higher concentrations of TCE to test product application methods and rates, and to assess the effectiveness of the treatment in order to establish a work plan for Phase II treatment. Direct-push drilling was used at both test locations to inject the selected treatment products into the aquifer, creating a permeable reactive zone. The results of Phase I treatment and the final work plan for Phase II treatment were described in the In-Situ Treatment of Areas of Residual Contamination Pilot Study Results and Full-Scale Treatment Plan (EA 2019) approved by EPA on 23 July 2019. The results of Phase II treatment are presented in this report.

## 1.2 PROJECT OBJECTIVE

This report describes the methodology and results of the Phase II treatment. The overall objective for the in-situ treatment is to achieve the groundwater cleanup levels in the areas of residual contamination and accelerate closure of the Site.

The design for the Phase II treatment was documented in the *In-Situ Treatment of Areas of Residual Contamination Pilot Study Results and Full-Scale Treatment Plan* (EA 2019). The Phase II work started in Fall 2019 (Phase IIA), with a break over the rainy season, and was completed in Spring/Summer 2020 (Phase IIB). The following table provides the dates of each phase of work:

Phase	Dates
Design Verification Testing	18 August – 18 September 2018
Phase I Pilot Testing	15–30 October 2018
Phase II Full-Scale Treatment:	
• Phase IIA	9 September – 19 October 2019
• Phase IIB	29 April – 1 August 2020

### 1.3 PROJECT ORGANIZATION

This document is organized as follows:

- Phases IIA and IIB In-Situ Treatment are discussed in Section 2.
- Performance Monitoring is discussed in Section 3.
- Conclusions and recommendations are presented in Section 4.
- A list of references cited is provided in Section 5.

Appendix A provides EA's subcontractor Regeneration's Application Summary Report for the AOC-1 injections. Appendix B (Phase IIA) and Appendix C (Phase IIB Round 1) provide Daily Injection Reports. The findings of the Daily Injection Reports are summarized in Table 1.

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## 2. PHASE II IN-SITU TREATMENT

Phase II injections were conducted in AOC-1 and AOC-2 as prescribed in the Treatment Plan (EA 2019) and the work conducted is described in the following sections, with exceptions to the Treatment Plan noted. Work in AOC-1 was conducted during Phase IIB while work in AOC-2 was conducted during Phases IIA and IIB. Figures 3 and 4 show the injection areas in AOC-1 and AOC-2, respectively.

As required in the Treatment Plan (EA 2019), different products were selected for treatment in AOC-1 and AOC-2 due to the different depths of contamination and the magnitude of contaminant concentrations in each area. As such, separate subcontractors were used to conduct the injections, as described in the following descriptions of work.

Both injection programs at AOC-1 and AOC-2 utilize in-situ chemical reduction (ISCR) of chlorinated volatile organic compounds (CVOCs) using ZVI. Injectable activated carbon was also utilized in both AOCs to provide sorption capacity to remove the CVOCs from groundwater and provide additional residence time for the ZVI to abiotically mineralize the CVOCs. The injection programs also included injection of electron donors and dechlorinating bacteria to enhance reductive dechlorination within the treatment rows as a treatment process. AOC-1 (as the former source area) relies more on an ISCR remedy than enhanced bioremediation while AOC-2 (the downgradient plume area) relies more on an enhanced reductive dechlorination remedy to treat the lower concentrations of CVOCs.

These two remediation processes are synergistic as the enhanced reducing conditions (i.e., low dissolved oxygen [DO] nominally less than 0.5 milligrams per liter [mg/L] and highly reducing conditions nominally less than -200 millivolts) created from ZVI are ideal for enhanced reductive dechlorination when available electron donors are available or are provided through injections.

The groundwater treatment program was designed to treat the dissolved-phase contaminants (CVOCs) in the groundwater as it passes through each of the treatment rows (which were oriented perpendicular to groundwater flow). The transects were installed nominally 150 ft from each other in AOC-2 and 50 ft from each other in AOC-1. With a nominal groundwater velocity of 120-200 ft/year (EPA 2000) and given the typical TCE retardation factor of approximately 2, TCE in groundwater would take approximately 1 to 2 years in AOC-1 and 2-3 years in AOC-2 for a clean pore volume flush between treatment transects. For maximum contaminant level (MCL) achievement, more than one pore volume flush will be required to account for matrix back-diffusion of contaminants from the aquifer materials that are at a contaminant concentration equilibrium with the groundwater being treated.

### 2.1 AOC-1

Work at AOC-1 consisted of product injections in six rows to treat TCE contamination and halt downgradient migration through the establishment of treatment rows. The six rows of injections

are shown in Figure 3 as Rows 9 through 14. The AOC-1 injections occurred in Phase IIB between 7 July and 1 August 2020.

AOC-1 injections were handled by EA's subcontractor, Regenesys, with field oversight provided by EA. Regenesys prepared a separate Application Summary Report on their AOC-1 injections (Appendix C). A direct-push drill rig was utilized to perform injections into treatment rows as shown in Figure 3. Considerable effort was spent avoiding numerous buried utilities in this active industrial area and public right-of-way. A vacuum truck was used to gently evacuate near-surface soils in areas with dense utilities until the maximum depth of the utility corridor was reached, prior to advancement of the direct-push drill rig in sensitive locations.

A total of 24,000 pounds (lb) of PlumeStop® Liquid Activated Carbon™ (PlumeStop), 6,000 lb of PlumeStop® Liquid Activated Carbon™ with Sulfidated-MicroZVI™ (PlumeStop-S), 8,500 lb of Sulfidated-MicroZVI™ (S-MicroZVI), 2,000 lb of 3-D Microemulsion® (3DME), 800 lb of Chemical Reduction Solution® (CRS), and 18 liters of Bio-Dechlor INOCULUM PLUS® (BDI) were mixed with water and injected into six treatment rows in AOC-1.

PlumeStop is a colloidal biomatrix of 1- to 2-micrometer activated carbon particles that binds to the aquifer matrix and removes contaminants from groundwater. S-MicroZVI is a sulfidated colloidal ZVI that promotes the destruction of chlorinated solvents. 3DME is a liquid emulsion designed to enhance the reductive dechlorination process through anaerobic biodegradation. CRS is an iron-based reagent that is mixed with 3DME to facilitate biogeochemical ISCR. BDI is designed to augment the naturally present microbial communities where they are otherwise insufficient to fully dechlorinate TCE through biodegradation. The S-MicroZVI, 3DME, CRS, and BDI solution is relatively mobile and treats chlorinated solvents through anaerobic bioremediation and abiotic destruction, whereas PlumeStop is less mobile and achieves contaminant reduction by sequestering chlorinated solvents for S-MicroZVI to remediate through ISCR pathways. The Work Plan (EA 2018) provides further details on the chemical characteristics of these products in Safety Data Sheets. The application balance for each AOC-1 treatment row is provided in Table 3 of Appendix A (Regenesys Application Summary Report).

In AOC-1, two different injectates were used for different treatment rows, based on area-specific restrictions due to site infrastructure as further explained. In five of the rows, a mixture of PlumeStop, PlumeStop-S, and S-MicroZVI was used; these five treatment rows are labeled Rows 9 through 13 in Figure 3 and are intended to treat upgradient groundwater that flows into the treatment transect. In the sixth easternmost treatment row (Row 14 on Figure 3), a mixture of S-MicroZVI, 3DME, CRS, and BDI was utilized. Row 14 was placed upgradient of the area of residual contamination characterized by monitoring well AMW-12A in an area of the Messer Gas Plant that has several utilities. Due to presence of utilities, Row 14 was located upgradient of the target area therefore S-MicroZVI, 3DME, CRS, and BDI, a higher mobility solution, was injected in Row 14 giving it the ability to migrate downgradient of the injection points and treat the limited access areas near AMW-12A.

## 2.2 AOC-2

Work performed at AOC-2 consisted of injection of EHC<sup>®</sup> Plus by PeroxyChem and bioaugmentation culture SDC-9<sup>™</sup> by RNAS Remediation Products into the aquifer to create a series of permeable reactive zones. Drilling and injections were conducted by Anderson Environmental Consulting, LLC. EHC<sup>®</sup> Plus (consisting of lecithin-based organic carbon donor, ZVI, and powdered activated carbon) augmented with SDC-9<sup>™</sup> was injected into a total of 112 injection points. EHC<sup>®</sup> Plus degrades chlorinated solvents through the biotic, abiotic and adsorption pathways, and SDC-9<sup>™</sup> further enhances the biotic pathway by providing additional bacterial culture to biodegrade the chlorinated solvents. The injection design consisted of rows of injection points that were staggered to achieve coverage perpendicular to the groundwater flow (Figures 3 and 4). Each injection point was placed 14 ft apart, based initially on recommendations from the manufacturer, as confirmed during pilot testing during Fall 2018, and as recommended in the Treatment Plan (EA 2019). Spacing was determined to allow overlap of radius of influence from each injection point to the next to ensure continuity of product throughout the treatment zones. At each injection point, product was injected every 2 ft at depths indicated in Table 1. Injections primarily occurred in a bottom-up fashion due to frequent surfacing occurring when top-down injections were performed.

The injectate was prepared onsite prior to injection with Anderson Environmental Consulting LLC's direct-push drill rig. Water low in DO was prepared by adding RNAS Remediation Product Newman Zone Oxygen Scavenger to a tank of water and allowing the product to react overnight. In the morning, EHC<sup>®</sup> Plus and the bioaugmentation culture SDC-9<sup>™</sup> by RNAS Remediation Products were mixed into the tank of low DO water. The drilling contractor then used Geoprobe<sup>®</sup> 7822DT and 3230DT direct-push drill rigs to inject the slurry into the target treatment zones.

To distribute the solid slurry of EHC<sup>®</sup> Plus (30-40 percent solids) into the formation, a narrow flow path is created to allow the slurry to flow through the target soils. The flow path is created by injecting at down-hole injection pressure rates sufficient to overcome the natural matrix cohesion and overburden pressure. Using a dry soil weight of approximately 100 lb per cubic ft, overburden pressure at 120 ft below ground surface is approximately 83 lb per square inch (psi). Matrix cohesion was not determined; however, for the purposes of this injection testing, the goal was to aim for injection pressures between 85 and 125 psi to initiate flow. Pressure drops as the slurry migrates out into the target soil. Distribution away from the injection point is controlled by the energy losses along its length or, in this case, the time it takes to inject the target volume of EHC<sup>®</sup> Plus at the design injection rates. Therefore, pressure drops/losses are not accounted for in the initial injection pressure goal.

Gauge pressure during testing was measured and reported from a location between the injection pump and the drill rig. Injection gauge pressures typically ranged from 25 to 300 psi, with a bulk of injections occurring around 200 psi to create distribution into the aquifer based on site-specific conditions. Pressure losses due to the DPT tooling and injection nozzle require approximately 125 psi to overcome, indicating that the many injections occurred either within or slightly above the range of downhole injection pressure objectives described in the Treatment Plan. Occasional

pressure spikes were observed in areas that were already saturated with product or had tighter soils such as silts, spiking as high as 700 psi. Typically, the higher pressures were observed when the injection nozzles clogged, thus requiring added pressure to overcome resistance within the injection nozzle. The observed spikes were limited in duration (typically 5 minutes or less) and are not expected to have negatively impacted product placement. Pressures are reported in Daily Injection Reports provided in Appendix B (Phase IIA) and Appendix C (Phase IIB Round 1).

### **2.2.1 Phase IIA Injections**

Phase IIA injections were completed at AOC-2 between 9 September and 19 October 2019. A total of 43,508 lb of EHC<sup>®</sup> Plus augmented with SDC-9 Bioaugmentation Culture was injected throughout Phase IIA at 70 injection points. This total meets the quantity of injectate specified by the Treatment Plan (EA 2019). Treatment rows established in AOC-2 during Phase IIA are shown Figure 4 as Rows 4 through 8, with additional product injected at the beginning of Row 3. Table 1 provides details on the injections that occurred during Phase IIA, and Daily Injection Reports are provided in Appendix B.

During injection of Row 8, a hydraulic connection was made with the filter pack of monitoring well AMW-59 and injectate flowed into the well casing. After subsurface pressures subsided and groundwater conditions returned to baseline, a drilling contractor used a well development rig to bail out the injectate and then redevelop the monitoring well.

As shown in Figure 4, locations of Phase IIA injections were adjusted in Row 8 from the planned locations shown in the Treatment Plan (EA 2019) in order to get treatment closer to monitoring wells MW-14C and MW-14E, which are both in limited access locations immediately downgradient of a major roadway, NE St. Johns Road. As shown on the figure, installing a treatment transect upgradient of the MW-14C and MW-14E was not possible due to NE St. Johns Road. Therefore, the injection wells were adjusted in Row 8 to maximize distribution in the areas of MW-14C and MW-14E while still providing a continuous treatment transect.

Additional injection points were added in Row 3 utilizing the remaining injectate from Rows 4 through 8. These additional injection points were completed to provide additional passive treatment of groundwater before flowing under NE 78<sup>th</sup> Street. Available injectate remained after completing injections in Rows 4 through 8 due to a few injection locations in Row 8 not achieving the number of injections proposed in the Treatment Plan due to subsurface conditions (as shown in Table 1), and due to ordered product quantity exceeding the calculated necessary product mass. These two variations from the approved plan were implemented to improve the performance of the injection remedy.

### **2.2.2 Phase IIB Injections**

Phase IIB injections were completed at AOC-2 between 29 April and 22 May 2020. Daily Injection Reports are provided in Appendix C. During Phase IIB, EHC<sup>®</sup> Plus with SDC-9<sup>TM</sup> was injected into three treatment rows in AOC-2, shown in Figure 4 as Rows 1 through 3,

downgradient of the Phase IIA injection locations. A total of 20,741 lb of EHC<sup>®</sup> Plus was injected at 42 injection points in Phase IIB. Table 1 provides details on the injections that occurred during Phase IIB.

While the alignment of Rows 1 through 3 was placed as intended by the Treatment Plan (EA 2019) during Round 1, the rows could not be placed as close to the NE 78<sup>th</sup> Street sidewalk as intended by the design, as overhead powerlines restricted access once an overhead safety buffer for the drill rig was factored in. As a result, these rows were shifted approximately 10 feet northward from the locations proposed in the Treatment Plan. Additional minor positional accommodations were made for Luke Jensen Park landscaping, irrigation lines, trees, and steep slopes.

As noted in the Daily Injection Reports (Appendix C), injections were more difficult in Rows 1 and 2 than in the upgradient rows due to less permeable aquifer sediments at these locations, with higher pressures and surfacing of product occurring on a number of points. As a result, not all points successfully reached the maximum depths or volumes laid out in the Treatment Plan (EA 2019). Row 1 received 90 percent of the designed injection volume while Row 2 received the full injection volume with some locations receiving more than the designed injection volume and others receiving less (Table 1). Given that pressurized injections could not move injectate into the finer-grained/lower permeability zones of the aquifer, it is reasonable to assume that groundwater (with CVOCs) does not transport through these lower permeability areas. Therefore, it is logical to augment the higher permeability zones with the additional injectate. Based on the total injection volume assessment and localized groundwater flowing through more permeable zones where injectate was received, reduced treatment performance from these site-specific conditions is not expected.

Row 3B was added at the end of the Phase IIB AOC-2 field event to use extra EHC<sup>®</sup> Plus product that could not be successfully injected into Rows 1 and 2 due to product surfacing issues from lower permeability aquifer material. The location of this additional row was chosen to maximize treatment of groundwater prior to flowing beneath NE 78<sup>th</sup> Street, which was inaccessible to drilling. Although located approximately 350 ft to the southeast, this additional row is located upgradient of monitoring well PZ-39 and will have a beneficial effect on TCE concentrations in that well in approximately 2 years. This variation from the approved plan is expected to improve performance of the injection remedy.

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### 3. PERFORMANCE MONITORING

Groundwater monitoring was conducted both before and after the Phase II product injections to assess the performance of the treatment relative to achieving site groundwater cleanup levels. Sampling was also performed to monitor temporary water quality changes associated with the injected treatment products. Full laboratory results and data validation packages for the analytical data presented in this report are provided in the Spring and Fall Progress and Groundwater Monitoring Reports associated with the year in which the data was collected. For the fall 2020 sampling event, results are included in the 2020 Annual Report. February 2021 results presented in this report will have laboratory results and data validation reported in the 2021 Semiannual Report.

#### 3.1 MONITORING APPROACH

Groundwater samples were collected from downgradient performance monitoring wells in AOC-1 and AOC-2 during semi-annual sampling events before and after Phase IIA and Phase IIB injections. To measure the performance of the injections to groundwater quality, 13 monitoring wells were selected as performance monitoring wells to assess AOC-wide groundwater treatment effectiveness over time. In general, performance wells were selected based on their downgradient or proximate position to treatment transects and were above the MCL prior to injections. The summary table below and Table 1 provide the list of performance monitoring well(s) and the nearest upgradient treatment row.

**Performance Monitoring Wells**

Treatment Row Number	Phase	Month/Year injected	Performance Monitoring Wells	First Performance Monitoring Sample Collection Date
<b>AOC-2</b>				
1	IIB	May 2020	MW-20D	October 2020
2	IIB	May 2020	PZ-39, MW-38	October 2020
3	IIB	May 2020	MW-19D, PZ-39	Jan. 2020 (MW-19D) Oct. 2020 (PZ-39)
3B	IIB	May 2020	PZ-39	October 2020
4	IIA	September 2019	None <sup>1</sup>	—
5	IIA	September 2019	None <sup>2</sup>	—
6	I, IIA	October 2018/October 2019	MW-18D, MW-18E	January 2019
7	IIA	October 2019	MW-18D, MW-18E	January 2020
8	IIA	October 2019	AMW-59, MW-14E, MW-14C	January 2020
<b>AOC-1</b>				
9	IIB	July 2020	None <sup>1</sup>	—
10	IIB	July 2020	None <sup>1</sup>	—
11	IIB	July 2020	MW-1A	February 2021
12	IIB	July 2020	None <sup>1</sup>	—
13	IIB	July 2020	AMW-1A	February 2021
14	IIB	July 2020	AMW-12A, AMW-2A	October 2020
Notes:				

1. Distribution of treatment zones was designed to treat the total distribution of contaminant mass at the time of treatment. Therefore, rows such as Rows 5, 9, 10, and 12, were placed in areas of residual contamination and downgradient performance wells associated with another row/transect are utilized for performance. Rows 9 and 10 are transects at the end of the targeted treatment area (Figure 3).
2. MW-15E is on the edge of Row 5 but did not have TCE concentrations above the 5 µg/L MCL prior to injections; therefore, it cannot function as an effective performance monitoring location.

Table 1 also identifies whether the sampling events were prior to or after the injection events (Phase I, IIA, or IIB) to allow the assessment the potential geochemical effects from the injections at the performance well locations. It is noted that some performance well locations such as PZ-39 will take more time to affect the groundwater quality in this area (Section 2.2.2) based on treatment transect distance from the performance monitoring well location and based on TCE transport velocity in groundwater.

Groundwater samples were analyzed by ALS Environmental of Kelso, Washington. The sampling effort was designed to measure concentration changes in the primary COCs and to monitor the aquifer for evidence of immediate TCE degradation (i.e., abiotic processes from the ISCR) and/or enhanced biodegradation (i.e., biotic process from enhanced reductive dechlorination), and desired changes in the groundwater geochemistry that are associated with the injected products.

Groundwater samples were analyzed for CVOCs to assess potential reductions in TCE and formation/reduction of daughter products such as *cis*-1,2-dichloroethene (DCE) and vinyl chloride from enhanced reductive dechlorination processes. Molar concentrations of tetrachloroethylene (PCE), TCE, *cis*-1,2-DCE, *trans*-1,2-DCE, and vinyl chloride were also calculated to track total CVOC concentrations during remediation (Table 2). Molar concentrations are used to remove the mass bias when considering concentrations of compounds with different masses. For example, if one mole of PCE is degraded to one mole of TCE, the total number of moles of CVOCs remaining in the subsurface has not changed. However, the mass of PCE is greater than the mass of TCE; therefore, the mass-based concentration (i.e., micrograms per liter) of total CVOCs would be smaller. Therefore, the molar concentration is used to compare the amount of contaminant remaining without a bias due to the different masses of the compounds at different stages of degradation. This comparison also ensures that full dechlorination is occurring and that breakdown of TCE is not just stalled at *cis*-1,2-DCE or vinyl chloride.

Samples were also analyzed for other parameters that provide evidence of enhanced geochemical conditions for accelerated CVOC reductions or potential temporary conditions such as elevated metals. The distance of the performance wells from the passive treatment transects is a consideration on whether changes in these secondary parameters can be expected. These secondary parameters include:

- ***Dissolved Hydrogen Gases (Ethane, Ethene, and Methane)***—Ethene and ethane are the benign end-products of reductive dechlorination of CVOCs such as TCE. Increased ethene and ethane are direct evidence of reductive dechlorination. Methane is produced during microbial

degradation of injected carbon substrates. Increased methane concentrations are indicative of increased biological activity during reductive dechlorination.

- **Dissolved Organic Carbon (DOC) or Total Organic Carbon (TOC)**—Enhanced reductive dechlorination generally occurs when DOC/TOC concentrations are above 10 mg/L.
- **Chemical Oxidant Demand (COD)**—Increases of COD in groundwater are indicators of organic carbon (from electron donor injections or microbial biomass) in the aquifer.
- **Arsenic, Magnesium, and Manganese**—Arsenic is also known to release from natural soils to groundwater in areas of reducing groundwater conditions when groundwater redox conditions are at or below the Eh for iron reduction and the dissolution of ferric oxides also releases arsenic (American Petroleum Institute 2011). Increased arsenic concentrations in groundwater are common temporary effects during enhanced bioremediation remediation when reducing conditions are produced to remediate CVOCs. A temporary increase in arsenic can be expected but attenuation of arsenic in groundwater is expected when the aquifer is restored (or groundwater mobilizes) to aerobic conditions. Arsenite is reoxidized to the less soluble arsenate (American Petroleum Institute 2011). Temporary increases in magnesium and manganese can also be expected during in-situ remediation under reducing conditions.
- **Iron and Dissolved Iron**—Increases in iron can be expected when groundwater has been in contact with ZVI.
- **Volatile Fatty Acids (VFAs)**—VFAs are produced from the utilization of organic carbon by microbes during reductive dechlorination when bacteria ferment the injected carbon/electron donors. Increases in VFAs are associated with enhanced reductive dechlorination. VFAs are short-lived and are consumed relatively quickly to also support the reductive dechlorination process.
- **Sulfate and Nitrate**—Depletion of natural nitrate and/or sulfate indicates reducing conditions that are favorable for reductive dechlorination.
- **Chloride**—Chloride concentrations will increase when reductive dechlorination occurs. CVOc concentrations are generally low (less than 150 µg/L). therefore, observable changes in chloride concentrations from reductive dechlorination are not expected.
- **DO and Oxidation Reduction Potential**—Reductive dechlorination (i.e., electron donor addition) and abiotic transformation (i.e., ZVI) of CVOcs are optimal under low DO (less than 0.5 mg/L) and with oxidation reduction potential less than 200 mV. Due to the sensitive nature of the field instruments, these parameters were not considered during the data evaluation.
- **Alkalinity**—Alkalinity is a measure of the aquifers natural buffering capacity. Low alkalinity groundwater is susceptible to rapid pH changes, which can occur when VFAs are formed during

reductive dechlorination. The aquifer generally has adequate buffering capacity (i.e., greater than 100 mg/L); therefore, changes in pH are not expected during reductive dichlorination.

### 3.2 AOC-1 MONITORING RESULTS

In AOC-1, samples were collected at the following four locations: AMW-1A, AMW-2A, AMW-12A, and MW-1A. The four performance well locations are used to assess the effectiveness of the treatment for the AOC-1 that is impacted above the MCLs (Figure 3).

Overall, the results to date support that the in-situ injection program is reducing TCE concentrations (and breakdown products) through abiotic and biotic processes at AOC-1, with two of four wells (MW-1A and AMW-1A) achieving the MCL for TCE and daughter products.

As previously noted, the primary remediation process for AOC-1 is ISCR with the secondary process of enhanced reductive dechlorination. Due to site constraints, Row 14 had to be installed potentially upgradient of the TCE impacts above the MCL. If an ISCR treatment transect was installed at this upgradient location, it would treat relatively “clean” groundwater and would only flush the groundwater impacts downgradient of Row 14. Therefore, the decision was made to inject more soluble electron donors that would travel downgradient of the injection points with groundwater flow to affect the geochemistry in a larger area (i.e., toward AMW-12A) and reduce TCE in groundwater through reductive dechlorination versus ISCR.

Measured changes in geochemistry at the performance well are dependent on groundwater velocity and distance from the injection location. Therefore, measured changes may take additional time and sampling events to observe. Discussion of the performance monitoring is provided by well location below:

**MW-1A**—A 98 percent TCE decrease (from 15 to 0.41 µg/L) of TCE between October 2019 and February 2021, with the post-treatment TCE concentration below the MCL and near the detection limit. Due to the abiotic process to reduce TCE, no TCE breakdown products were expected or observed. Molar concentrations of total CVOCs have decreased approximately 97 percent from pre-injection sampling events confirming complete CVOC reductions. No secondary parameters were sampled through February 2021 at MW-1A.

**AMW-1A**—A 54 percent TCE decrease (from 21 to 4.8 µg/L) of TCE between October 2019 and February 2021, with the post-treatment TCE concentration below the MCL. *Cis*-DCE was observed in AMW-1A at concentrations below the MCL and near the DL in samples collected prior to injections but has increased from 0.13 to 12 µg/L between April 2020 and February 2021, indicating that reductive dechlorination is occurring to reduce TCE. Molar concentrations of total CVOCs have decreased by 2 percent from pre-injection, which confirms that reductive dechlorination is occurring; however, full dechlorination of TCE to benign end-products such as ethene has not occurred yet.

**AMW-12A**—A 45 percent TCE decrease (from 21 to 11 µg/L) between October 2019 and February 2021. Molar concentrations of CVOCs have decreased by 48 percent confirming that CVOCs are degrading to benign end products through either abiotic or biotic processes. The presence of ethene (1 µg/L) and ethane (0.6 µg/L) and the presence of methane at 10 µg/L are indications that biotic processes are contributing the reductions of TCE. Decreasing nitrate and sulfate concentrations from October 2020 to February 2021 also support enhanced reducing conditions being established in the upgradient area of AMW-12A.

**AMW-2A**—An 83 percent TCE decrease (from 12 to 5.7 µg/L) between October 2019 and February 2021. Molar concentrations of CVOCs have decreased by 84 percent confirming that CVOCs are degrading to benign end products through either abiotic or biotic processes. No secondary parameters were sampled through February 2021 at AMW-2A.

### 3.3 AOC-2 MONITORING RESULTS

In AOC-2, samples were collected at the following nine locations: MW-20D, MW-38, PZ-39, MW-19D, MW-18D, MW-18E, AMW-59, MW-14C, and MW-14E. The nine performance well locations are used to assess the effectiveness of the treatment for the AOC-2 that is impacted above the MCLs (Figure 4).

Overall, the results to-date support that the in-situ injection program is reducing TCE concentrations (and daughter products) primarily through biotic processes (i.e., enhanced reductive dechlorination) at AOC-2 with three of nine wells (MW-18E, MW-18D, and MW-14C) achieving the MCL for TCE and daughter products.

As previously noted, the primary remediation process for AOC-2 is enhanced reductive dechlorination with a secondary process of ISCR. Some of the Row 8 injection points were adjusted due to limitations from NE St. Johns Road, a major arterial roadway, to include injection locations as far upgradient of performance well MW-14E as possible (Figure 4). Also due to site limitations caused by NE 78<sup>th</sup> Street, PZ-39 is on the southern edge of the treatment zone established by Row 2, with areas immediately south of PZ-39 treated by Row 3, which is located further upgradient (Figure 4). Measured changes in geochemistry at the performance wells are dependent on groundwater velocity and distance from the injection location. Therefore, due to the distance of PZ-39 from treatment Rows 2 and 3, measured TCE reductions at performance well PZ-39 may take longer than other well locations.

Performance monitoring results are provided in Table 2. As injections in AOC-2 occurred in three different years, the AOC-2 performance monitoring wells have varying post-injection performance monitoring periods. MW-18D and MW-18E (Row 6) were first affected by injections performed in Phase I in October 2018; seven sampling events have now occurred post-injection. For MW-14C, MW-14E, MW-19D, and AMW-59, the first injections occurred in Phase IIA, conducted in September and October 2019; four sampling events have occurred after the injections took place. For PZ-39, MW-38, and MW-20D, the first injections occurred in Phase IIB, conducted in April and May 2020; as a result, only two sampling events have

occurred post-injections. A discussion of the performance monitoring from downgradient to upgradient position is provided by well location below.

**MW-20D**—A 59 percent TCE decrease in TCE concentrations (from 17 to 6.9 µg/L) between April 2020 and February 2021. Molar concentrations of total CVOCs have decreased approximately 60 percent from pre-injection sampling events confirming complete CVOC reductions to ethene/ethane. This is confirmed by no detections of *cis*-1,2-DCE or vinyl chloride. Detections of ethene and ethane (1 and 0.6 µg/L) and methane (2.8 µg/L) provide evidence that enhanced reductive dechlorination is partially responsible for the TCE reductions along with the abiotic ISCR processes.

**MW-38**—A 50 percent TCE decrease (from 28 to 14 µg/L) between October 2019 and February 2021. Molar concentrations of total CVOCs have also decreased approximately 50 percent from pre-injection sampling events confirming complete CVOC reductions to ethene/ethane. This is confirmed by no detections of *cis*-1,2-DCE or vinyl chloride in the post-treatment samples collected. Detections of ethene and ethane (1 and 0.6 µg/L) provide evidence that enhanced reductive dechlorination is partially responsible for the TCE reductions along with the abiotic ISCR processes.

Monitoring well MW-38 was administratively moved by EPA to Northern Plume monitoring in October 2020 after continued increases in TCE concentrations were recorded between 2017 and 2019. The Northern Plume is an offsite TCE plume that EPA has determined is not attributed to the Boomsnub/Airco Superfund Site (EA 2020). Prior to 2017, continual decreases in TCE concentrations in MW-38 had been observed since 2014. While the encroachment of the Northern Plume adds another source of TCE to this location, the Row 2 injections are having a beneficial effect on the TCE concentrations in this area.

**PZ-39**—No appreciable TCE change observed (from 33 to 36 µg/L) between October 2019 and February 2021. Molar concentrations of total CVOCs are similar from the pre-injection sampling event to the February 2021 injection event (increased 9 percent). No indications of increased abiotic or enhanced reduction dechlorination were observed from the secondary parameters. In the direction of groundwater flow, PZ-39 aligns with the southern edge of Row 2 and is 75 ft downgradient of Row 2. South of Row 2, treatment is provided by Rows 3 and 3B, which are located 290 and 350 ft upgradient of PZ-39, respectively. While the 120–200 ft/year range of sitewide groundwater velocities would imply that groundwater would have traveled the distance from Row 2 to PZ-39 between May 2020 and February 2021, difficult injection conditions encountered during the field implementation suggest that subsurface sediments are locally finer-grained than the typical alluvial aquifer sediments encountered across the site. Finer-grained material has a lower hydraulic conductivity, which would inherently lower groundwater velocity and lengthen travel times. PZ-39 will require additional monitoring events before a reduction in TCE concentration is observed due to potentially slower local groundwater velocities.

**MW-19D**—A 48 percent TCE decrease (from 15 to 7.7 µg/L) between October 2019 and February 2021. Molar concentrations of total CVOCs have decreased approximately 32 percent from pre-injection sampling events confirming partial CVOC reductions to ethene/ethane as some of the TCE has been partially converted to *cis*-1,2-DCE (1.7 µg/L) and *trans*-1,2-DCE (0.21 µg/L). Detected ethene and ethane concentrations (0.35 and 3.1 µg/L, respectively), and methane at 1,500 µg/L, TOC at 9.4 mg/L, and COD at 23 mg/L provide evidence of conditions that have stimulated reductive dechlorination. Detections of VFAs also provide evidence of enhanced reductive dechlorination near this performance well location. As expected with enhanced reductive dechlorination and ISCR, temporary mobilization of dissolved arsenic is possible due to changes in the groundwater geochemistry and was observed at MW-19D.

**MW-18D**—A 93 percent decrease (from 49 to 3.4 µg/L) between October 2018 and February 2021, with the post-treatment concentration below the MCL. Molar concentrations of total CVOCs have decreased approximately 83 percent from pre-injection sampling events confirming partial CVOC reductions to ethene/ethane as some of the TCE has been partially converted to *cis*-1,2-DCE (3.8 µg/L). It is expected that these daughter products (which are below the MCLs) will continue to degrade over time. Detected ethene and ethane concentrations (1 and 6.7 µg/L, respectively), methane at 18,000 µg/L, and COD at 13 mg/L provide evidence of conditions that have stimulated reductive dechlorination. Increased iron concentrations (2,710 µg/L) relative to general background conditions (less than 1,000 µg/L) were observed, which is the result of the ZVI in the injections.

**MW-18E**—A 99.8 percent decrease (from 150 to 0.22 µg/L) between October 2018 and February 2021, with concentrations in MW-18E near the detection limit and well below the MCL (0.22-1.8 µg/L) from April 2019 through February 2021. Molar concentrations of total CVOCs have decreased approximately 97 percent from pre-injection sampling events confirming almost complete CVOC reductions to ethene/ethane as some of the TCE has been partially converted to *cis*-1,2-DCE (0.74 µg/L), *trans*-1,2-DCE (0.47 µg/L), and vinyl chloride (1.5 µg/L). It is expected that these daughter products (which are below the MCLs) will continue to degrade over time. Detected ethene and ethane concentrations (4.3 and 5.3 µg/L, respectively), methane at 17,000 µg/L, and COD at 38 mg/L provide evidence of conditions that have stimulated reductive dechlorination. Increased iron concentrations (10,800 µg/L) relative to general background conditions (less than 1,000 µg/L) were observed, which is the result of the ZVI in the injections.

**AMW-59**—A 64 percent TCE decrease (from 45 to 16 µg/L) between October 2019 and February 2021 was observed. Molar concentrations of total CVOCs are similar to the pre-injection sampling event indicating CVOC reductions to ethene/ethane is not complete yet as some of the TCE has been partially converted to *cis*-1,2-DCE (18 µg/L), *trans*-1,2-DCE (0.70 µg/L), and vinyl chloride (5.7 µg/L). It is expected that these daughter products will continue to degrade over time. Detected ethene and ethane concentrations (2.0 and 1.8 µg/L, respectively), methane at 5,700 µg/L, and COD at 20 mg/L provide evidence of conditions that have stimulated reductive dechlorination. Increased iron concentrations (22,800 µg/L) relative to general background conditions (less than 1,000 µg/L) were observed, which is the result of the

ZVI in the injections. Based on these observations, continued TCE (and daughter products) degradation can be expected over time.

**MW-14C**—A 51 percent TCE decrease (from 5.9 to 2.9 µg/L) between October 2019 and February 2021 was observed, with TCE concentrations below the MCL beginning in January 2020. Molar concentrations of total CVOCs have decreased approximately 51 percent from pre-injection sampling events confirming complete CVOC reductions. Detected ethene and ethane concentrations (1 and 0.88 µg/L, respectively), methane at 670 µg/L, and COD at 20 mg/L provide evidence of conditions that have stimulated reductive dechlorination. Iron concentrations (262 µg/L) are within the general background conditions (less than 1,000 µg/L), which indicates that the ZVI has not affected the groundwater geochemistry near MW-14C to date. Given the sidegradient location of MW-14C relative to injection locations, the lower than background iron concentrations are due to limited distribution of ZVI from the injections versus the more soluble carbon donor in the injectate that traveled further perpendicular to groundwater flow. Iron concentrations are not expected to increase above background concentrations during future sampling events.

**MW-14E**—A 75 percent decrease (from 39 to 10 µg/L) between October 2019 and February 2021 was observed. Molar concentrations of total CVOCs have decreased approximately 75 percent from pre-injection sampling events confirming complete CVOC reductions. Detected ethene and ethane concentrations (1 and 0.86 µg/L, respectively), methane at 0.75 µg/L, and COD less than 10 mg/L provide limited evidence of conditions that will stimulate continued reductive dechlorination. Similarly, iron concentrations (553 µg/L) are within the general background conditions (less than 1,000 µg/L), which indicates that the ZVI has not affected the groundwater geochemistry near MW-14E to date. The location of MW-14E is generally the most upgradient location of the plume and NE St. Johns Road prevents upgradient injections to MW-14E. It is possible that dispersion will cause TOC and the corresponding ideal geochemical conditions to permeate toward MW-14E from the sidegradient injection locations over time. Additional performance monitoring and contingency remediation planning are recommended for this location.

## 4. CONCLUSIONS AND RECOMMENDATIONS

### 4.1 CONCLUSIONS

The results of the Phase II treatment show that the in-situ treatments have created conditions conducive to ISCR and/or enhanced reductive dechlorination of CVOCs at AOC-1 and AOC-2 as observed in the 13 performance monitoring wells. Reductions in TCE concentrations in 11 of 13 performance monitoring wells and TCE below the MCL in 5 of 13 performance wells were observed during the February 2021 sampling event. To date, the alternative in-situ treatment remedy approved in the 2015 ESD (EPA 2015) is reducing TCE concentrations.

Two areas (as measured by specific performance monitoring wells) that have not yet responded as favorably to the injections or have not created geochemical conditions for continued in-situ remediation include PZ-39 and MW-14E.

Performance well PZ-39 is located 75 ft from the closest injection transect (Row 2) in an area that may feature longer groundwater travel times due to subsurface conditions and does not yet have groundwater data to support enhanced TCE reduction. If the local groundwater velocity was half of the lowest value in the range given by the Record of Decision (EPA 2000), then it would be expected that within the next two sampling events treated groundwater from upgradient Row 2 would arrive at PZ-39 and TCE reductions would be observed. Given the hydraulic gradient of the Row 2 area and a typical effective porosity for silty sands, a travel time of 60 ft/year would equate to a hydraulic conductivity value typical of silty sediments ( $6.6 \times 10^{-3}$  cm/s), which aligns with feedback from the field team on subsurface conditions encountered. It is also possible that desired geochemical changes to PZ-39 will be from the Row 3 injections, located approximately two to three years' time-of-travel away from PZ-39. Additional monitoring is required to assess when the desired geochemical changes will arrive at PZ-39.

Performance well MW-14E is located in a generally upgradient position from the injection locations and the groundwater geochemistry at this well is not currently conducive to enhanced TCE degradation at this time. It is possible that dispersion from the sidegradient injection locations will transport injection amendments to this area of the plume over time to create the desired geochemical conditions.

### 4.2 RECOMMENDATIONS

Groundwater monitoring should continue to measure the effectiveness of the remediation. It is recommended that quarterly monitoring continues at performance monitoring locations for three more quarters except wells MW-18D and MW-18E. Both wells have shown TCE concentrations below the MCL for eight sampling events, and it has been over 1 year since the final injections in the vicinity of these wells took place (October 2019). It is also recommended that performance wells MW-18D and MW-18E be removed from the sampling program. Other performance monitoring wells are recommended to be sampled quarterly for three more quarters, transitioning to semi-annual sampling following the three quarterly events.

Analysis of performance monitoring data should continue to evaluate if future contingency injection events may be required (especially for PZ-39 and MW-14E) to treat the groundwater to MCLs within the next three years. If, after continued analysis of performance monitoring data, it is determined that COC concentrations in a well are either unlikely to continue decreasing further or that the amount of time it will take to reach the MCL is unacceptable, a work plan will be prepared for Phase III injections to address hot spots through additional treatments.

Further monitoring optimizations include elimination of the following parameters, which are generally redundant or not needed based on initial monitoring:

- **TOC**—Sampling should continue for DOC versus both TOC and DOC. TOC and DOC concentrations observed to date are similar.
- **VFAs**—VFA analysis is used to confirm biological activity from microbes. Analysis of methane, ethane, and ethene provides similar lines of evidence for increased biological activity and is a more direct evidence of TCE degradation.
- **Chloride**—Chloride is used to also measure full dechlorination of TCE. Given the low levels of TCE in the aquifer (less than 150 µg/L) when the remediation started, increases in chloride concentrations from CVOC degradation would be negligible and other parameters (ethene and ethane) and the reduction of TCE provide the evidence required to validate the remediation processes.
- **Alkalinity**—The aquifer has sufficient buffering capacity (approximately 100 mg/L) for pH adjustments associated the reductive dechlorination process of TCE concentration that are less than 150 µg/L. Therefore, alkalinity provides no data useful for remediation progress evaluations.

Other monitored natural attenuation analytes should be collected for the three additional quarters for the performance monitoring wells, then transitioning to an as-needed basis for treatment effectiveness analysis.

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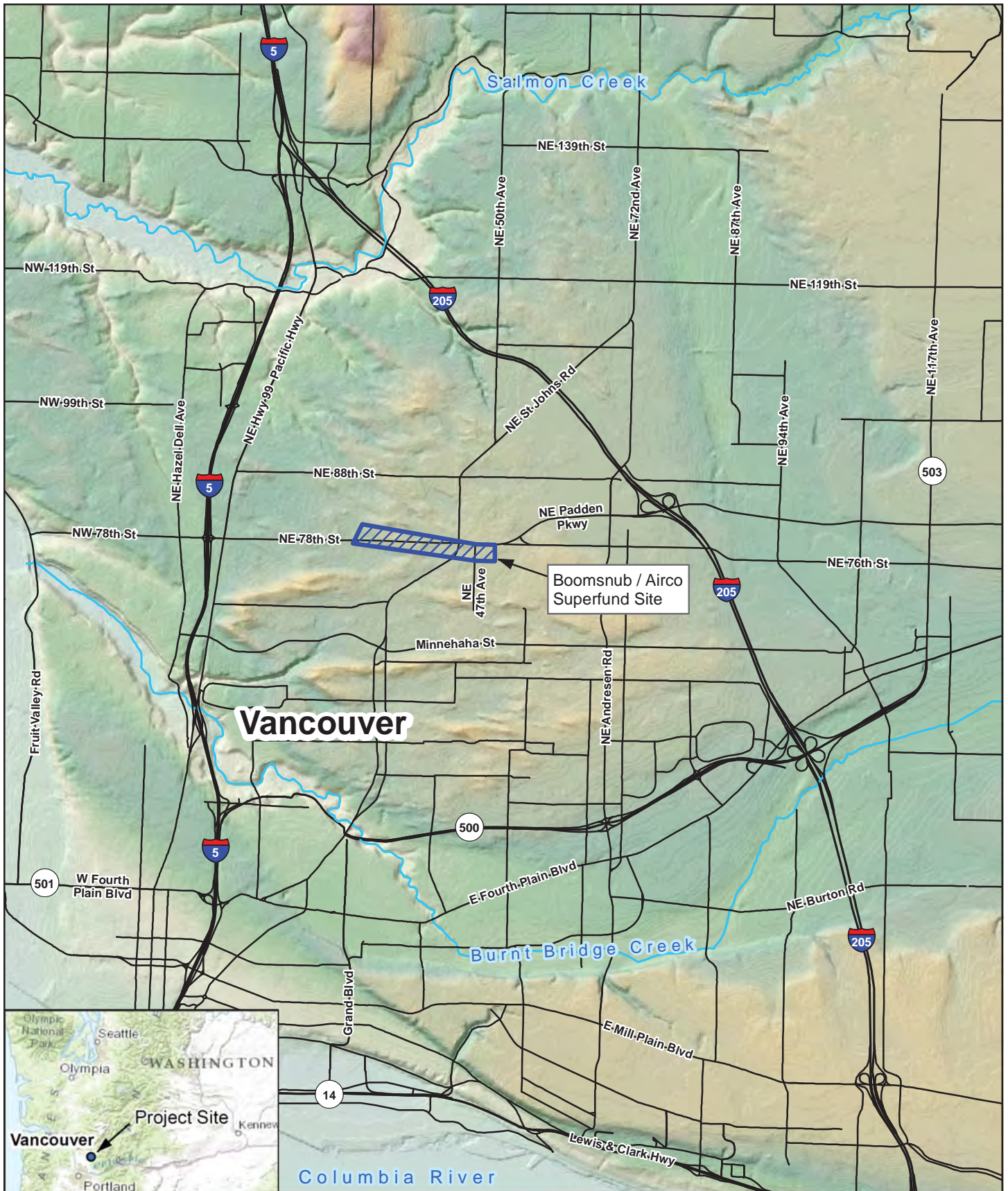
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# Figures

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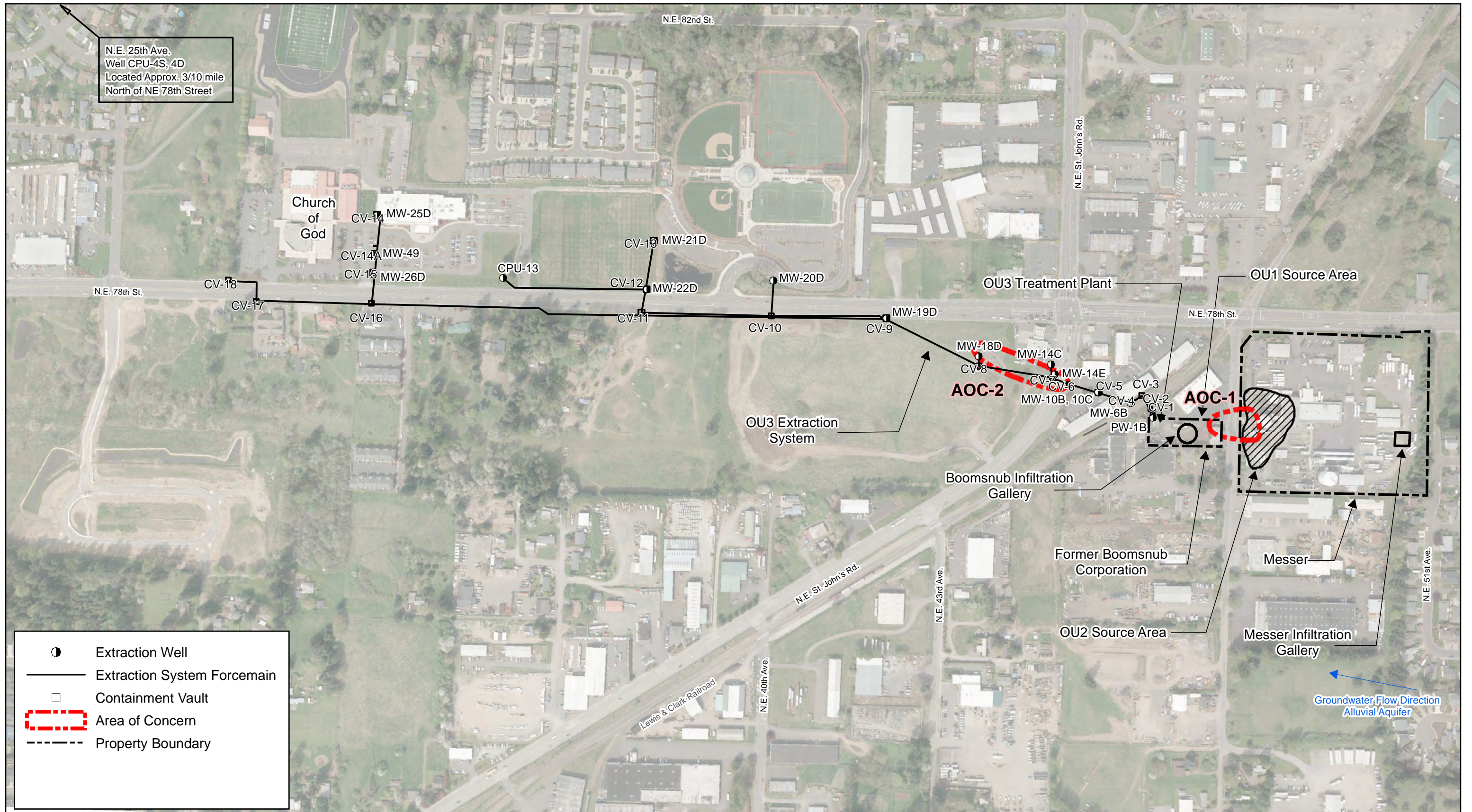



BOOMSNUB / AIRCO SUPERFUND SITE  
 HAZEL DELL, WASHINGTON

FIGURE 1  
 SITE LOCATION MAP

EA Project No. 1611303  
 File Name: Fig\_1\_Site\_Location

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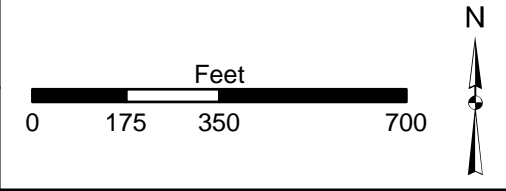


N.E. 25th Ave.  
Well CPU-4S, 4D  
Located Approx. 3/10 mile  
North of NE 78th Street

- Extraction Well
- Extraction System Forcemain
- Containment Vault
- Area of Concern
- Property Boundary

Groundwater Flow Direction  
Alluvial Aquifer

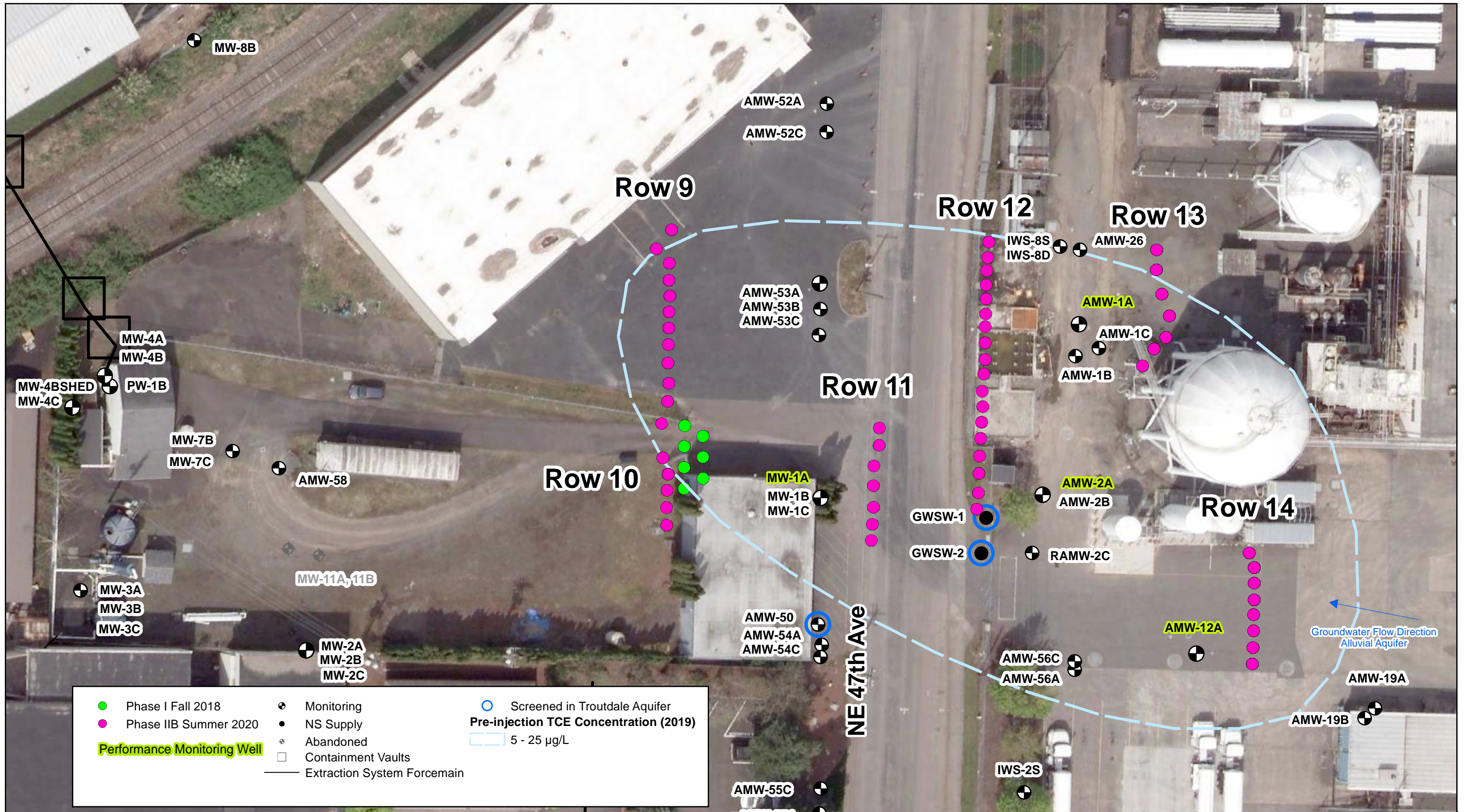
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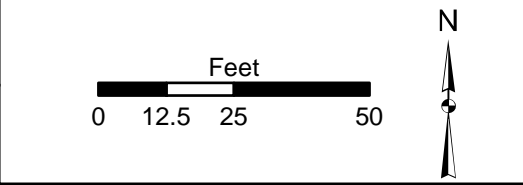
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**FIGURE 2  
OPERABLE UNITS, TREATMENT SYSTEM, AND  
AREAS OF CONCERN**



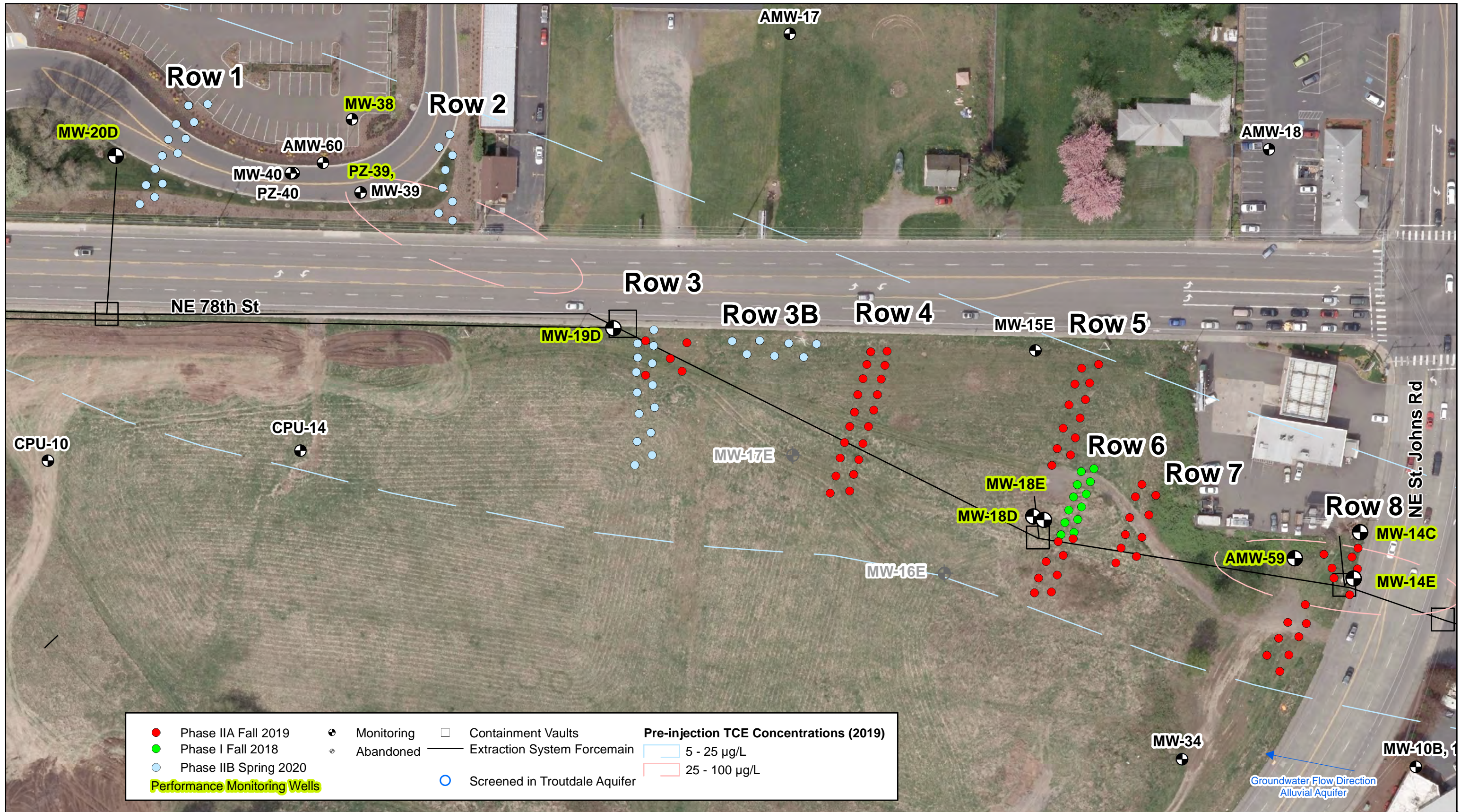
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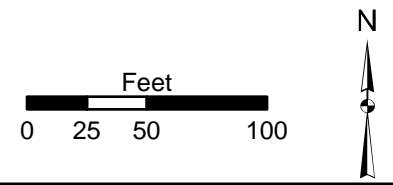
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EA Project No. 1524080  
 File Location: C:\Users\jreeve\Documents\ArcGIS\Boomsnub\In-Situ Report\Final Phase II Locations AOC-1.mxd  
 File Name: Final Phase II Locations AOC-1

FIGURE 3  
 INJECTION LOCATIONS - AOC-1, FULL SCALE IN-SITU TREATMENT



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EA Project No. 1524080  
 File Location: C:\Users\jreeve\Documents\ArcGIS\Boomsnub\In-Situ Report\Final Phase II Locations AOC-2.mxd  
 File Name: Final Phase II Locations AOC-2

FIGURE 4  
 INJECTION LOCATIONS - AOC-2,  
 FULL SCALE IN-SITU TREATMENT

# Tables

Table 1 AOC-2 Injections

Row	ID	Start Depth (ft)	End Depth (ft)	Actual Intervals	Product Used (lb)	Date Completed	Notes
<b>Phase IIB</b>							
1	1	76	90	8	512	5/8/2020	
1	2	76	90	8	512	5/8/2020	
1	3	76	90	8	512	5/12/2020	
1	4	76	90	8	512	5/12/2020	
1	5	76	90	8	512	5/12/2020	
1	6	76	90	8	512	5/13/2020	
1	7	76	90	8	512	5/19/2020	
1	8	76	90	8	512	5/12/2020	
1	10	76	90	1	32	5/20/2020	Surfacing
1	11	76	90	8	496	5/12/2020	Surfacing
1	12	76	90	8	512	5/19/2020	
1	13	76	90	8	512	5/12/2020	
1	14	76	90	5	320	5/13/2020	Surfacing at 82 ft
2	1	76	90	8	512	5/14/2020	
2	2	76	90	8	512	5/13/2020	
2	4	66	76	6	384	5/20/2020	
2	5	66	76	6	384	5/20/2020	
2	6	76	90	1	64	5/14/2020	High pressure and surfacing
2	7	66	80	7	448	5/20/2020	
2	8	62	75	8	656	5/18/2020	
2	10	66	80	7	656	5/18/2020	
3	1	76	90	8	512	4/30/2020	
3	2	76	90	8	512	5/6/2020	
3	3	76	90	8	496	5/5/2020	
3	4	76	90	8	496	5/4/2020	
3	5	76	90	8	512	4/30/2020	
3	6	76	90	8	512	4/29/1930	
3	7	76	90	8	512	5/6/2020	
3	8	76	90	8	512	5/4/2020	
3	9	76	90	8	512	4/30/2020	
3	10	76	90	8	512	4/30/2020	
3	11	76	90	8	512	4/29/1930	
3	12	76	90	8	512	5/4/2020	
3	13	76	90	8	512	5/5/2020	
3	14	76	90	8	512	4/29/1930	
3B	1	76	95	10	640	5/21/2020	
3B	2	76	94	10	640	5/22/2020	
3B	3	76	95	10	640	5/21/2020	
3B	4	78	94	9	576	5/21/2020	
3B	5	76	94	10	501	5/22/2020	Surfacing at 88 ft
3B	6	76	90	8	512	5/22/2020	
3B	7	76	90	8	512	5/22/2020	
			<b>Totals</b>	<b>322</b>	<b>20741</b>		
<b>Phase IIA Injections</b>							
3	1	76	90	8	496	10/15/2019	
3	2	76	90	8	496	10/14/2019	
3	3	78	90	7	434	10/15/2019	
3	4	76	90	8	496	10/15/2019	
3	5	76	90	8	558	10/15/2019	

**Table 1 AOC-2 Injections**

Row	ID	Start Depth (ft)	End Depth (ft)	Actual Intervals	Product Used (lb)	Date Completed	Notes
4	1	75	95	11	704	9/18/2019	
4	2	76	90	11	704	9/11/2019	
4	3	76	90	8	536	9/18/2019	
4	4	76	90	8	512	9/24/2019	
4	5	75	90	8	512	9/17/2019	
4	6	76	90	8	512	9/26/2019	
4	7	76	90	8	512	9/12/2019	
4	8	76	90	8	482	9/24/2019	
4	9	76	90	8	512	9/26/2019	
4	10	76	90	8	512	9/16/2019	
4	11	76	90	8	512	9/12/2019	
4	12	76	90	8	496	9/25/2019	
4	13	76	90	8	512	9/26/2026	
4	14	76	90	8	512	9/12/2019	
4	15	76	90	8	512	9/30/2019	
4	16	76	90	8	496	9/25/2019	
4	17	76	90	8	512	10/1/2019	
4	18	76	90	8	512	9/30/2019	
4	19	76	90	8	512	10/1/2019	
4	20	76	90	8	512	10/1/2019	
5	1	95	115	11	704	9/19/2019	
5	2	95	115	11	704	9/24/2019	
5	3	97	115	10	640	9/10/2019	
5	4	95	115	11	704	10/1/2019	
5	5	95	115	11	737	9/18/2019	
5	6	95	115	11	704	9/19/2019	
5	7	97	115	11	704	9/13/2019	
5	8	95	113	10	640	9/10/2019	
5	9	95	115	11	704	9/11/2019	
5	10	95	115	11	704	9/16/2019	
5	11	95	115	11	704	10/2/2019	
5	12	95	115	11	704	10/2/2019	
6	1	95	115	11	682	10/16/2019	
6	2	95	115	11	704	10/9/2019	
6	3	95	115	11	704	10/9/2019	
6	4	95	115	11	704	10/9/2019	
6	5	95	115	11	704	10/7/2019	
6	6	95	115	11	704	10/4/2019	
6	7	95	115	11	704	10/9/2019	
6	8	95	115	11	704	10/7/2019	
7	1	95	115	11	704	9/11/2019	
7	2	95	115	11	704	9/27/2019	
7	3	95	115	11	682	9/20/2019	
7	4	95	115	11	682	9/23/2019	
7	5	95	115	11	704	10/3/2019	
7	6	95	115	11	704	10/2/2019	
7	7	95	115	11	704	9/27/2019	
7	8	95	115	11	681	9/24/2019	
7	9	95	115	11	704	10/4/2019	
7	10	95	115	11	704	10/3/2019	

**Table 1 AOC-2 Injections**

Row	ID	Start Depth (ft)	End Depth (ft)	Actual Intervals	Product Used (lb)	Date Completed	Notes
8	1	128	140	6	372	10/17/2019	
8	2	70/125	80/135	12	600	10/16/2019	
8	3	120	140	11	682	10/17/2019	
8	4	120	140	11	682	10/18/2019	
8	5	120	140	11	682	10/18/2019	
8	6	110	126	9	450	10/17/2019	
8	7	95	115	11	682	10/19/2019	
8	8	110	126	9	450	10/17/2019	
8	9	95	115	11	704	10/11/2019	
8	10	95	115	11	704	10/18/2019	
8	11	95	115	11	704	10/10/2019	
8	12	95	115	11	704	10/11/2019	
8	13	95	115	11	682	10/18/2019	
8	14	95	115	11	704	10/10/2019	
8	15	95	115	11	704	10/10/2019	
			<b>Totals</b>	<b>690</b>	<b>43508</b>		
Notes: ID = Identification lb = Pound(s) ft = Foot (feet)							

Table 2 Phase II In-Situ Injection Performance Monitoring

Area	Performance Well Location	Upgradient Treatment Row #	Sample Date	Pre- or Post Injection Event	Primary Parameters		Field Parameters		Molar Concentration (µM)					Change from Baseline Event
					TCE (µg/L)	Cr (µg/L)	DO (mg/L)	ORP (mV)	TCE (µM)	Cis-DCE (µM)	Trans-DCE (µM)	Vinyl Chloride (µM)	Total	
in	MW-1A	11	Oct-19	Pre	15	--	--	--	0.11	--	--	--	0.115	
			Apr-20	Pre	4.8	--	--	--	0.04	--	--	--	0.037	
			Oct-20	Post	NS	--	NS	NS	NS	--	--	--	0.000	NS
			Feb-21	Post	0.41 J	--	50	301	0.00	--	--	--	0.003	-97%
	AMW-1A	13	Oct-19	Pre	21	--	--	--	0.16	0.002	--	--	0.163	
			Apr-20	Pre	9.2	--	--	--	0.07	0.001	--	--	0.072	
			Oct-20	Post	DRY	--	DRY	DRY	0.00	0.000	0.00	0.00	0.000	DRY
			Feb-21	Post	4.8	--	11.64	252.7	0.04	0.124	--	--	0.160	-2%
	AMW-2A	14	Oct-19	Pre	12 J	--	--	--	0.09	0.001	--	--	0.092	
			Apr-20	Pre	37	--	--	--	0.28	0.006	--	--	0.288	
			Oct-20	Post	DRY	--	DRY	DRY	0.00	0.000	0.00	0.00	0.000	DRY
			Feb-21	Post	5.7	--	9.18	233.4	0.04	0.002	--	--	0.046	-84%
AMW-12A	14	Oct-19	Pre	21	--	--	--	0.16	0.002	0.00	--	0.163		
		Apr-20	Pre	20	--	--	--	0.15	0.002	--	--	0.154		
		Oct-20	Post	12	8.4 U	8.34	120.7	0.09	0.002	--	--	0.093	-43%	
		Feb-21	Post	11	--	7.32	96.7	0.08	0.001	--	--	0.085	-48%	
AOC-2	MW-20D	1	Apr-20	Pre	17	--	4.93	110.3	0.13	0.002	--	--	0.132	
			Oct-20	Post	12	59.9	1.57	95.1	0.09	--	--	--	0.092	-31%
			Feb-21	Post	6.9	79.2	1.02	162.0	0.05	--	--	--	0.053	-60%
	MW-38	2	Oct-19	Pre	28	--	--	--	0.21	--	--	--	0.214	
			Oct-20	Post	12	4.7 J	0.96	150.6	0.09	--	--	--	0.092	-57%
			Feb-21	Post	14	--	1.30	191.3	0.11	--	--	--	0.107	-50%
	PZ-39	2	Oct-19	Pre	33	--	--	--	0.25	0.006	--	--	0.258	
			Oct-20	Post	42	3.2 J	1.26	107.2	0.32	0.006	--	--	0.326	27%
			Feb-21	Post	36	15.0	0.90	331.1	0.27	0.01	--	--	0.280	9%
	MW-19D	3	Oct-19	Pre	15	87.5	3.44	128.5	0.11	0.002	--	--	0.116	
			Jan-20	Pre	3.5	119	1.44	128.9	0.03	--	--	--	0.027	
			Apr-20	Pre	4.3	171	1.05	145.3	0.03	--	--	--	0.033	
Oct-20			Post	45	38.4	0.39	-173.7	0.34	0.036	0.01	--	0.391	237%	
MW-18D	6	Feb-21	Post	7.7	122	0.81	281.8	0.06	0.018	0.00	--	0.078	-32%	
		Oct-18	Pre	49	127	3.20	155.8	0.37	0.001	--	--	0.375		
		Apr-19	Post	2.2	65.6	--	--	0.02	--	--	--	0.017	-96%	
		Oct-19	Post	2.9	74.2	0.11	86.9	0.02	0.005	--	--	0.027	-93%	
MW-18E	6	Jan-20	Post	4.8	47.9	0.02	81.7	0.04	0.025	--	--	0.061	-84%	
		Apr-20	Post	3.0	89.8	0.65	93.4	0.02	0.012	--	--	0.035	-91%	
		Oct-20	Post	3.1	15.8	0.40	14.7	0.02	0.022	--	--	0.045	-88%	
		Feb-21	Post	3.4	25.7	0.83	25.8	0.03	0.039	--	--	0.065	-83%	
MW-18E	6	Oct-18	Pre	150	--	0.01	-162.1	1.15	0.320	0.01	0.01	1.482		
		Apr-19	Post	1.8	11.2	--	--	0.01	0.113	0.00	0.03	0.162	-89%	
		Oct-19	Post	0.70	69.2	0.13	-168.2	0.01	0.039	--	0.04	0.080	-95%	
		Apr-20	Post	0.25 J	8.4 U	0.42	-102.1	0.00	0.013	--	0.03	0.043	-97%	
AMW-59	8	Oct-20	Post	0.24 J	2.9 J	0.32	-127.8	0.00	0.005	0.00	0.02	0.026	-98%	
		Feb-21	Post	0.22 J	8.4 U	0.85	-127.8	0.00	0.008	0.00	0.02	0.038	-97%	
		Oct-19	Pre	45	--	--	--	0.34	0.043	0.01	0.00	0.396		
		Jan-20	Post	41	70.9	0.01	-97.8	0.31	0.070	0.00	0.00	0.392	-1%	
MW-14C	8	Apr-20	Post	14	100	0.46	41.8	0.11	0.124	0.00	0.01	0.243	-39%	
		Oct-20	Post	3.1	18.2	1.28	-114.5	0.02	0.237	0.00	0.03	0.295	-25%	
		Feb-21	Post	16	11.6	0.73	223.6	0.12	0.186	0.01	0.09	0.406	3%	
		Oct-19	Pre	5.9	48.1	7.45	164.1	0.05	--	--	--	0.045		
MW-14E	8	Jan-20	Post	3.9	62.9	3.31	14.14	0.03	--	--	--	0.030	-34%	
		Apr-20	Post	2.6	73.8	3.01	54.4	0.02	0.002	--	--	0.021	-52%	
		Oct-20	Post	2.4	10.2	1.33	70.7	0.02	--	--	--	0.018	-59%	
		Feb-21	Post	2.9	74.6	1.55	398.3	0.02	--	--	--	0.022	-51%	
MW-14E	8	Oct-19	Pre	39	27.5	5.80	136.8	0.30	0.021	0.00	--	0.321		
		Jan-20	Post	6.7	38.1	0.83	139.2	0.05	0.001	--	--	0.052	-84%	
		Apr-20	Post	9.6	54.4	0.8	55.3	0.07	0.002	--	--	0.075	-77%	
		Oct-20	Post	9.2	173	6.13	90.4	0.07	0.001	--	--	0.072	-78%	
Feb-21	Post	10	166	6.07	417.7	0.08	0.002	--	--	0.079	-75%			

Notes:  
 mg/L = Milligram(s) per liter  
 µg/L = Microgram(s) per liter  
 AOC = Area of concern  
 NA = Not applicable  
 NS = Not sampled due to field conditions

Table 2 Phase II In-Situ Injection Performance Monitoring

Area	Performance Well Location	Upgradient Treatment Row #	Sample Date	Pre- or Post Injection Event	Secondary Parameters																				
					Ethane (µg/L)	Ethylene (µg/L)	Methane (µg/L)	TOC (mg/L)	DOC (mg/L)	COD (mg/L)	As (µg/L)	Fe (µg/L)	Diss. Fe (µg/L)	Mg (µg/L)	Mn (µg/L)	Acetic Acid (mg/L)	Butyric Acid (mg/L)	DL-Lactic Acid (mg/L)	Propionic Acid (mg/L)	Pyruvic Acid (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Alkalinity (mg/L)	
in	MW-1A	11	Oct-19	Pre	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			Apr-20	Pre	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			Oct-20	Post	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			Feb-21		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	AMW-1A	13	Oct-19	Pre	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			Apr-20	Pre	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			Oct-20	Post	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			Feb-21		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	AMW-2A	14	Oct-19	Pre	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			Apr-20	Pre	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
			Oct-20	Post	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
			Feb-21		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AMW-12A	14	Oct-19	Pre	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		
		Apr-20	Pre	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		
		Oct-20	Post	0.60 U	1.0 U	1.3 U	0.79	1.18	65	21 U	--	416	6730	25.7	1.0 U	2.0 U	1.0 U	1.0 U	0.50 U	1.08	11.0	5.51	--		
		Feb-21		0.6	1	10	1.10	1.09	10 U	21 U	740	--	2240	32.7	1.0 U	2.0 U	1.0 U	1.0 U	0.50 U	0.26	2.97	3.98	--		
MW-20D	1	Apr-20	Pre	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		
		Oct-20	Post	0.60 U	1.0 U	1.3 U	0.21 J	0.55	4 J	--	--	25 J	--	1.0 U	2.0 U	1.0 U	1.0 U	0.50 U	1.61	17.3	4.42	--			
		Feb-21		0.6	1	2.8	0.96	1.37	10 U	21 U	953	26 J	15300	214	1.0 U	2.0 U	1.0 U	1.0 U	0.50 U	1.42	16.5	4.40	--		
MW-38	2	Oct-19	Pre	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		
		Oct-20	Post	--	--	--	--	--	--	--	21 U	342	--	13100	1.1 UJ	--	--	--	--	--	--	--	--	--	
		Feb-21		0.6	1	1.3	1.81	1.78	10 U	21 U	112	--	13300	3.1	1.0 U	2.0 U	1.0 U	1.0 U	0.50 U	1.90	31.7	5.56	--		
PZ-39	2	Oct-19	Pre	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		
		Oct-20	Post	0.60 U	0.36	0.73	0.56	0.71	10 U	--	--	14 J	--	1.0 U	2.0 U	1.0 U	1.0 U	0.50 U	1.50	18.1	4.44	--			
		Feb-21		0.6	0.29	1.2	--	--	--	5 J	1120	172	19400	84.1	--	--	--	--	--	--	--	--	--	--	
MW-19D	3	Oct-19	Pre	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		
		Jan-20		0.60 U	1.0 U	1.3 U	0.86	0.34 J	14	6 J	--	--	12200	2930	1.0 U	2.0 U	1.0 U	1.0 U	0.50 U	2.65	3.39	5.45	96		
		Apr-20	Post	0.60 U	1.0 U	1.3 U	1.08	0.86	10 U	--	--	--	--	--	--	--	--	--	--	2.84	12.5	5.42	123		
		Oct-20		4.0	2.2	1200	68.4	69.9	166	29	5510	3750	25300	3450	91	32	1.0 U	11	0.50 U	1.25	9.73	6.51	--		
MW-18D	6	Oct-19	Pre	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		
		Jan-20		1.1	0.30 J	20000	0.17 J	0.15 J	657	--	--	--	--	1.0 U	2.0 U	1.0 U	1.0 U	0.29 J	1.51	9.93	3.91	86			
		Apr-20	Post	5.5	1.2	21000	0.35 J	0.50 J	8 J	21 U	--	--	9770	368	1.0 U	2.0 U	5.4	1.0 U	0.50 U	0.98	11.4	4.19	88		
		Oct-20		3.4	0.33 J	11000	0.57	0.48 J	10 U	--	--	--	--	1.0 U	2.0 U	1.0 U	1.0 U	0.50 U	1.27	10.8	4.18	86			
MW-18E	6	Oct-20	Post	4.2	1.0 U	14000	0.43 J	0.47 J	55	21 U	--	849	9080	535	1.0 U	2.0 U	1.0 U	1.0 U	0.50 U	0.94	12.8	4.34	--		
		Feb-21		6.7	1	18000	0.87	1.26	13	21 U	2710	1390	9880	553	1.0 U	2.0 U	1.0 U	1.0 U	0.50 U	1.19	11.8	5.10	--		
		Oct-18	Pre	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		
		Apr-19		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		
MW-14C	8	Oct-19	Pre	1.3	1.2	19000	13.0	13.5	10 U	--	--	--	--	4.9	2.0 U	1.0 U	0.99 J	0.50 U	0.10 U	0.74	12.0	573			
		Jan-20		2.4	3.1	27000	5.81	4.75	212	--	--	--	--	--	--	--	--	--	0.10 U	0.48	12.4	477			
		Apr-20	Post	5.2	2.3	24000	2.95	1.78	134	21 U	--	9460	27300	1210	1.0 U	2.0 U	1.0 U	1.0 U	0.50 U	0.10 U	0.83	10.2	--		
		Oct-20		5.3	4.3	17000	2.18	1.54	38	21 U	10800	8270	21700	1080	1.0 U	2.0 U	1.0 U	1.0 U	0.50 U	0.10 U	1.86	9.42	--		
AMW-59	8	Oct-19	Pre	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		
		Jan-20	Post	0.96	1.0	290	479	435	1200	21 U	--	--	36600	2670	170	52	520	19	3.4	0.10 U	18.5	18.9	196		
		Apr-20		2.1	2.3	9500	677	668	4570	--	--	--	--	710	520	5.0 U	140	2.5 U	0.10 U	0.40 U	21.2	475			
		Oct-20	2.1	1.4	12000	15.5	10.6	101	21 U	40200	39000	32600	1900	3.4	2.0 U	1.0 U	1.0 U	0.50 U	0.10 U	2.27	18.0	--			
MW-14E	8	Feb-21	Post	1.8	2.0	5700	5.43	4.89	20	21 U	22800	20400	30800	1710	4.6	2.0 U	1.0 U	1.0 U	0.50 U	0.10 U	4.75	16.5	--		
		Oct-19		Pre	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		
		Jan-20	Post	0.60 U	1.0 U	1.0 J	0.12 J	0.21 J	10 U	21 U	--	--	10500	155	1.0 U	2.0 U	1.0 U	1.0 U	0.50 U	4.51	18.6	6.80	80		
		Apr-20		0.60 U	1.0 U	4.4	0.62	0.57	9 J	--	--	--	--	1.0 U	2.0 U	1.0 U	1.0 U	0.50 U	4.29	34.2	8.00	71			
MW-14E	8	Oct-20	Post	1.4	1.0 U	750	0.50 U	0.84	51	21 U	--	14 J	10100	305	1.0 U	2.0 U	1.0 U	1.0 U	0.50 U	4.34	19.0	7.01	--		
		Feb-21		0.88	1	670	1.07	1.07	10 U	21 U	262	22 J	10300	372	1.0 U	2.0 U	1.0 U	1.0 U	0.50 U	4.08	30.7	8.02	--		
		Oct-19	Pre	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		
		Jan-20	Post	0.60 U	1.0 U	0.57 J	0.44 J	0.93	10 U	21 U	--	--	14200	1030	1.0 U	2.0 U	1.0 U	1.0 U	0.50 U	1.61	13.0	4.07	141		
Apr-20	0.60 U	1.0 U		1.5	0.47 J	0.51	5 J	--	--	--	--	1.0 U	2.0 U	1.0 U	1.0 U	0.50 U	1.55	11.5	3.96	140					
MW-14E	8	Oct-20	Post	0.60 U	1.0 U	2.8	0.16 J	0.70	4 J	21 U	--	57	10900	353	1.0 U	2.0 U	1.0 U	1.0 U	0.50 U	2.50	31.1	5.33	--		
		Feb-21		0.6	1	0.75	0.59	0.93	10 U	21 U	553	22 J	10400	2500	1.0 U	2.0 U	1.0 U	1.0 U	0.50 U	2.56	31.7	5.71	--		

Notes:  
mg/L = Milligram(s) per liter  
µg/L = Microgram(s) per liter  
AOC = Area of concern  
NA = Not applicable  
NS = Not sampled due to field conditions

DOC = Dissolved Organic Carbon  
MNA = Monitored Natural Attenuation  
"--" = not measured

## **Appendix A**

# **Regenesis Application Summary Report**

September 11, 2020

**REGENESIS Proposal No. ChL60819**

Jonathan Reeve  
EA Engineering  
2200 6<sup>th</sup> Avenue, Suite 707  
Seattle, WA 98121

**SUBJECT: Application Summary Report for the Boomsnub Airco Superfund Site**

Dear Mr. Jonathan Reeve,

REGENESIS Remediation Services (RRS) has recently completed an in-situ injection application of PlumeStop<sup>®</sup> Liquid Activated Carbon<sup>®</sup> (PlumeStop), Sulfidated MicroZVI<sup>™</sup> (S-MicroZVI), 3-D Microemulsion<sup>®</sup> (3DME), Chemical Reducing Solution (CRS<sup>®</sup>), and Bio-Dechlor INOCULUM PLUS (BDI<sup>®</sup>) at the Boomsnub Airco Superfund Site. The subject site was located at 7608 NE 47<sup>th</sup> Avenue, Vancouver, WA 98661. The goal of the application was to treat dissolved-phase chlorinated solvents in the groundwater of the site. RRS employed in-situ sorption, in-situ chemical reduction, anaerobic bioremediation, and abiotic destruction technologies to meet remediation goals.

RRS mobilized an injection trailer, support truck with equipment and personnel to the site on July 7, 2020 to begin work over a seventeen (17) day on-site schedule. On-site operations began on July 7, 2020 and finished August 1, 2020 with a scheduled work break between July 19<sup>th</sup> through July 26<sup>th</sup>. RRS staffed this project with an experienced Project Supervisor who ensured a safe and successful injection application.

RRS applied remedial technologies PlumeStop, S-MicroZVI, 3DME, CRS, and BDI to 56 direct push technology (DPT) injection wells over the event duration. The target treatment zone for the contaminants is approximately 30 to 45 feet below ground surface (ft. bgs).

Please review the attached application summary page, injection log, and photo log for additional application details.

RRS appreciates the opportunity to work with EA Engineering on this project. RRS will be available to interpret the post application field data as it is collected or answer any questions regarding this application summary report. If you need additional information regarding the application process or attached field notes, please contact Andrea Maben at 949.899.0729 ([Amaben@regenesiS.com](mailto:Amaben@regenesiS.com)) or Andrew Punsoni at 503.504.1399 ([Apunsoni@regenesiS.com](mailto:Apunsoni@regenesiS.com))

Sincerely,



Andrea Maben  
West Region Project Manager  
REGENESIS Remediation Services



Andrew Punsoni  
Northwest District Technical Manager  
REGENESIS Remediation Solutions

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## Application Summary Page



### 1. Overview

**Client:** EA Engineering

**Project Name:** Boomsnub Airco Superfund Site

**Client Project Manager:** Jonathan Reeve

**Site Address:** 7608 NE 47<sup>th</sup> Avenue, Vancouver, WA 98661

**RRS Project Manager:** Andrea Maben

**RRS Project Supervisor:** Dominic Forlini

**Project Dates:** July 7, 2020 - August 1, 2020

### 2. Treatment Technology

RRS used the following products to remediate the treatment area: PlumeStop, S-MicroZVI, 3DME, CRS, and BDI. Application of these products are designed to sorb and degrade chlorinated volatile organic compounds through in situ chemical reduction, and to promote anaerobic bioremediation and abiotic destruction.

**PlumeStop** is an innovative groundwater remediation technology designed to rapidly remove and degrade groundwater contaminants. PlumeStop® is composed of very fine particles of activated carbon (1-2µm) suspended in water through the use of unique organic polymer dispersion chemistry. Once in the subsurface, the material behaves as a colloidal biomatrix, binding to the aquifer matrix, rapidly removing contaminants from groundwater, and promoting permanent contaminant biodegradation.

**S-MicroZVI** is a suspension of sulfidated, colloidal zero-valent iron (ZVI) that promotes the destruction of many organic pollutants, including chlorinated solvents, pesticides, haloalkanes and energetics. The passivation technique of sulfidation, completed through proprietary processing methods, provides unparalleled reactivity with chlorinated hydrocarbons like PCE and TCE, and increases its stability and longevity in situ by minimizing undesirable side-reactions. It is engineered to promote multiple pathways for contaminant degradation which leads to faster cleanup while minimizing daughter product formation. In addition, S-MicroZVI is easy to handle and simple to inject leading to significantly better reagent distribution.

**3DME** is an injectable liquid material specifically designed for in situ remediation projects where the anaerobic biodegradation of chlorinated compounds through the enhanced reductive dechlorination (ERD) process is possible. ERD is the primary anaerobic biological process by which problematic chlorinated solvents such as tetrachloroethylene (PCE) and trichloroethene (TCE), dichloroethene (DCE) and vinyl chloride (VC) in groundwater are biologically transformed into less harmful end products such as ethene.

**CRS** is an iron-based reagent that facilitates biogeochemical *in situ* chemical reduction (ISCR) of halogenated contaminants such as chlorinated ethenes and ethanes. CRS is a pH neutral, liquid iron solution that is easily mixed with 3DME before injection into a contaminated aquifer.

**BDI Plus** is designed for use at sites where chlorinated contaminants are present and unable to be completely biodegraded via the existing microbial communities. BDI Plus is an enriched, natural microbial consortium containing species of *Dehalococcoides* sp. (DHC) which are capable of completely dechlorinating contaminants during *in situ* anaerobic bioremediation processes. BDI Plus has been shown to stimulate the rapid dechlorination of chlorinated compounds such as tetrachloroethene (PCE), trichloroethene (TCE), dichloroethene (DCE), and vinyl chloride (VC). It also contains microbes capable of dehalogenating halomethanes (e.g. carbon tetrachloride and chloroform) and haloethanes (e.g. 1,1,1 TCA and 1,1, DCA) as well as mixtures of these halogenated contaminants.

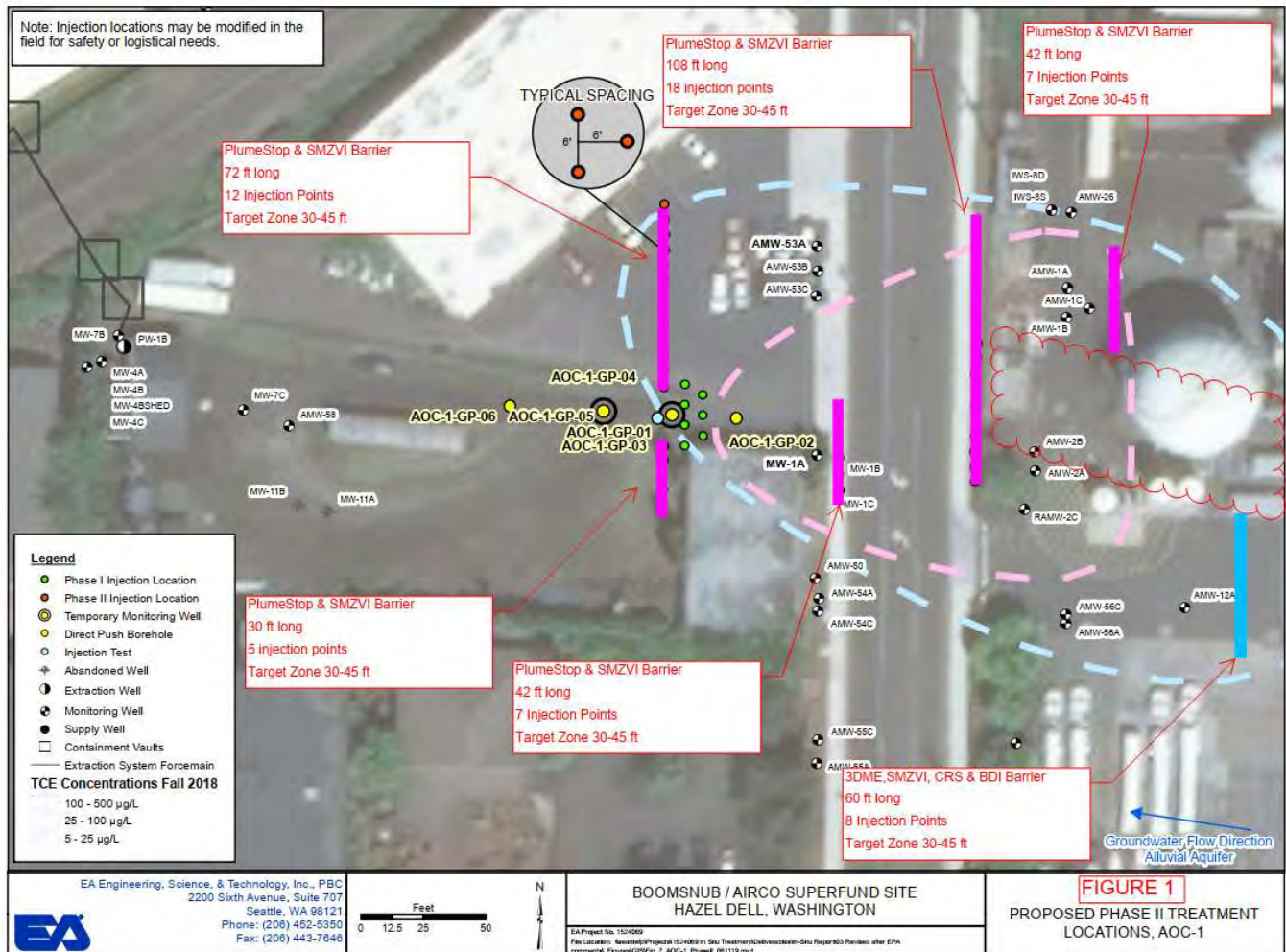
### 3. Design

The full-scale barrier is positioned in four segments due to utilities and infrastructure. The largest continual segment is the furthest downgradient on the west side of NE 47<sup>th</sup> Ave. An additional smaller segment is located in the sidewalk on the west side of NE 47<sup>th</sup> within the highest flow path. Upgradient on the east side of NE 46<sup>th</sup> Ave two additional barriers are located closest to the source area and discontinuous due to utilities and infrastructure. See **Figure 1** on the following page for details.

Considering the site conditions, contaminants and the remediation objectives, we believe that the combined technologies of In-Situ Chemical Reduction (ISCR) using S-Micro ZVI and sorption using PlumeStop Liquid Activated Carbon applied within the targeted treatment zone, is the best approach to achieve remediation goals. The combination of these technologies will provide a cost effective and long-lasting remedial solution. PlumeStop will sorb the contaminants migrating through the treatment zone, essentially sequestering the contaminants and rapidly remediating the passing groundwater. S-MicroZVI will remediate the contaminants using ISCR destructive pathways in addition to naturally contaminant degradation of cVOCs. The destruction of contaminants via ISCR and natural degradation within the treatment zone will have a regenerative effect on the PlumeStop increasing its longevity. The PlumeStop and S-Micro ZVI treatment is designed to rapidly clean up the proposed treatment area. Within a matter of months (depending on the locations of the downgradient performance wells relative to the barrier placement); monitoring wells should begin to see a decline in cVOC concentrations. The proposed PlumeStop and S-MicroZVI treatment has an estimated longevity of 10 years with no scheduled maintenance. A fifth barrier segment using 3DME, S-MicroZVI, CRS and BDI will be used to treat a limited access portion of the treatment area using an anaerobic bioremediation and abiotic destruction. These products injected at the fifth barrier location are more mobile than PlumeStop and are more suitable to treat contaminants down gradient of the injection points. Furthermore, these products are appropriate because there appears to be little to no source material upgradient of the proposed fifth barrier location.

Four (4) barrier segments totaling 294 feet-long will be installed utilizing PlumeStop and S-MicroZVI. A fifth barrier segment totaling 60 feet-long will be installed utilizing 3DME, S-MicroZVI, CRS, and BDI. The vertical treatment interval is 30 to 45 feet below ground surface for each of the planned barriers. Injection points will be installed with direct push injection tooling with retractable screens injecting from bottom to top of the injection interval. A total of forty-nine (49) PlumeStop injection points will be advanced to inject the total remediation solution volume of 33,074 gallons and a total of eight (8) 3-D Microemulsion injection points will be advanced to inject a

total remediation solution of 5,400 gallons. Further design parameters are provided in **Table 1** and **Table 2** on the design output sheets.



**Figure 1: Proposed PlumeStop and S-MicroZVI application area design**

**Table 1: PlumeStop Application Design Summary**

<b>PlumeStop<sup>®</sup> Application Design Summary</b>		
<i>Treatment Unit</i>		
<b>PlumeStop + S-MZVI</b>		<b>Technical Notes</b>
<b>Treatment Type</b>	<b>Barrier</b>	
Distance Perpendicular to Flow (ft)	294	<u>Injection Radius for Soil Coverage (ft-est.avg.)</u>
Spacing Within Rows (ft)	6	<b>5.2</b>
Number of Rows	1	
<b>DPT Injection Points</b>	<b>49</b>	<u>PlumeStop Injection Concentration (mg/L)</u>
Top Application Depth (ft bgs)	30	<b>7,952</b>
Bottom Application Depth (ft bgs)	45	
<b>PlumeStop to be Applied (lbs)</b>	<b>30,000</b>	<u>S-MicroZVI Concentration (mg/L)</u>
PlumeStop to be Applied (gals)	3,542	<b>3,082</b>
<b>In Situ Chemical Reduction - S-MZVI</b>		
<b>S-MZVI to be added to PlumeStop (lbs)</b>	<b>7,000</b>	<u>Gallons Per Foot</u>
S-MZVI to be added to PlumeStop (gals)	464	<b>45.00</b>
<b>PlumeStop + S-MZVI Volume Totals</b>		
Mixing Water (gal)	29,008	<b>Special Instructions:</b>
<b>Total Application Volume (gals)</b>	<b>33,074</b>	
Injection Volume per Point (gals)	675	

**Table 2: 3DME Application Design Summary**

<b>3-D Microemulsion<sup>®</sup>, S-MZVI<sup>®</sup>, CRS<sup>®</sup>, BDI<sup>®</sup> Plus Application Design Summary</b>		
<b>Dissolved Plume</b>		
<b>Treatment Type</b>	<b>Barrier</b>	
Distance Perpendicular to Flow (ft)	60	<b>Input special application instructions here as needed.</b>
Spacing Within Rows (ft)	8	
Number of Rows	1	
DPT Injection Points	8	
Top Application Depth (ft bgs)	30	<b>Field Mixing Ratios</b>
Bottom Application Depth (ft bgs)	45	3DME Concentrate per Pt (gals)
<b>3DME to be Applied (lbs)</b>	<b>2,000</b>	30
3DME to be Applied (gals)	240	Mix Water per Pt (gals)
3DME Mix %	5%	621
<b>Volume Water (gals)</b>	<b>4,965</b>	3DME Mix Volume per Pt (gals)
3DME Mix Volume (gals)	5,204	651
<b>S-MZVI to be Applied (lbs)</b>	<b>1,500</b>	S-MZVI Volume per Pt (gals)
S-MZVI Volume (gals)	99	12
<b>BDI Plus to be Applied (L)</b>	<b>18</b>	BDI Volume per Pt (L)
BDI Plus Mix Water Volume (gals)		2.3
<b>CRS to be Applied (lbs)</b>	<b>800</b>	CRS per Pt (lbs)
CRS Volume (gals)	91	100
<b>Total Application Volume (gals)</b>	<b>5,400</b>	Volume per pt (gals)
Estimated Radius of Injection (ft)	5.2	675
Prepared by: Chris Lee-Design Services		Volume per vertical ft (gals)
Date: 10/17/2019		45.00

## 4. Application

### A. Job Site Inspection

RRS and our drilling contractor along with the EA Engineering field staff arrived on-site on July 7, 2020. A health and safety tailgate meeting was performed with all on-site field staff present and the site specific health and safety plan (HASP) was reviewed. RRS performed site reconnaissance, becoming familiar with the project site, storage area, water source and completed a jobsite safety inspection. Notable site hazards included: Utility clearance, vehicle and pedestrian traffic through exclusion zones, proximity of well locations to storm drains, slip/trip hazards including injection hosing and injection system pressure buildup. Once completed, the injection trailer was staged and prepared for product transfer and mixing.

### B. Product Delivery

EA Engineering personnel accepted the deliveries of RegenesiS products prior to the start of on-site injection operations.

All shipments were offloaded from the delivery trucks via a forklift and securely stored on-site. All product totes and drums were shuttled to work areas via a forklift and accessible to RRS personnel and injection trailer.

#### **Product Delivery Schedule:**

##### **June 29, 2020:**

- 24,000 lb. (12 tote) PlumeStop
- 6,000 lb. (3 tote) PlumeStop-S
- 8,500 lb. (4 tote; 1 drum) S-MicroZVI
- 2000 lb. (1 tote) 3DME
- 800 lb. (2 drum) CRS

##### **July 8, 2020:**

- 18 L. (1 keg - 1.0x) BDI

### C. Injection Sequence

RRS applied the REGENESIS technologies by mixing the products in the RRS injection trailer and injecting through 1.5-inch diameter DPT injection tool string fitted with an injection cap that securely receives 3/4-inch pressure rated injection hosing. The injection trailer is fully enclosed and contains mixing tanks, pumps and delivery system equipped for direct connection to the injection wells. The application pump is a multiple diaphragm positive displacement pump designed to prevent pulsation of the remediation chemistry while being applied. The application pump can deliver the remediation chemistry at up to 250 pounds per square inch (psi) at up to 20 gallons per minute (gpm) to overcome potential hydraulic limitations. Safety bypass mechanisms are also installed to release back pressure buildup in the event injection pressures exceed commonly accepted application ranges. We delivered the remediation chemistry at up to four (4) separate delivery lines simultaneously, each having the capability of monitoring injection pressures and injection flowrates/totals at any given time. Each delivery line can

reach beyond the injection trailer of at least 100 linear feet, limiting the need to move the injection trailer from point to point or in this case limiting the need to move the trailer several times each day. Additional line extensions were utilized when necessary to increase the trailer range without being moved.

The remedial solutions were prepared in two (2) 350-gallon conical tanks that are configured with chemically resistant materials. Mixing water was provided by a property owned water source and fitted for a 1.5-inch MNHT output as a direct source to the RRS injection trailer. Once water was filled to the appropriate volume per the design concentration, each product was transferred from their respective container via an air-driven diaphragm pump. Product containers were measured and marked to track volumetric batch amount to ensure accurate product dosing.

#### D. Deviations from Design

Several injection locations were off set from their original marked location due to underground utility clearance. Volume was redistributed to adjacent injection locations during product surfacing events to keep product in the subsurface. Location R12-9 was omitted after several air-knife pre-clear attempts found a building foundation pad at ~5 ft. bgs; volume was redistributed to R12-8 and R12-10 to best match the original design. An injection location site map (**Figure 2**) and injection field logs (**Table 3**) detail these changes.

### 5. On-Site Work Summary

Injections were performed in a single mobilization event from July 7, 2020 to August 1, 2020. Each workday began with a safety tailgate meeting where safety topics were discussed including but not limited to stop work authority, personal protective equipment (PPE), chemical handling, inclement weather, near misses and the plan for the day's tasks.

#### A. Treatment Area: R9

A total of 7,965 gallons was injected into twelve (12) locations at treatment barrier R9. 5,738 lbs. of PlumeStop, 1,434 lbs. of PlumeStop-S and 1,674 lbs. of S-MicroZVI was distributed across the target treatment zone. The injection interval ranged between 30-45 ft bgs. Flow rates were observed between 0.0 to 6.5 gallons per minute (GPM) and averaged 3.3 GPM. Injection pressures were observed between 5 to 175 pounds per square inch (PSI) and averaged 45 PSI.

Locations for each injection well are shown in **Figure 2** and detailed injection data for each location can be found in **Appendix A**, Table 4.

#### B. Treatment Area: R10

A total of 3,370 gallons was injected into five (5) locations at treatment barrier R10. 2,426 lbs. of PlumeStop, 607 lbs. of PlumeStop-S and 707 lbs. of S-MicroZVI was distributed across the target treatment zone. The injection interval ranged between 30-45 ft bgs. Flow rates were observed between 0.8 to 6.2 GPM and averaged 2.8 GPM. Injection pressures were observed between 25 to 175 PSI and averaged 130 PSI.

Locations for each injection well are shown in **Figure 2** and detailed injection data for each location can be found in **Appendix A**, Table 5.

### C. Treatment Area: R11

A total of 4,985 gallons was injected into seven (7) locations at treatment barrier R11. 3,589 lbs. of PlumeStop, 897 lbs. of PlumeStop-S and 1,047 lbs. of S-MicroZVI was distributed across the target treatment zone. The injection interval ranged between 30-45 ft bgs. Flow rates were observed between 0.0 to 5.3GPM and averaged 3.3 GPM. Injection pressures were observed between 18 to 190 PSI and averaged 65 PSI.

Locations for each injection well are shown in **Figure 2** and detailed injection data for each location can be found in **Appendix A**, Table 6.

### D. Treatment Area: R12

A total of 12,240 gallons was injected into seventeen (17\*) locations at treatment barrier R12. 8,820 lbs. of PlumeStop, 2,205 lbs. of PlumeStop-S and 2,572 lbs. of S-MicroZVI was distributed across the target treatment zone. The injection interval ranged from 30-45 ft bgs. Flow rates were observed between 2.2 to 5.5 GPM and averaged 3.9 GPM. Injection pressures were observed between 5 to 160 PSI and averaged 50 PSI.

Locations for each injection well are shown in **Figure 2** and detailed injection data for each location can be found in **Appendix A**, Table 7.

### E. Treatment Area: R13

A total of 4,760 gallons was injected into seven (7) locations at treatment barrier R13. 3,427 lbs. of PlumeStop, 857 lbs. of PlumeStop-S and 1,000 lbs. of S-MicroZVI was distributed across the target treatment zone. The injection interval ranged from 30-45 ft bgs. Flow rates were observed between 2.5 to 5.0 GPM and averaged 3.6 GPM. Injection pressures were observed between 15 to 110 PSI and averaged 40 PSI.

Locations for each injection well are shown in **Figure 2** and detailed injection data for each location can be found in **Appendix A**, Table 8.

### F. Treatment Area: R14

A total of 5,400 gallons was injected into eight (8) locations at treatment barrier R14. 2,000 lbs. of 3DME, 800 lbs. of CRS, 1,500 lbs. of S-MicroZVI and 18 L. of BDI was distributed across the target treatment zone. The injection interval ranged from 30-45 ft bgs. Flow rates were observed between 2.9 to 5.8 GPM and averaged 3.9 GPM. Injection pressures were observed between 20 to 90 PSI and averaged 45 PSI.

Locations for each injection well are shown in **Figure 2** and detailed injection data for each location can be found in **Appendix A**, Table 9.

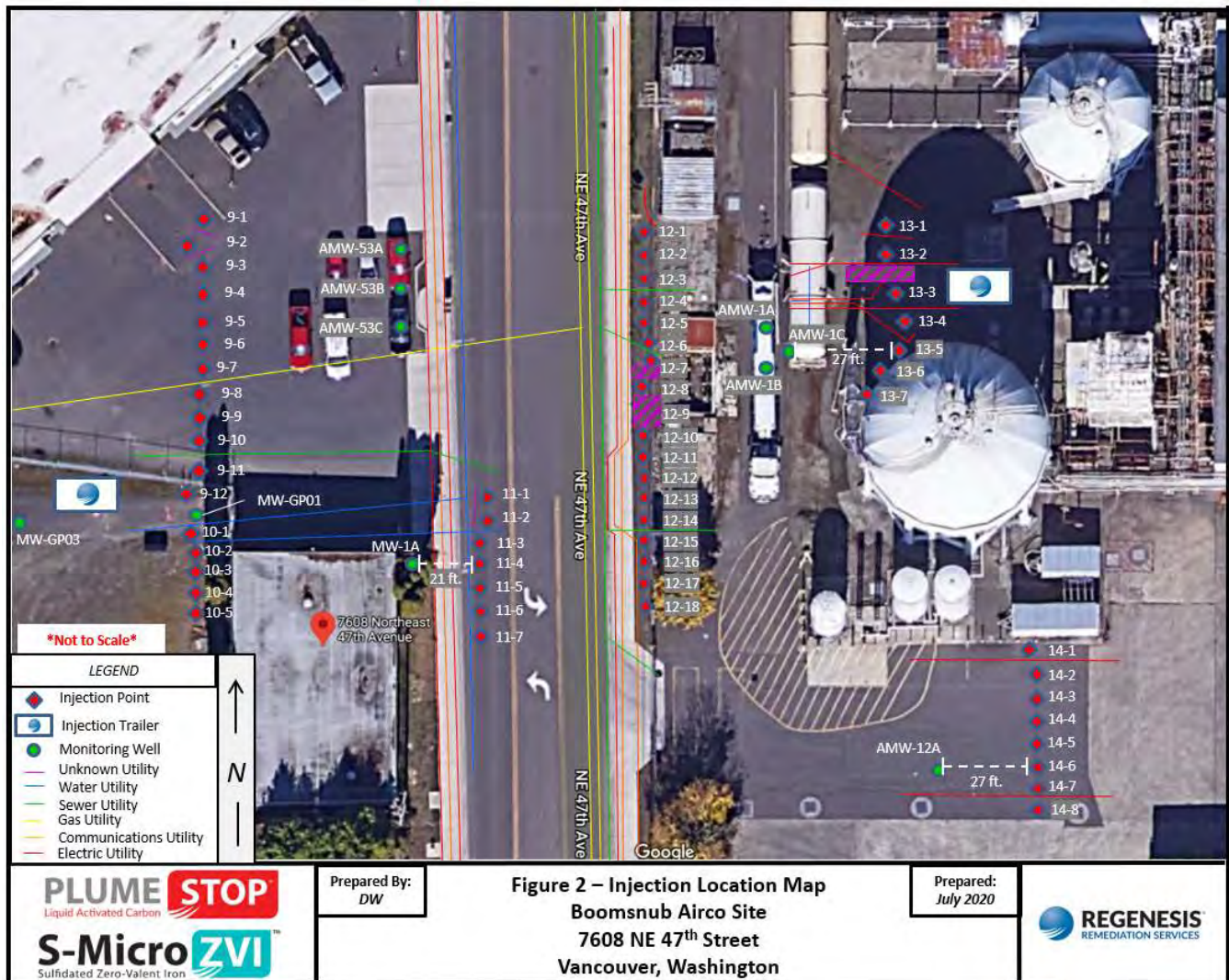


Figure 2: Site Map with Injection Well Locations

## 6. Conclusion

A total of 24,000 lbs. of PlumeStop, 6,000 lbs. of PlumeStop-S, 8,500 lbs. of S-MicroZVI, 2,000 lbs. of 3DME, 800 lbs. of CRS and 18 L. of BDI was mixed and applied to the subject site (Table 3). 33,320 gallons of PlumeStop / S- MicroZVI solution was applied over Row 9 through Row 13. PlumeStop was applied at 12% vol/wt.; S-MicroZVI was applied at 3% vol/wt. 5,400 gallons of 3DME / CRS solution was applied at Row 14 and augmented with 18 L. of BDI intermittently during injection intervals. 3DME was applied at 5% vol/wt.; CRS was applied at 2% vol/wt.

**Table 3: Product Application Balance**

<u>Injection Row</u>	<u>IP</u>	<u>Volume (gal.)</u>	<u>PlumeStop (lb.)</u>	<u>PlumeStop-S (lb.)</u>	<u>S-MicroZVI (lb.)</u>	<u>3DME (lb.)</u>	<u>CRS (lb.)</u>	<u>BDI (L.)</u>	<u>Volume / IP (gal.)</u>
Row 9	12	7965	5738	1434	1674	0	0	0	664
Row 10	5	3370	2426	607	707	0	0	0	674
Row 11	7	4985	3589	897	1047	0	0	0	712
Row 12	17*	12240	8820	2205	2572	0	0	0	720
Row 13	7	4760	3427	857	1000	0	0	0	680
Row 14	8	5400	0	0	1500	2000	800	18	675
<b>Total</b>	<b>56</b>	<b>38720</b>	<b>24000</b>	<b>6000</b>	<b>8500</b>	<b>2000</b>	<b>800</b>	<b>18</b>	<b>691</b>
Proposed	57	38474	24000	6000	8500	2000	800	18	675
(+ / -) %	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000

\* R12-9 location omitted per utility clearance.

# Appendix A: Injection Log

EA Engineering - Boomsnub Airco Superfund Site

Injection Summary Log

Barrier R9

Table 4



Injection Point	Date	Time	Injection Depth (ft. bgs)	Injection Pressure (psi)	Flow Rate (gpm)	Volume of PlumeStop/SMZVI Injected			Gallons Per Location	PlumeStop Per Location (lb.)	PlumeStop-S Per Location (lb.)	S-MicroZVI Per Location (lb.)	Comments	Injection Tooling
						Beginning Flow Meter (gal.)	Ending Flow Meter (gal.)	Gallons Per Interval						
R9-1	7/11/2020	9:04	45-42	105	4.5	0.0	150.0	150.0	750	541	135	158		3-Foot Screen
	7/11/2020	9:52	42-39	15	4.1	150.0	300.0	150.0						
	7/11/2020	10:45	39-36	5	3.3	300.0	450.0	150.0						
	7/11/2020	12:11	36-33	25	3.3	450.0	600.0	150.0						
	7/11/2020	13:26	33-30	25	3.3	600.0	750.0	150.0						
R9-2	7/10/2020	11:11	45-42	125	4.0	0.0	145.0	145.0	715	515	129	150		Expendable Tip
	7/10/2020	11:53	42-39	35	3.1	145.0	290.0	145.0						
	7/10/2020	12:55	39-36	40	4.2	290.0	435.0	145.0						
	7/10/2020	13:52	36-33	30	3.7	435.0	580.0	145.0						
	7/10/2020	14:34	33-30	25	3.4	580.0	715.0	135.0						
R9-3	7/13/2020	9:05	45-42	100	3.9	0.0	145.0	145.0	680	490	123	143		3-Foot Screen
	7/13/2020	10:13	42-39	90	3.3	145.0	290.0	145.0						
	7/13/2020	11:47	39-36	25	3.3	290.0	435.0	145.0						
	7/13/2020	12:45	36-33	23	3.0	435.0	580.0	145.0						
	7/13/2020	14:30	33-30	12	2.1	580.0	680.0	100.0						
R9-4	7/11/2020	9:04	45-42	110	3.2	0.0	150.0	150.0	760	548	137	160		3-Foot Screen
	7/11/2020	9:52	42-39	65	4.5	150.0	300.0	150.0						
	7/11/2020	10:45	39-36	23	3.7	300.0	450.0	150.0						
	7/11/2020	12:12	36-33	23	3.7	450.0	600.0	150.0						
	7/11/2020	13:26	33-30	23	3.8	600.0	760.0	160.0						
R9-5	7/10/2020	11:11	45-42	60	3.8	0.0	145.0	145.0	715	515	129	150		Expendable Tip
	7/10/2020	11:53	42-39	42	3.7	145.0	290.0	145.0						
	7/10/2020	12:56	39-36	8	3.2	290.0	435.0	145.0						
	7/10/2020	13:52	36-33	15	4.2	435.0	580.0	145.0						
	7/10/2020	14:34	33-30	25	3.6	580.0	715.0	135.0						
R9-6	7/13/2020	9:09	45-42	95	3.6	0.0	145.0	145.0	450	324	81	95	Surfacing from R9-7 - reduce gpm - next interval. Surfacing from R9-7 - reduce gpm - next interval. Surfacing from R9-7 - reduce gpm - next interval.	3-Foot Screen
	7/13/2020	10:13	42-39	50	3.6	145.0	290.0	145.0						
	7/13/2020	11:47	39-36	35	3.8	290.0	350.0	60.0						
	7/13/2020	12:45	36-33	15	0.8	350.0	400.0	50.0						
	7/13/2020	14:30	33-30	5	0.5	400.0	450.0	50.0						
R9-7	7/11/2020	9:09	45-43	130	1.6	0.0	100.0	100.0	725	523	131	152	Surfacing from rod annulus - stopped.	Pressure Activated Probe
	7/11/2020	9:45	43-41	55	3.8	100.0	200.0	100.0						
	7/11/2020	10:45	41-39	32	3.7	200.0	300.0	100.0						
	7/11/2020	12:12	39-37	30	4.4	300.0	400.0	100.0						
	7/11/2020	13:26	37-35	25	4.0	400.0	500.0	100.0						
	7/11/2020	13:58	35-33	25	4.1	500.0	600.0	100.0						
	7/11/2020	14:20	33-30	25	3.6	600.0	725.0	125.0						
R9-8	7/10/2020	11:10	45-42	45	4.4	0.0	145.0	145.0	715	515	129	150		Expendable Tip
	7/10/2020	11:53	42-39	40	4.1	145.0	290.0	145.0						
	7/10/2020	12:56	39-36	8	2.9	290.0	435.0	145.0						
	7/10/2020	13:53	36-33	28	3.0	435.0	580.0	145.0						
	7/10/2020	14:34	33-30	22	2.6	580.0	715.0	135.0						
R9-9	7/13/2020	9:11	45-42	35	3.8	0.0	145.0	145.0	450	324	81	95	Surfacing from R9-7 - reduce gpm - next interval. Surfacing from R9-7 - reduce gpm - next interval. Surfacing from R9-7 - reduce gpm - next interval.	3-Foot Screen
	7/13/2020	10:13	42-39	85	3.6	145.0	290.0	145.0						
	7/13/2020	11:47	39-36	20	3.6	290.0	350.0	60.0						
	7/13/2020	12:45	36-33	15	0.8	350.0	400.0	50.0						
	7/13/2020	14:30	33-30	5	0.5	400.0	450.0	50.0						

EA Engineering - Boomsnub Airco Superfund Site

Injection Summary Log

Barrier R9

Table 4



Injection Point	Date	Time	Injection Depth (ft. bgs)	Injection Pressure (psi)	Flow Rate (gpm)	Volume of PlumeStop/SMZVI Injected			Gallons Per Location	PlumeStop Per Location (lb.)	PlumeStop-S Per Location (lb.)	S-MicroZVI Per Location (lb.)	Comments	Injection Tooling
						Beginning Flow Meter (gal.)	Ending Flow Meter (gal.)	Gallons Per Interval						
R9-10	7/11/2020	9:09	45-43	125	3.7	0.0	100.0	100.0	765	552	138	161		Pressure Activated Probe
	7/11/2020	9:44	43-41	55	3.7	100.0	200.0	100.0						
	7/11/2020	10:45	41-39	30	3.3	200.0	300.0	100.0						
	7/11/2020	12:12	39-37	32	3.1	300.0	400.0	100.0						
	7/11/2020	13:26	37-35	35	3.0	400.0	500.0	100.0						
	7/11/2020	14:00	35-33	20	2.8	500.0	600.0	100.0						
	7/11/2020	14:20	33-30	30	2.5	600.0	765.0	165.0						
R9-11	7/10/2020	11:09	45-43	150	2.4	0.0	90.0	90.0	680	490	123	143		Pressure Activated Probe
	7/10/2020	11:53	43-41	25	3.9	90.0	180.0	90.0						
	7/10/2020	12:56	41-39	18	3.2	180.0	270.0	90.0						
	7/10/2020	13:53	39-37	18	2.9	270.0	360.0	90.0						
	7/10/2020	14:34	37-35	25	4.1	360.0	450.0	90.0						
	7/10/2020	15:06	35-33	30	4.4	450.0	540.0	90.0						
	7/10/2020	15:23	33-30	35	4.6	540.0	680.0	140.0						
R9-12	7/9/2020	13:50	45-42	175	0.0	0.0	0.0	0.0	560	404	101	118	Influence through AOC-1-GP-01 at 130 gal. input. (6.5 ft. ROI)	Expendable Tip
	7/9/2020	13:50	42-39	160	0.8	0.0	30.0	30.0						
	7/9/2020	14:24	39-36	160	0.9	30.0	80.0	50.0						
	7/9/2020	15:25	36-33	40	6.5	80.0	260.0	180.0						
	7/9/2020	16:28	33-30	30	5.5	260.0	395.0	135.0						
	7/10/2020	8:38	33-30	30	4.8	395.0	560.0	165.0						
									7965	5738	1434	1674		

**EA Engineering - Boomsnub Airco Superfund Site**  
**Injection Summary Log**  
**Barrier R10**  
**Table 5**



Injection Point	Date	Time	Injection Depth (ft. bgs)	Injection Pressure (psi)	Flow Rate (gpm)	Volume of PlumeStop/SMZVI Injected			Gallons Per Location	PlumeStop Per Location (lb.)	PlumeStop-S Per Location (lb.)	S-Micro ZVI Per Location (lb.)	Comments	Injection Tooling							
						Beginning Flow Meter (gal.)	Ending Flow Meter (gal.)	Gallons Per Interval													
R10-1	7/9/2020	13:46	45-42	160	1.4	0.0	50.0	50.0	605	436	109	127	7-8 ft drill rod clogged on retrieval.	Expendable Tip							
	7/9/2020	14:24	42-39	160	1.8	50.0	130.0	80.0													
	7/9/2020	15:26	39-36	160	1.2	130.0	180.0	50.0													
	7/9/2020	16:28	36-33	160	1.5	180.0	215.0	35.0													
	7/10/2020	8:37	33-30	160	1.2	215.0	235.0	20.0													
	Drill Attempt #2																				
	7/13/2020	13:30	38-40	160	3.0	235.0	315.0	80.0													
	7/13/2020	14:00	36-38	160	4.0	315.0	395.0	80.0													
	7/13/2020	14:10	34-36	160	-	395.0	395.0	0.0													
	7/13/2020	14:20	44-42	125	2.8	395.0	500.0	105.0													
	7/13/2020	14:40	42-40	145	3.2	515.0	620.0	105.0													
	7/9/2020	13:17	45-42	160	2.7	0.0	135.0	135.0													
R10-2	7/9/2020	14:24	42-39	130	4.5	135.0	410.0	275.0	1040	750	187	219	5 ft drill rod clogged on retrieval.	Expendable Tip							
	7/9/2020	15:26	39-36	130	4.6	410.0	545.0	135.0													
	7/9/2020	16:28	36-33	150	5.0	545.0	665.0	120.0													
	7/10/2020	8:42	36-33	90	3.5	665.0	850.0	185.0													
	7/10/2020	9:30	33-30	45	3.0	850.0	1040.0	190.0													
	7/8/2020	15:24	45-42	175	1.5	0.0	85.0	85.0													
R10-3	7/9/2020	9:39	42-39	150	1.4	85.0	100.0	15.0	250	180	45	53	Tooling ports clogged on retrieval.	3-Foot Screen							
	7/9/2020	10:30	39-36	130	1.1	100.0	150.0	50.0													
	7/9/2020	11:00	36-33	130	1.5	150.0	200.0	50.0													
	7/9/2020	12:35	33-30	130	1.5	200.0	250.0	50.0													
	7/8/2020	15:24	45-42	175	4.3	0.0	135.0	135.0													
R10-4	7/9/2020	16:27	42-39	150	3.7	135.0	270.0	135.0	485	350	87	102	Tooling ports clogged on retrieval.	3-Foot Screen							
	7/9/2020	8:16	39-36	130	2.1	270.0	405.0	135.0													
	7/9/2020	9:39	36-33	130	1.2	405.0	445.0	40.0													
	7/9/2020	10:30	33-30	130	1.0	445.0	485.0	40.0													
	7/8/2020	15:23	45-42	175	0.8	0.0	80.0	80.0													
R10-5	7/9/2020	9:39	42-39	85	3.2	80.0	270.0	190.0	990	714	178	208		3-Foot Screen							
	7/9/2020	10:29	39-36	35	4.6	270.0	510.0	240.0													
	7/9/2020	11:00	36-33	38	4.9	510.0	750.0	240.0													
	7/9/2020	12:35	33-30	35	6.2	750.0	990.0	240.0													
									<b>Total Gallons</b>	<b>Total PlumeStop (lb.)</b>	<b>Total PlumeStop-S (lb.)</b>	<b>Total S-MicroZVI (lb.)</b>									
									3370	2426	607	707									

EA Engineering - Boomsnub Airco Superfund Site

Injection Summary Log

Barrier R11

Table 6



Injection Point	Date	Time	Injection Depth (ft. bgs)	Injection Pressure (psi)	Flow Rate (gpm)	Volume of PlumeStop/SMZVI Injected			Gallons Per Location	PlumeStop Per Location (lb.)	PlumeStop-S Per Location (lb.)	S-Micro ZVI Per Location (lb.)	Comments	Injection Tooling							
						Beginning Flow Meter (gal.)	Ending Flow Meter (gal.)	Gallons Per Interval													
R11-1	7/15/2020	9:08	45-42	78	3.3	0.0	145.0	145.0	785	566	141	165		3-Foot Screen							
	7/15/2020	10:10	42-39	20	3.9	145.0	290.0	145.0													
	7/15/2020	11:07	39-36	40	4.0	290.0	430.0	140.0													
	7/15/2020	12:56	36-33	25	2.9	430.0	650.0	220.0													
	7/15/2020	14:18	33-30	25	3.1	650.0	785.0	135.0													
R11-2	7/15/2020	9:09	45-42	68	3.2	0.0	145.0	145.0	735	530	132	155		3-Foot Screen							
	7/15/2020	10:09	42-39	45	3.9	145.0	290.0	145.0													
	7/15/2020	11:08	39-36	38	4.0	290.0	430.0	140.0													
	7/15/2020	12:57	36-33	42	3.0	430.0	600.0	170.0													
	7/15/2020	14:30	33-30	22	2.0	600.0	735.0	135.0													
R11-3	7/14/2020	9:00	45-42	130	4.2	0.0	145.0	145.0	765	552	138	161		3-Foot Screen							
	7/14/2020	9:58	42-39	45	5.3	145.0	290.0	145.0													
	7/14/2020	11:00	39-36	35	3.8	290.0	475.0	185.0													
	7/14/2020	12:30	36-33	25	4.2	475.0	620.0	145.0													
	7/14/2020	14:00	33-30	25	4.0	620.0	765.0	145.0													
R11-4	7/15/2020	9:09	45-42	120	3.2	0.0	145.0	145.0	640	461	115	135		3-Foot Screen							
	7/15/2020	10:10	42-39	38	3.9	145.0	290.0	145.0													
	7/15/2020	11:09	39-36	28	4.0	290.0	430.0	140.0													
	7/15/2020	12:57	36-33	18	2.9	430.0	505.0	75.0													
	7/15/2020	14:30	33-30	22	2.0	505.0	640.0	135.0													
R11-5	7/14/2020	9:00	45-42	95	4.4	0.0	145.0	145.0	750	541	135	158		3-Foot Screen							
	7/14/2020	9:58	42-39	47	3.2	145.0	290.0	145.0													
	7/14/2020	11:00	39-36	20	3.6	290.0	460.0	170.0													
	7/14/2020	12:30	36-33	18	4.1	460.0	605.0	145.0													
	7/14/2020	14:00	33-30	32	3.3	605.0	750.0	145.0													
R11-6	7/15/2020	9:12	45-42	35	3.2	0.0	145.0	145.0	675	487	122	142		3-Foot Screen							
	7/15/2020	10:10	42-39	35	4.0	145.0	320.0	175.0													
	7/15/2020	11:09	39-36	23	4.0	320.0	465.0	145.0													
	7/15/2020	12:58	36-33	35	2.9	465.0	540.0	75.0													
	7/15/2020	14:31	33-30	33	2.1	540.0	675.0	135.0													
R11-7	7/14/2020	9:00	45-43	170	2.7	0.0	100.0	100.0	635	458	114	134		Pressure Activated Probe							
	7/14/2020	9:24	43-41	165	2.3	100.0	200.0	100.0													
	7/14/2020	9:57	41-39	190	0.0	200.0	200.0	0.0													
	7/14/2020	10:21	39-37	190	1.2	200.0	225.0	25.0													
	7/14/2020	11:00	37-35	150	2.5	225.0	235.0	10.0													
	<b>Drill Attempt #2</b>																				
	7/14/2020	12:00	32-30	55	2.9	235.0	335.0	100.0							<b>Drill Attempt #2</b>						
	7/14/2020	13:00	34-32	80	3.1	335.0	435.0	100.0													
	7/14/2020	14:00	36-34	110	3.3	435.0	535.0	100.0													
	7/14/2020	15:00	38-36	150	3.7	535.0	635.0	100.0													
									<b>Total Gallons</b>	<b>Total PlumeStop (lb.)</b>	<b>Total PlumeStop-S (lb.)</b>	<b>Total S-MicroZVI (lb.)</b>									
									4985	3589	897	1047									

EA Engineering - Boomsnub Airco Superfund Site

Injection Summary Log

Barrier R12

Table 7



Injection Point	Date	Time	Injection Depth (ft. bgs)	Injection Pressure (psi)	Flow Rate (gpm)	Volume of PlumeStop/SMZVI Injected			Gallons Per Location	PlumeStop Per Location (lb.)	PlumeStop-S Per Location (lb.)	S-Micro ZVI Per Location (lb.)	Comments	Injection Tooling
						Beginning Flow Meter (gal.)	Ending Flow Meter (gal.)	Gallons Per Interval						
R12-1	7/18/2020	10:02	45-42	58	3.9	0.0	140.0	140.0	680	490	123	143		3-Foot Screen
	7/18/2020	11:25	42-39	40	4.9	140.0	275.0	135.0						
	7/18/2020	12:38	39-36	35	3.8	275.0	410.0	135.0						
	7/18/2020	13:39	36-33	25	2.5	410.0	545.0	135.0						
	7/18/2020	13:50	33-30	25	4.0	545.0	680.0	135.0						
R12-2	7/27/2020	10:53	45-42	110	5.4	0.0	145.0	145.0	705	508	127	148		3-Foot Screen
	7/27/2020	11:47	42-39	85	5.0	145.0	285.0	140.0						
	7/27/2020	12:56	39-36	48	4.8	285.0	425.0	140.0						
	7/27/2020	14:11	36-33	20	4.1	425.0	565.0	140.0						
	7/27/2020	15:13	33-30	25	3.0	565.0	705.0	140.0						
R12-3	7/18/2020	10:02	45-42	92	3.9	0.0	140.0	140.0	680	490	123	143		3-Foot Screen
	7/18/2020	11:23	42-39	110	3.0	140.0	275.0	135.0						
	7/18/2020	12:07	39-36	40	5.2	275.0	410.0	135.0						
	7/18/2020	13:37	36-33	85	3.9	410.0	545.0	135.0						
	7/18/2020	14:21	33-30	20	4.5	545.0	680.0	135.0						
R12-4	7/17/2020	10:07	45-42	95	2.7	0.0	140.0	140.0	680	490	123	143		3-Foot Screen
	7/17/2020	11:01	42-39	40	4.1	140.0	275.0	135.0						
	7/17/2020	12:04	39-36	28	3.5	275.0	410.0	135.0						
	7/17/2020	13:05	36-33	42	4.0	410.0	545.0	135.0						
	7/17/2020	14:00	33-30	33	4.2	545.0	680.0	135.0						
R12-5	7/18/2020	11:25	45-42	80	4.5	0.0	140.0	140.0	680	490	123	143		3-Foot Screen
	7/18/2020	12:07	42-39	160	2.2	140.0	275.0	135.0						
	7/18/2020	13:39	39-36	155	2.5	275.0	410.0	135.0						
	7/18/2020	14:21	36-33	60	4.8	410.0	545.0	135.0						
	7/18/2020	15:06	33-30	40	5.0	545.0	680.0	135.0						
R12-6	7/17/2020	10:07	45-42	72	3.2	0.0	140.0	140.0	680	490	123	143		3-Foot Screen
	7/17/2020	11:02	42-39	38	3.8	140.0	275.0	135.0						
	7/17/2020	12:04	39-36	30	4.1	275.0	410.0	135.0						
	7/17/2020	13:05	36-33	52	4.4	410.0	545.0	135.0						
	7/17/2020	14:09	33-30	25	3.9	545.0	680.0	135.0						
R12-7	7/18/2020	10:02	45-42	95	2.9	0.0	140.0	140.0	680	490	123	143		3-Foot Screen
	7/18/2020	11:23	42-39	80	4.3	140.0	275.0	135.0						
	7/18/2020	12:07	39-36	42	5.5	275.0	410.0	135.0						
	7/18/2020	13:37	36-33	25	3.7	410.0	545.0	135.0						
	7/18/2020	14:21	33-30	30	4.6	545.0	680.0	135.0						
R12-8	7/16/2020	11:39	45-42	105	3.0	0.0	140.0	140.0	1000	721	180	210		3-Foot Screen
	7/16/2020	12:41	42-39	90	3.7	140.0	275.0	135.0						
	7/16/2020	13:28	39-36	30	4.1	275.0	480.0	205.0						
	7/16/2020	14:45	36-33	28	4.3	480.0	685.0	205.0						
	7/16/2020	15:30	33-30	35	5.0	685.0	820.0	135.0						
	7/16/2020	16:00	43-41	38	5.5	820.0	1000.0	180.0						
R12-9	-	-	45-42	-	-	0.0	0.0	0.0	0	0	0	0		
	-	-	42-39	-	-	0.0	0.0	0.0						
	-	-	39-36	-	-	0.0	0.0	0.0						
	-	-	36-33	-	-	0.0	0.0	0.0						
	-	-	33-30	-	-	0.0	0.0	0.0						
R12-10	7/16/2020	11:39	45-42	88	3.4	0.0	140.0	140.0	940	678	169	198		3-Foot Screen
	7/16/2020	12:41	42-39	85	4.4	140.0	275.0	135.0						
	7/16/2020	14:45	39-36	42	4.1	275.0	480.0	205.0						
	7/16/2020	15:30	36-33	30	4.4	480.0	685.0	205.0						
	7/16/2020	16:00	33-30	35	4.5	685.0	940.0	255.0						

EA Engineering - Boomsnub Airco Superfund Site

Injection Summary Log

Barrier R12

Table 7



Injection Point	Date	Time	Injection Depth (ft. bgs)	Injection Pressure (psi)	Flow Rate (gpm)	Volume of PlumeStop/SMZVI Injected			Gallons Per Location	PlumeStop Per Location (lb.)	PlumeStop-S Per Location (lb.)	S-Micro ZVI Per Location (lb.)	Comments	Injection Tooling
						Beginning Flow Meter (gal.)	Ending Flow Meter (gal.)	Gallons Per Interval						
R12-11	7/17/2020	10:07	45-42	90	4.0	0.0	140.0	140.0	680	490	123	143		3-Foot Screen
	7/17/2020	11:03	42-39	40	4.1	140.0	275.0	135.0						
	7/17/2020	12:04	39-36	23	3.7	275.0	410.0	135.0						
	7/17/2020	13:05	36-33	40	4.4	410.0	545.0	135.0						
	7/17/2020	14:10	33-30	20	3.6	545.0	680.0	135.0						
R12-12	7/16/2020	11:40	45-42	112	2.7	0.0	140.0	140.0	680	490	123	143		3-Foot Screen
	7/16/2020	12:42	42-39	70	4.9	140.0	275.0	135.0						
	7/16/2020	13:29	39-36	35	3.6	275.0	410.0	135.0						
	7/16/2020	14:29	36-33	25	3.8	410.0	545.0	135.0						
	7/16/2020	14:57	33-30	22	3.7	545.0	680.0	135.0						
R12-13	7/17/2020	10:07	45-42	80	3.5	0.0	140.0	140.0	680	490	123	143		3-Foot Screen
	7/17/2020	11:01	42-39	45	4.1	140.0	275.0	135.0						
	7/17/2020	12:04	39-36	25	3.8	275.0	410.0	135.0						
	7/17/2020	13:05	36-33	25	4.0	410.0	545.0	135.0						
	7/17/2020	14:10	33-30	22	3.6	545.0	680.0	135.0						
R12-14	7/16/2020	11:40	45-42	60	2.8	0.0	140.0	140.0	680	490	123	143		3-Foot Screen
	7/16/2020	12:41	42-39	38	4.8	140.0	275.0	135.0						
	7/16/2020	13:29	39-36	28	3.3	275.0	410.0	135.0						
	7/16/2020	14:29	36-33	22	3.2	410.0	545.0	135.0						
	7/16/2020	14:57	33-30	22	3.7	545.0	680.0	135.0						
R12-15	7/18/2020	10:02	45-42	47	3.4	0.0	140.0	140.0	680	490	123	143		3-Foot Screen
	7/18/2020	11:23	42-39	35	4.1	140.0	275.0	135.0						
	7/18/2020	12:07	39-36	35	4.7	275.0	410.0	135.0						
	7/18/2020	13:37	36-33	45	4.3	410.0	545.0	135.0						
	7/18/2020	14:21	33-30	30	4.1	545.0	680.0	135.0						
R12-16	7/27/2020	10:53	45-42	60	2.6	0.0	145.0	145.0	705	508	127	148		3-Foot Screen
	7/27/2020	11:47	42-39	50	4.7	145.0	285.0	140.0						
	7/27/2020	12:56	39-36	22	3.5	285.0	425.0	140.0						
	7/27/2020	14:12	36-33	30	3.9	425.0	565.0	140.0						
	7/27/2020	15:13	33-30	18	2.6	565.0	705.0	140.0						
R12-17	7/27/2020	10:53	45-42	105	3.1	0.0	145.0	145.0	705	508	127	148		3-Foot Screen
	7/27/2020	11:47	42-39	38	4.4	145.0	285.0	140.0						
	7/27/2020	12:56	39-36	25	3.3	285.0	425.0	140.0						
	7/27/2020	14:12	36-33	22	3.6	425.0	565.0	140.0						
	7/27/2020	15:14	33-30	5	2.6	565.0	705.0	140.0						
R12-18	7/27/2020	10:53	45-42	35	2.6	0.0	145.0	145.0	705	508	127	148		3-Foot Screen
	7/27/2020	11:47	42-39	32	4.4	145.0	285.0	140.0						
	7/27/2020	12:56	39-36	30	4.8	285.0	425.0	140.0						
	7/27/2020	14:12	36-33	17	3.2	425.0	565.0	140.0						
	7/27/2020	15:14	33-30	17	2.8	565.0	705.0	140.0						
									<b>Total Gallons</b>	<b>Total PlumeStop (lb.)</b>	<b>Total PlumeStop-S (lb.)</b>	<b>Total S-MicroZVI (lb.)</b>		
									12240	8820	2205	2572		

**EA Engineering - Boomsnub Airco Superfund Site**  
**PlumeStop Injection Summary Log**  
**Barrier R13**  
**Table 8**



Injection Point	Date	Time	Injection Depth (ft. bgs)	Injection Pressure (psi)	Flow Rate (gpm)	Volume of PlumeStop/SMZVI Injected			Gallons Per Location	PlumeStop Per Location (lb.)	PlumeStop-S Per Location (lb.)	S-Micro ZVI Per Location (lb.)	Comments	Injection Tooling
						Beginning Flow Meter (gal.)	Ending Flow Meter (gal.)	Gallons Per Interval						
R13-1	7/28/2020	10:04	45-42	55	4.8	0.0	140.0	140.0	680	490	123	143		3-Foot Screen
	7/28/2020	11:00	42-39	30	4.0	140.0	275.0	135.0						
	7/28/2020	12:47	39-36	30	4.0	275.0	410.0	135.0						
	7/28/2020	13:46	36-33	25	2.9	410.0	545.0	135.0						
	7/28/2020	15:01	33-30	30	3.1	545.0	680.0	135.0						
R13-2	7/29/2020	9:29	45-42	80	3.3	0.0	140.0	140.0	720	519	130	151		3-Foot Screen
	7/29/2020	10:26	42-39	55	3.8	140.0	275.0	135.0						
	7/29/2020	11:42	39-36	15	2.5	275.0	410.0	135.0						
	7/29/2020	13:30	36-33	25	3.8	410.0	565.0	155.0						
	7/29/2020	14:18	33-30	25	2.8	565.0	720.0	155.0						
R13-3	7/28/2020	10:04	45-42	92	4.6	0.0	140.0	140.0	680	490	123	143		3-Foot Screen
	7/28/2020	11:00	42-39	45	3.6	140.0	275.0	135.0						
	7/28/2020	12:47	39-36	30	3.8	275.0	410.0	135.0						
	7/28/2020	13:46	36-33	45	4.0	410.0	545.0	135.0						
	7/28/2020	15:02	33-30	25	3.1	545.0	680.0	135.0						
R13-4	7/29/2020	9:29	45-42	30	3.1	0.0	140.0	140.0	600	433	108	126	Surfacing from rod annulus - reduce gpm.	3-Foot Screen
	7/29/2020	10:27	42-39	30	2.5	140.0	275.0	135.0						
	7/29/2020	11:42	39-36	28	3.2	275.0	410.0	135.0						
	7/29/2020	13:30	36-33	18	2.7	410.0	505.0	95.0						
	7/29/2020	14:18	33-30	18	2.5	505.0	600.0	95.0						
R13-5	7/28/2020	10:04	45-42	38	5.0	0.0	140.0	140.0	680	490	123	143		3-Foot Screen
	7/28/2020	11:00	42-39	30	3.8	140.0	275.0	135.0						
	7/28/2020	12:47	39-36	25	4.3	275.0	410.0	135.0						
	7/28/2020	13:47	36-33	25	3.3	410.0	545.0	135.0						
	7/28/2020	15:02	33-30	33	3.2	545.0	680.0	135.0						
R13-6	7/29/2020	9:29	45-42	110	4.3	0.0	140.0	140.0	720	519	130	151		3-Foot Screen
	7/29/2020	10:27	42-39	52	4.3	140.0	275.0	135.0						
	7/29/2020	11:42	39-36	28	3.2	275.0	410.0	135.0						
	7/29/2020	13:30	36-33	50	3.1	410.0	565.0	155.0						
	7/29/2020	14:18	33-30	25	3.5	565.0	720.0	155.0						
R13-7	7/28/2020	10:04	45-42	40	4.2	0.0	140.0	140.0	680	490	123	143		3-Foot Screen
	7/28/2020	11:00	42-39	35	4.0	140.0	275.0	135.0						
	7/28/2020	12:48	39-36	25	4.2	275.0	410.0	135.0						
	7/28/2020	13:47	36-33	25	3.2	410.0	545.0	135.0						
	7/28/2020	15:02	33-30	55	3.3	545.0	680.0	135.0						
									<b>Total Gallons</b>	<b>Total PlumeStop (lb.)</b>	<b>Total PlumeStop-S (lb.)</b>	<b>Total S-MicroZVI (lb.)</b>		
									4760	3427	857	1000		



**EA Engineering - Boomsnub Airco Superfund Site**  
**3DME Injection Summary Log**  
**Barrier R14**  
**Table 9**



Injection Point	Date	Time	Injection Depth (ft. bgs)	Injection Pressure (psi)	Flow Rate (gpm)	Volume of 3DME Injected			Gallons Per Location	3DME Per Location (lb.)	CRS Per Location (lb.)	SMZVI Per Location (lb.)	BDI Per Location (L.)	Comments	Injection Tooling
						Beginning Flow Meter (gal)	Ending Flow Meter (gal)	Gallons Per Interval							
R14-1	7/30/2020	10:30	45-42	80	2.9	0.0	135.0	135.0	675	250	100	187	2.25		3-Foot Screen
	7/30/2020	11:24	42-39	50	4.0	135.0	270.0	135.0							
	7/30/2020	12:34	39-36	30	3.5	270.0	405.0	135.0							
	7/30/2020	13:35	36-33	25	3.3	405.0	540.0	135.0							
	7/30/2020	14:36	33-30	25	4.0	540.0	675.0	135.0							
R14-2	7/30/2020	10:30	45-42	50	3.0	0.0	135.0	135.0	675	250	100	187	2.25		3-Foot Screen
	7/30/2020	11:24	42-39	45	4.0	135.0	270.0	135.0							
	7/30/2020	12:35	39-36	25	4.0	270.0	405.0	135.0							
	7/30/2020	13:35	36-33	22	3.3	405.0	540.0	135.0							
	7/30/2020	14:36	33-30	25	3.6	540.0	675.0	135.0							
R14-3	7/30/2020	10:31	45-42	70	3.0	0.0	135.0	135.0	675	250	100	187	2.25		3-Foot Screen
	7/30/2020	11:24	42-39	55	4.2	135.0	270.0	135.0							
	7/30/2020	12:35	39-36	28	4.0	270.0	405.0	135.0							
	7/30/2020	13:36	36-33	28	3.3	405.0	540.0	135.0							
	7/30/2020	14:37	33-30	20	3.5	540.0	675.0	135.0							
R14-4	7/30/2020	10:31	45-42	50	3.0	0.0	135.0	135.0	675	250	100	187	2.25		3-Foot Screen
	7/30/2020	11:24	42-39	45	4.7	135.0	270.0	135.0							
	7/30/2020	12:35	39-36	28	4.0	270.0	405.0	135.0							
	7/30/2020	13:36	36-33	25	3.6	405.0	540.0	135.0							
	7/30/2020	14:37	33-30	20	3.3	540.0	675.0	135.0							
R14-5	7/31/2020	9:04	45-42	82	3.5	0.0	135.0	135.0	675	250	100	187	2.25		3-Foot Screen
	7/31/2020	10:19	42-39	90	3.9	135.0	270.0	135.0							
	7/31/2020	11:22	39-36	35	3.7	270.0	405.0	135.0							
	7/31/2020	12:43	36-33	60	5.8	405.0	540.0	135.0							
	7/31/2020	13:25	33-30	30	4.3	540.0	675.0	135.0							
R14-6	7/31/2020	9:04	45-42	85	5.0	0.0	135.0	135.0	675	250	100	187	2.25		3-Foot Screen
	7/31/2020	10:20	42-39	58	4.1	135.0	270.0	135.0							
	7/31/2020	11:22	39-36	30	4.0	270.0	405.0	135.0							
	7/31/2020	12:42	36-33	55	4.5	405.0	540.0	135.0							
	7/31/2020	13:26	33-30	28	4.1	540.0	675.0	135.0							
R14-7	7/31/2020	9:04	45-42	80	4.0	0.0	135.0	135.0	675	250	100	187	2.25		3-Foot Screen
	7/31/2020	10:20	42-39	45	4.9	135.0	270.0	135.0							
	7/31/2020	11:22	39-36	30	4.0	270.0	405.0	135.0							
	7/31/2020	12:42	36-33	40	4.8	405.0	540.0	135.0							
	7/31/2020	13:26	33-30	28	3.9	540.0	675.0	135.0							
R14-8	7/31/2020	9:05	45-42	72	4.2	0.0	135.0	135.0	675	250	100	187	2.25		3-Foot Screen
	7/31/2020	10:20	42-39	28	3.9	135.0	270.0	135.0							
	7/31/2020	11:22	39-36	30	4.0	270.0	405.0	135.0							
	7/31/2020	12:43	36-33	38	5.0	405.0	540.0	135.0							
	7/31/2020	13:26	33-30	28	4.2	540.0	675.0	135.0							
									<b>Total Gallons</b>	<b>Total 3DME (lb.)</b>	<b>Total CRS (lb.)</b>	<b>Total S-MicroZVI (lb.)</b>	<b>Total BDI (L.)</b>		
									5400	2000	800	1500	18		

# Appendix B: Photo Log

**Photo Log: Boomsnub Aircro Superfund Site**



**Photo 1:** Product storage on-site and RRS Trailer.



**Photo 2:** Row 9/Row 10 air-knife clearing.



**Photo 3:** DPT injection wells on Row 9.



**Photo 4:** Roadway traffic control.



**Photo 5:** DPT injection wells on Row 11.



**Photo 6:** Row 11 air-knife clearing.



**Photo 7:** DPT injection wells on Row 12.



**Photo 8:** Injection trailer location inside Messer plant.



**Photo 9:** DPT injection wells on Row 13.



**Photo 10:** Product storage inside Messer plant.



**Photo 11:** Row 14 pre-survey to determine barrier location.



**Photo 12:** Row 14 air-knife clearing and traffic control for Messer plant trucks.

## **Appendix B**

### **Phase IIA Daily Injection Reports**



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 8-18-19 DAY: Friday	Report #: 29	PAGE 1 OF 3
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER: Cloudy, Rain		
REPORT PREPARED BY:		TEMP: 52°F - 61°F		
PROJECT MANAGER: Jil Frain		WIND: 5mph ESE		
TIME ON-SITE: 0700		TIME DEPARTED SITE: 1900		

**PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):**

EA: ABugher, RRead, GLee, PEhrman, H Dennis

AEC: N Mainard, J Mahard, T , B Zander

**ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):**

- 0700 AB & AEC on site
  - 0800 Rest of EA on site
  - 0900 At AOC-2, continue drilling 8-13 (70' drilled 8/17/19) to 115' bgs
  - 0950 Drilling of 8-13 complete, DO = 0.7 small tank, DO = 0.5 large tank
  - 1044 Start injecting 8-13 [start drilling 8-10 to 115' bgs (0958), complete 1035]
  - 1135 8-13 injection complete, pulling rods 8-13
  - 1251 start injecting 8-10
  - 1335 start drilling 8-5 (140)
  - 1345 injection complete 8-10, pulling rods 8-10 to finish 8-5
  - 1430 Drilling complete 8-5, start injection 8-5 (1458), start drilling 8-4 (1510)
  - 1540 Injection complete 8-5, pulling rods 8-5
  - 1620 Drilling complete 8-4 (hard to drill deeper than 120' bgs)
  - 1640 injection started 8-4
  - 1718 injection complete 8-4, pulling rods 8-4
  - 1620 start drilling 8-7 (115 bgs)
- 1 injecting location → remains

**ITEMS NEEDING ATTENTION:**

**SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:**

DAILY PHOTOS: Download to project folder





# Injection Summary

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 10-18-19 DAY: Friday	Report #: 29	PAGE 3 OF 3
EA PROJECT No: 1524092		LOCATION: A-6-2		

Note: Only record exceptions to work plan

Injection Point ID (Row-ID)	Time	Depth (ft bgs)	Quantity Injected			Injection Rates (gpm)	Injection Pressure (psi)
			Anaerobic Water (gal)	Microbes (L)	product Slurry (gal) (lb)		
8-5	14:58	140	40		62		350
8-5	14:52	138	40		62		375
8-5	15:06	136	40		62		375
8-5	15:09	134	40 + 5		62		375
8-5	15:15	132	40		62		350
8-5	15:19	130	40		62		350
8-5	15:23	128	40 + 5		62		375
8-5	15:26	126	40		62		350
8-5	15:29	124	40		62		350
8-5	15:32	122	40		62		350
8-5	15:36	120	40 + 5		62		350
	15:40	Complete					
8-4	16:40	140	40		62		325
8-4	16:43	138	40		62		325
8-4	16:47	136	40		62		325
8-4	16:50	134	40 + 5		62		350
8-4	16:58	132	40		62		325
8-4	17:01	130	40		62		325
8-4	17:04	128	40		62		350
8-4	17:09	126	40 + 5		62		350
8-4	17:12	124	40		62		350
8-4	17:15	122	40		62		325
8-4	17:18	120	40 + 5		62		325
		Complete					



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 09-09-2019	Report #: /	PAGE OF /
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER: Rainy / Sunny		
REPORT PREPARED BY: Frain		TEMP.: 60 80		
		WIND: Low		
TIME ON-SITE: 0900	TIME LEFT SITE: 1700	HUMIDITY: _____		

PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):  
AEC: L. Mainard, N. Mainard  
EA: Frain, Read

SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:  
None

ACTIVITIES WORKED TODAY:  
Set up water tank  
filled w 1,200 gallon using 250 gal tank -  
no water truck

ITEMS NEEDING ATTENTION:  
Need water truck

OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS:  
no drilling conducted

DAILY PHOTOS: Download to project folder.



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 9/10/19	Report #: 2	PAGE 1 OF 2
EA PROJECT No: 1524092		LOCATION:		
CONTRACTOR: AEC		WEATHER: overcast		
REPORT PREPARED BY:		TEMP.: 65	WIND: none	
TIME ON-SITE: 0700	TIME LEFT SITE:	HUMIDITY:		

PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):  
 AEC : L Mainard, N Mainard, B. Puckett, Brian Zander  
 EA : Frain / Read

SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:

ACTIVITIES WORKED TODAY:  
 started drilling at 5-3 mixed culture @ .45 liters / 1200 gallon tank  
 down to 115' @ 0930 / start injections 1031  
 mixing water tanks 1050 set up at 5-8

ITEMS NEEDING ATTENTION:  
 need water truck

OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS:  
 incl 1155 1230  
 restart @ 5-8 @ 1250  
 working top down  
 tested water at 216 → 0.0 mg/L

DAILY PHOTOS: Download to project folder.



## Injection Summary

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 9/10/19 DAY: Tues	Report #: 2	PAGE OF 2 2
EA PROJECT No: 1524092		LOCATION: AOC-2		

**Note: Only record exceptions to work plan**

*note: microber mixed in tank .45L/1200 gal*

Injection Point ID (Row-ID)	Time	Depth (ft bgs)	Quantity Injected			Injection Rates (gpm)	Injection Pressure (psi)	
			Anaerobic Water (gal)	Microbes (L) <i>see note</i>	Product Slurry (gal) <i>lb</i>			
5-3	1031	115	~ 20		64	~ 10	75-125 @ pump	
	1038	113	~ 33		64			
	1143	111			64			
	1150	109			64			
	1156	107			64			
	1101	105			64			
	1111	103			64			
	1117	101			64			
	1129	99			64			
	1141	95.7			64			
5-8		Started drilling @ 1050 ready to inject top down - 1129						
	1250	95	~ 33		64		pressure ~ 225 psi → 275 psi	
	1310	97						
	1320	99						
	1340	101						
	1355	103						
	1406	105					pressure back to 175 psi	
	1411	107						
	1420	109						
	1427	111						
1435	113							
1500 -	move to 4-1 to start pushing rod. will stop at 75' bgs							
1530 -	pulling rods from 5-8, stopped due to product surfacing							



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 9/11/19	Report #: 3	PAGE/OF 3
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER: overcast / misty		
REPORT PREPARED BY: FRAIN / Wood		TEMP.: ~65		
		WIND: none		
TIME ON-SITE: 0700	TIME LEFT SITE:	<del>HUMIDITY:</del> on		

**PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):**

AEC: L. Mainard, N Mainard, B Puckett, B Zander  
EA: Frain, Wood

**SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:**

*injections*

ACTIVITIES WORKED TODAY: Starting on 4-1. Drilled to depth on 104  
Injection start @  
started pushing to depth @ 4-10<sup>am</sup> 7-1  
smaller rig to test @ 2.25 rods  
1103 added .25 liter microbes to 500 gallons water  
Break for lunch.

**ITEMS NEEDING ATTENTION:**

**OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS:**

continued from above:  
started back at 1130  
completed injections @ 7-7  
started at 5-9 @ 12 1410.  
completed 5-9 and left site at 4:00 pm

DAILY PHOTOS: Download to project folder.

425)  
422-  
7930  
713  
703  
6514



# Injection Summary

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 9/11/19 DAY: Wed	Report #: 3	PAGE 2 OF 3
EA PROJECT No: 1524092		LOCATION: AOC - 2 / 4-1, 7-1, 5-9		

Note: Only record exceptions to work plan

*note using microbes mixed in water tank*

Injection Point ID (Row-ID)	Time	Depth (ft bgs)	Quantity Injected			Injection Rates (gpm)	Injection Pressure (psi)
			Anaerobic Water (gal)	<i>note</i> Microbes (L)	<i>product</i> Slurry (gal) (lb)		
4-1	0830	75	<del>~35 gal</del>		~64	~10 gpm	~175-225 @ pump
	0844	77	~35 gal				
	0852	79					
	0900	81					
	0911	83					
	0919	85					
	0927	87					
	0936	89					
	942	91					
	0950	93					
	1000	95	<i>left rods in hole until: 9/12/19</i>				
7-1	1136	95	~35 gal		~64 lb	~10	~100-210 psi @ pump
	1148	97					
	1158	99					
	1205	101					
	1203	103					
	12:23	<del>103</del>	105				
		1230	107				
		1240	109				
		1246	111				
		1256	113				
5-9	1300	115					
	1410*	95	~35 gal		~64 lb	~10	~140-210 psi
	1420	97					~200-400
	1428	99					~100-500
	1438	101					~20-250
	1445	103					~40-300
	1452	105					

\* switched microbe tank halfway through injection 1411 new mix of microbes 0.19L/500gal





# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 9-12-19	Report #:	PAGE OF 1 2
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER: Sunny		
REPORT PREPARED BY: Wood		TEMP.: 60 - 80°F		
		WIND: ~ 7 mph morning ~ 5 mph afternoon		
TIME ON-SITE: 830	TIME LEFT SITE: 1530	HUMIDITY:		

PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):  
 AEC: L. Mainard, B. Puckett, N. Mainard, B. Zander  
 EA: Fran/Wood

SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:  
 Mud in areas making conditions slick - discussed getting gravel for upcoming rain

ACTIVITIES WORKED TODAY:  
 830 pulled rods from 9-11-19. ↓ microbes added 0.19 L / out 845 500 gal  
 PH = 0.0 for tank used today (500 gal) PH = 2.8 (1,200 gal)  
 (from top) (from spigot)  
 prep - started pushing 4-7 at 8:36 PH = 0.0 1,200 gal  
 " " 4-14 at 8:50 (from top)

ITEMS NEEDING ATTENTION:

OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS:  
 Microbes add to 1,200-gal tank at 11:25  
 0.45 L / 1,200 gal.  
 started pulling rods from 4-7 at 1300 - rods were full of liquid " " 4-14 at 1315 " "

DAILY PHOTOS: Download to project folder.  
 Left 5' rod in 4-7. 4-14 was not "ready" & liquid was coming out - rods were put back. "Lost" some rods in the hole but it seems like they were able to connect with them manually.  
 started pushing 4-11 at 1400



## Injection Summary

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: DAY: 9-12-19 Thurs.	Report #:	PAGE OF 2 2
EA PROJECT No: 1524092		LOCATION: AOC-2, 4-7, 4-14, 4-11		

Note: Only record exceptions to work plan

Injection Point ID (Row-ID)	Time	Depth (ft bgs)	Quantity Injected			Injection Rates (gpm)	Injection Pressure (psi)
			Anaerobic Water (gal)	Microbes (L)	Slurry (gal)		
4-7	1039	90	~35	0.194/500gal	64	~8.5	~100-240
	1044	88					~100-300
	1048	86					~200-300
	1055	84					~100-300
	1059	82					
	1104	80					
	1110	78					
	1115	76					
4-14	928	90	~35gal	0.194/500gal	64	~8.5gpm	~100-300
	932	88					~100-200
	936	86					~100-300
	946	84					~100-200
	949	82					~180-220
	953	80					~200-300
	1002	78					~100-240
	1006	76					~40-220
4-11	1421	90	235	0.432/1200gal	64	~8.5	~100-300
	1425	88					~20-300
	1432	86					~100-400
	1436	84					
	1442	82					
	1449	80					
	1453	78					
	1459	76					~10-200





# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 9/16/19 DAY: Mon	Report #: 6	PAGE 1 OF 2
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER: Variable		
REPORT PREPARED BY: Frain		TEMP: ~ 65		
PROJECT MANAGER: Jil Frain		WIND: light - from SW		
TIME ON-SITE:		TIME DEPARTED SITE:		

PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):  
 A. L. Mainard, N. Mainard, D. Phillip  
 EA: Frain

ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):

Moved equipment to site 9:15 AM  
 tested water 0.9 mg/L 9:55 AM add .12 L microbes  
 started pushing @ 5-10 10:05 AM  
 reached depth 115 bgs @ 10:44 AM  
 product taking longer to mix ~ absorbed moisture one week or more.  
 Conditions allowing adding gear gun to mix  
 to 1205 completed STD, break for lunch  
 Back from lunch 12:30 - start pulling rd @ 5-10 - placed plus  
 viewed holes in Row to plan for vac truck + traffic control  
 looked at new points selected for row 3 -> need to check w/ Rick to see if pipeline will interfere with Loes  
 119 mob to 4-10 to start probing. Complete probe to 90' bgs @

ITEMS NEEDING ATTENTION:  
 demob @  
 prep for rain on Tuesday

SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:

DAILY PHOTOS: Download to project folder

**Injection Data Summary Table**  
**Boomsnub/Airco Superfund Site**  
**In-situ Treatment Injections**  
**Hazel Dell, Washington**

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment	<b>CLIENT:</b> Messer	<b>DATE:</b> 9/16/19	<b>Report #:</b> 6	<b>PAGE</b> 2 <b>of</b> 2
<b>EA PROJECT No:</b> 1524092	<b>LOCATION:</b> ADC-2, Start @ 5-10	<b>DAY:</b> Mon		

Note: Focus on EXCEPTIONS to work plan

Injection Point ID	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes (time)
		Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)			
5-10	115	~40		~64 lb		175-125	1052
	113	~40		64		175-225	1056
	111	~40		64			1104
	109	~45		64		50-175	1107 - add. extra
	107	40		64		50-175	1118 water @
	105	40		64		25-175	1124 pipe
	103	~45		64		50-200	1133 removal
	101	40		64		25-175	1142
	99	40		64		25-200	1147
	97	45		64		50-225	1155
	95	40-45		64		50-200	1159
				complete @	1205		

note: microbes added into de-oxygenated water just prior to first injection.

Rate: 0.45 liters OS/1,200 gal tank, 0.19 liters for each 500 gallon tank

Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 9/12/09 DAY: Tues	Report #: 7	PAGE / OF
EA PROJECT No: 1524092		LOCATION: ADC-2		
CONTRACTOR: AEC		WEATHER: rain		
REPORT PREPARED BY:		TEMP: low 60's		
PROJECT MANAGER: Jil Frain		WIND:		
TIME ON-SITE:	0730	TIME DEPARTED SITE:		

**PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):**

AEC: L Mainard, N Mainard, D. Phillips  
EA: Frain, Read

**ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):**

Set up @ 4-10  
tested water tank 0.0 mg/L  
added 0.19 L microbes, slowly rolled tank to mix  
Finished 4-10 at 849, Letting rods sit 30 min.  
Returned to site trailer - filling water tanks  
Setup @ 4-5 pushed Rod to 75' at 11:40  
Finished Filling water tank and treated w/newmans  
Finished 4-5 at 14:18, Letting rods sit 30 min.  
15:00 Finished Pulling Rods @ 4-5. Refilling 500 gal water tank  
15:16 Setup on 5-5  
16:30 Locking up

**ITEMS NEEDING ATTENTION:**

**SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:**

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**Injection Data Summary Table**  
**Boomsnub/Airco Superfund Site**  
**In-situ Treatment Injections**  
**Hazel Dell, Washington**

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment	<b>CLIENT:</b> Messer	<b>DATE:</b> 9-17-19 <b>DAY:</b> Tues	<b>Report #:</b> 7	<b>PAGE</b> 2 <b>of</b>
<b>EA PROJECT No:</b> 1524092	<b>LOCATION:</b>			

Note: Focus on EXCEPTIONS to work plan

Injection Point ID	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes
		Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)			
4-10	90	~40		64		50-200	0814
	88	~40		64		50-200	rainy heavy
	86	~45		64		150-225	0820
	84	~40		64		0-175	0827
	82	~40		64		150-200	0833
	80	40		64		50-75	0840
	78	~45		64		50-125	0846
	76	~40		64		25-125	0849
	74						
4-5	75	~40		64		50-125	13:23
	77	~40		64		50-200	13:31
	79	~40		64		50-175	13:39
	81	~45		64		50-250	13:45
	83	~40		64		150-225	13:53
	85	~40		64		50-200	14:02
	87	~40		64		50-200	14:06
	90	~45		64		50-200	14:13

note: microbes added into de-oxygenated water just prior to first injection.  
Rate: 0.45 liters OS/1,200 gal tank, 0.19 liters for each 500 gallon tank  
Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 9/18/19 DAY: Wed	Report #: 8	PAGE 1 OF 3
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER: Overcast, Rain showers 55°		
REPORT PREPARED BY:		TEMP: 55° - 68°		
PROJECT MANAGER: Jil Frain		WIND: SW		
TIME ON-SITE: 7:00		TIME DEPARTED SITE: <del>16:00</del> 16:30		

**PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):**

AEC - L Mainard, N Mainard, Daniel Phillips  
EA - Read

**ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):**

7:00-7:45 Setup. 7:45 tested 100 in tall tank at 0.2, 1 short tank at 0.2  
1 short tank 5.2. Added microbes to the good short Tank.

9:47 Finished 5-5

10:35 Pulling Rods at 5-5. Added Microbes to large tank,

11:05 Set up on 4-3. 11:15 Begin pushing Rod to 75'; 11:30 Lunch.

12:22 Begin injecting at 4-3. Finish injections - 76' to 90' at 4-3.  
Wait for pressure to drop before pulling rods.

14:37 Begin pushing Rods at 4-1. Begin injecting at 15:00.

15:37 Noticed product Surfacing 6 ft. East of 4-3. Approx 15 gallons  
on ground. Pushed 2 x 4ft 3 inch Rods into 4-3 and flow  
Stopped.

**ITEMS NEEDING ATTENTION:**

**SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:**

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### Injection Data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

PROJECT NAME:	CLIENT:	DATE: 9/18/19	Report #: 8	PAGE 2 of 3
Boomsnub In-situ Treatment	Messer	DAY: Wed		
EA PROJECT No: 1524092	LOCATION: AOC-2			

Note: Focus on EXCEPTIONS to work plan

Injection Point ID	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes
		Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)			
5-5							
8:30	95	~40		67		0-175	
8:38	97	~40		67		50-200	
8:46	99	~40		67		50-215	
8:53	101	~40		67		50-215	
9:00	103	~40		67		25-175	
9:08	105	~40		67		50-200	
9:14	107	~40		67		25-125	
9:20	109	~40		67		25-150	
9:29	111	~40		67		25-200	
9:36	113	~40		67		10-110	
9:42	115	~40		67		50-200	
4-3							
12:22	76	~40		67		0-150	
12:29	78	~40		67		25-175	
12:38	80	~40		67		50-200	
12:46	82	~40		67		100-250	
12:54	84	~40		67		50-150	
13:02	86	~40		67		25-180	
13:09	88	~40		67		0-175	
13:15	90	~40		67		0-100	
13:20	Done						

note: microbes added into de-oxygenated water just prior to first injection.

Rate: 0.45 liters OS/1,200 gal tank, 0.19 liters for each 500 gallon tank

Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.





# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 9/19/19 DAY: Thurs	Report #: 9	PAGE 1 OF 2
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER: Fog AM, Partly Sunny PM		
REPORT PREPARED BY: R. READ		TEMP: 54-70		
PROJECT MANAGER: Jil Frain		WIND: Calm NW		
TIME ON-SITE:	8:00 AM	TIME DEPARTED SITE: 16:40		

**PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):**

AEC - L Malnard, N Malnerd, Briand Zander  
EA - RICK READ

**ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):**

8:20 Pulling Rods at 4-1  
9:00 Set up on 5-1. 9:15 Begin pushing rods at 5-1 to 95 ft.  
10:09 Begin injecting at 5-1. Grout pump is leaking under hopper, cleaned up around joint and tapped on it with pipe wrench and leak stopped for a few intervals on 5-1.  
10:26 Finished injecting at 5-1. Taking leaky pump seal apart to inspect.  
11:30 Pump apart and gasket is shot. Breaking for lunch.  
12:30 Silicone caulk was used to temporarily replace gasket and the pump re-assembled new seals ordered.  
13:00 Pulling Rods from 5-1.  
13:22 Setting up on 5-6. 13:25 Begin pushing rods at 5-6 to 95'.  
14:00 Silicone still tacky, AEC Refilling water tanks.  
15:17 Begin injecting at 5-6. Temporary fix holding for now.  
16:25 Finished injecting at 5-6. Packing up. Temporary pump seal fix on grout pump lasted to final interval and started leaking again.

**ITEMS NEEDING ATTENTION:**

**SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:**

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## Injection Data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

<b>PROJECT NAME:</b>	<b>CLIENT:</b>	<b>DATE:</b> 9/19/19	<b>Report #:</b> 9	<b>PAGE</b> 2 of 2
Boomsnub In-situ Treatment	Messer	<b>DAY:</b> Thursday		
<b>EA PROJECT No:</b> 1524092	<b>LOCATION:</b> AOC-2			

Note: Focus on EXCEPTIONS to work plan

Injection Point ID	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes
		Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)			
5-1							
10:09	95	~45		64		25-175	
10:17	97	~40		64		50-200	
10:25	99	~45		64		25-175	
10:32	101	~45		64		50-200	
10:38	103	~40		64		50-200	
10:44	105	~40		64		75-250	
10:51	107	~40		64		75-225	
10:57	109	~40		64		50-225	
11:04	111	~40		64		50-200	
11:12	113	~40		64		0-175	
11:18	115	~45		64		50-200	
5-6	95	~40		64		25-200	
15:17	97	~40		64		25-175	
15:26	99	~40		64		50-200	
15:33	101	~40		64		50-200	
15:39	103	~40		64		50-225	
15:46	105	~40		64		50-225	
15:51	107	~40		64		75-225	
15:58	109	~40		64		50-200	
16:05	111	~40		64		50-200	
16:11	113	~40		64		25-175	
16:18	115	~40		64		25-175	
16:25	done						

note: microbes added into de-oxygenated water just prior to first injection.

Rate: 0.45 liters OS/1,200 gal tank, 0.19 liters for each 500 gallon tank

Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 9/20/19 DAY: Friday	Report #: 10	PAGE 1 OF
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER:		
REPORT PREPARED BY:		TEMP: 56-67		
PROJECT MANAGER: Jil Frain		WIND: NW 3-4		
TIME ON-SITE:	7:00	TIME DEPARTED SITE: 12:00		

**PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):**

AEC - L Mainard, N Mainard, Brian Zander  
EA - R. READ

**ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):**

7:00-7:30 Loading product, measuring microbes, filling water tanks.

7:30 Pulling Rods at 5-6. 8:10 Pushing Rods at 7-3

9:00 Finished Pushing Rods at 7-3 to 105. Going bottom up on this hole due to the grout pump leak.

10:28 Finished injecting at 7-3. Pump seal leak got a bit worse on the last 2 intervals, taking the grout pump back to Boomsnub yard to clean-up and take apart.

11:00 Pressure Washed pump; put EHC plus bags back in warehouse. Secured Equipment, ordered new pump seals to repair pump Monday

12:00 AEC Leaving site

**ITEMS NEEDING ATTENTION:**

**SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:**

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**Injection Data Summary Table**  
**Boomsnub/Airco Superfund Site**  
**In-situ Treatment Injections**  
**Hazel Dell, Washington**

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment	<b>CLIENT:</b> Messer	<b>DATE:</b> 9/23/19	<b>Report #:</b> 11	<b>PAGE</b> 1 of 3
<b>EA PROJECT No:</b> 1524092	<b>LOCATION:</b> AOC-2			

Note: Focus on EXCEPTIONS to work plan

Injection Point ID	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes
		Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)			
7-4(1130)	95	40		62		0-175	
1138	97	40		62		25-250	
1145	99	40		62		25-225	
1155	101	40		62		25-225	
1159	103	40		62		25-225	
<del>1203</del>	<del>105</del>	<del>40</del>		<del>62</del>		<del>25-200</del>	<del>HD</del>
1210	105	40		62		25-275	
1218	107	40		62		25-200	
1225	109	40		62		25-250	
1232	113 III	40		62		25-250	
1239	113	40		62		25-275	
1245	115	40		62		25-225	
<hr/>							
7-8(1510)	95	40		62		200 <sup>HD</sup> -250	
1517	97	40		62		100-325	
1528	99	<sup>HD</sup> 40 20		<sup>HD</sup> 62 31		100-430	<sup>HD</sup> <del>not daylighting</del> Surfacing
1542	115	<sup>HD</sup> 40 55		<sup>HD</sup> 62 80		25-250	Go to bottom up
1548	113	40		62		25-175	
							Out of water.
						Will	Continue 9/24/19.

note: microbes added into de-oxygenated water just prior to first injection.  
 Rate: 0.45 liters OS/1,200 gal tank, 0.19 liters for each 500 gallon tank  
 Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment	<b>CLIENT:</b> Messer	<b>DATE:</b> 9/23/19 <b>DAY:</b> Mon	<b>Report #:</b> 11	<b>PAGE</b> 2 <b>OF</b> 3
<b>EA PROJECT No:</b> 1524092		<b>LOCATION:</b> AOC-2		
<b>CONTRACTOR:</b> AEC		<b>WEATHER:</b> Partly Cloudy		
<b>REPORT PREPARED BY:</b> Hannah Dennis		<b>TEMP:</b> 60° - 65° F		
<b>PROJECT MANAGER:</b> Jil Frain		<b>WIND:</b> SW 3 MPH		
<b>TIME ON-SITE:</b>		<b>TIME DEPARTED SITE:</b> 1740		
<b>PERSONNEL ONSITE (include subcontractors; verify proper PPE &amp; credentials):</b> EA: H. Dennis, R. Read AEC: N. Mainard, J. Mainard, B. Zander				
<b>ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):</b> 8:30 - Arrive on site 0845 - JM and BZ pulling rods from 7-3. NM getting parts for grout pump and fixing grout pump. JM and BZ drilling at 7-4. 1100 - NM, HD, RR mob to AOC-2. 1130 - Begin injecting at 7-4. 1250 - Finished injecting at 7-4. Letting rods sit for at least 30 mins. 1255 - Break for lunch. 1330 - Return from lunch. NM to get water in 500 gal. tank. JM and BZ pull rods from 7-4. 1400 - Begin drilling at 7-8. 1445 - Mob to warehouse with BZ to pick up additional product. Return to AOC-2. 1510 - Begin injecting at 7-8.				
<b>ITEMS NEEDING ATTENTION:</b>				
<b>SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:</b>				

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# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 9/23/19 DAY: Mon	Report #: 11	PAGE 3 OF 3
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER: Partly Cloudy		
REPORT PREPARED BY: Hannah Dennis		TEMP: 60°-65°		
PROJECT MANAGER: Jil Frain		WIND: SW 3 MPH		
TIME ON-SITE:		TIME DEPARTED SITE: 1740		
PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):  see pg 1				
ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):  1530 - surfacing occurring when injecting at 99 ft. Approximately 31 lbs of product injected before stopping. Surfacing occurring around rod. Transition to bottom-up-drill to 115 ft. Inject remainder of product started at 99 ft interval, plus one bag (approximately 80 lbs). 1554 - stop injections (completed 113). out of de-oxygenated water. Will continue at 111 ft on 9/24/19 moving up. 1605 - mob to trailer. AEC filling 500 gal. tank, locking up and 1200 gal. tank. Treat with de-oxygenator. Locking up. 1740 - AEC leaves site				
ITEMS NEEDING ATTENTION:				
SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:				

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# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 9/24/14 DAY: Tuesday	Report #: 12	PAGE 1 OF 4
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER: 60°-70° overcast		
REPORT PREPARED BY: H. Dennis		TEMP: 60°-70°		
PROJECT MANAGER: Jil Frain		WIND: 6 mph SW		
TIME ON-SITE: 7:00	TIME DEPARTED SITE:			
PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials): EA- H. Dennis, R. Read AEC - N. Mainard, J. Mahard, B. Zander				
ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):				
0700 Arrive at trailer. Prep for day, pack supplies.				
0730 Arrive at AOC-2.				
0750 Test <del>DO</del> O <sub>2</sub> for 500 gal tank. O <sub>2</sub> = 0.0 mg/L. Add microbes				
0800 Continue at 7-8 from 9/23/14. Start at 111 ft moving up to <del>99 ft</del> <sup>101</sup> 101 ft.				
0846 Complete injections at 7-8. Remove remaining rods from 7-4 and <del>pack w/ bentonite fill.</del>				
0852 Pull rods from 7-8 and <del>at</del> cap. Nozzle threads showing signs of wear. New nozzle to be shipped overnight as backup.				
0915 Begin drilling at 5-2 to 95 ft.				
0947 Begin injecting at 5-2 at 95 ft.				
1054 Some product surfacing through rod (111 ft to 115 ft)				
1116 Injection at 5-2 complete				
1122 Test O <sub>2</sub> for 1200 gal tank. O <sub>2</sub> = 0.0 mg/L.				
1125 JM, BZ to get gas/diesel. Break for lunch at 11:30.				
ITEMS NEEDING ATTENTION: Injection tip threads showing signs of wear/abrasion. AEC sending replacement tip overnight to have as backup.				
SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:				

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# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 9/24/19 DAY: Tuesday	Report #: 12	PAGE 2 OF 4
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER:		
REPORT PREPARED BY: H. Dennis		TEMP:		
PROJECT MANAGER: Jil Frain		WIND: see pg 1		
TIME ON-SITE:		TIME DEPARTED SITE:		

PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):  
See pg 1

ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):

- 1230 Return from lunch
- 1240 Remove cap from 7-8 and fill.
- 1245 Pull rod from 5-2, Add microbes to 1200 gal. tank. Cap 5-2.
- 1310 Begin drilling at 4-4 to 76 ft.
- 1348 Begin injecting at 4-4 at 76 ft. Pump starting to leak at O-ring. By 80 ft, spraying product. After 80 ft. injection, stop pump to replace O-ring. Continue injecting at 82 ft.
- 1435 Surfacing at 84 ft. After completing 84 ft injection, drill to 90 ft; transition to bottom-up. Still some surfacing through rod at 88-86 ft.
- 1455 Pull cap from 5-2 and fill. Finish injections at 4-4 and cap.
- 1505 Mob to trailer to pick up more product.
- 1520 Begin drilling at 4-8 to ~~76~~ 90 ft. Inject bottom-up beginning at 1600.
- 1630 JM mobs to fill 500 gal. tank.
- 1648 Injection at 4-8 complete, cap pulled rods + capped.
- 1700 Mob to trailer. AEC filling 500 gal. tank, locking up.
- 1750 AEC leaves site.

ITEMS NEEDING ATTENTION: see pg 1.

SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:

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### Injection data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment	<b>CLIENT:</b> Messer	<b>DATE:</b> 9/24/19 <b>DAY:</b> Tuesday	<b>Report #:</b> 17	<b>PAGE</b> 3 <b>OF</b> 4
<b>EA PROJECT No:</b> 1524092		<b>LOCATION:</b> AOC-2		

Note: Focus on EXCEPTIONS to work plan

Injection Point ID and Time	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes
		Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)			
7-8						Continued from 9/23/19	
806	111	40		64		0-175	
813	109	40		64		25-225	
820	107	40		64		25-225	
827	105	40		64		25-200	
834	103	40		64		25-175	
840	101	40		64		25-175	
846	Injection at 7-8 complete						
5-2							
977	95	40		64		0-200	
957	97	40		64		25-225	
1010	99	40		64		25-200	
1016	101	40		64		25-200	
1025	103	40		64		50-200	
1032	105	40		64		25-225	
1039	107	40		64		25-250	
1046	109	40		64		25-250	
1054	111	40		64		25-225	
1102	113	40		64		25-200	
1109	115	40		64		25-225	
1116	Injection at 5-2 complete						
4-4							
1348	76	40		64		50-275	
1356	78	40		64		50-325	
1403	80	40		64		75-325	

note: microbes added into de-oxygenated water just prior to first injection.

Rate 0.45 liters/1200 gal tank

0.19 liters for each 500 gallon tank

Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.

leak at O-ring replaced.





# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 9/25/19 DAY: Wed	Report #: 13	PAGE 1 OF 3
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER: 56°-71°, partly cloudy		
REPORT PREPARED BY: H. Dennis		TEMP: 56°-71°		
PROJECT MANAGER: Jil Frain		WIND: 0 mph		
TIME ON-SITE: 700		TIME DEPARTED SITE: 1600		

**PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):**

EA- H. Dennis, R. Read

AEC - N. Mamard, ~~J. Mamard~~<sup>HD</sup>, B. Zander, J. Mamard

**ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):**

- 700 - Arrive at trailer, load ~~trash~~<sup>HD</sup> supplies/product.
- 800 - Arrive at AOC-2. Pull rods from 4-8 and fill.
- ~~830 - Pull cap from 4-4 and fill HD~~
- 840 - Mob to trailer with NM to get de-oxygenator. Add to 500 gal tank.
- 848 - Begin drilling at 4-12 to 76 ft.
- 852 - Manager from AEC onsite. Leaves site at 9:00.
- 924 - Begin injecting at 4-12 at 76 ft.
- 959 - At 86 ft., rod being pushed out of hole when injection starts. Clamp down rod and continue injecting. After injection at 86', surfacing occurs. Drill to 90', transition to bottom-up. At 90', significant surfacing. Inject approximately 1/4 of product before stopping. Inject remaining 3/4 at 85 ft; no surfacing occurs. Inject last interval at 83 ft; ~~no~~ significant surfacing. Approximately half injected before stopping.
- 1030 Pull cap from 4-4 and fill. Pull rods from 4-12 and cap.
- 1047 Begin pushing rod to 90 ft. - will inject bottom up. at 4-16.
- 1125 Lunch
- 1210 Return from lunch.
- 1220 Begin injecting at 4-16. At 90 ft interval, inject extra product from 4-12 along w/ standard injection.

**ITEMS NEEDING ATTENTION:****SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:**

DAILY PHOTOS: Download to project folder



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 9/25/19 DAY: Wed	Report #: 13	PAGE 2 OF 3
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER:		
REPORT PREPARED BY: H. Dennis		TEMP:		
PROJECT MANAGER: Jil Frain		WIND: see pg 1		
TIME ON-SITE: 700		TIME DEPARTED SITE: 1600		
PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):  see pg 1				
ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):  1304 Injection at 4-16 complete. Pull rods. Pull cap from 4-12. <del>Cap 4 to 10</del> Injection tip lost at 4-16. Injection tip replacement not available. JM to go to Seattle to pick up replacement tips for 9/26/19.  1330 Filling 1,200 gal tank and add de-oxygenator. Locking up, prepping for 9/26/19.  1600 AEC leaves site				
ITEMS NEEDING ATTENTION:				
SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:				

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# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 9/26/19 DAY: Thurs	Report #: 14	PAGE 1 OF 4
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER: <del>to</del> Overcast		
REPORT PREPARED BY: H. Dennis		TEMP: 60° - 70°		
PROJECT MANAGER: Jil Frain		WIND: W, 5-8 mph		
TIME ON-SITE: 7:00		TIME DEPARTED SITE: 18:00		

**PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):**

ER: H. Dennis, R. Bead

AEC: N. Mainard, J. Mainard, B. Zander

**ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):**

- 7:00 Arrive at trailer. Load truck, prep for day.
- 7:35 Mob to AOC-2
- 745 JM arrives with new injection tip. Test 1200 gal tank: O<sub>2</sub> = 0.0 mg/L  
NM to get parts to modify tip at Home Depot. AD + BZ mob to trailer to pick up hoses and generator. NM returns, adds putty to new tip.
- 830 Remove cap from 4-16 and fill. Waiting for putty to dry. Added microbes to 1200-gal tank.
- 920 Begin pushing at 4-9 to 90 ft. Use ~~smaller rig to start pushing at 4-6.~~<sup>to</sup>  
Move large rig to 4-6 to ~~start~~<sup>push</sup> to 90 ft. Use smaller rig at 4-9 to pull rods up for bottom-up injection while pushing at 4-6.
- 1000 Start injecting at 4-9 (bottom-up)
- 1045 Finish injecting at 4-9. Switch rigs; use large rig to pull rods at 4-9, small rig for injections at 4-6.
- 1047 Start injecting at 4-6 (bottom-up). Pressure gauge not working at 72-76 ft. To be replaced.
- 1105 Use large rig to push to 90 ft at 4-13
- 1125 Injection complete at 4-6. NM to purchase new pressure gauge during lunch break.

**ITEMS NEEDING ATTENTION:****SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:**

DAILY PHOTOS: Download to project folder



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 9/26/19 DAY: Thurs	Report #: 14	PAGE 2 OF 4
EA PROJECT No: 1524092		LOCATION: AOL-2		
CONTRACTOR: AEC		WEATHER:		
REPORT PREPARED BY: H. Dennis		TEMP:		
PROJECT MANAGER: Jil Frain		WIND: see pg 1		
TIME ON-SITE:		TIME DEPARTED SITE: 12:00		

PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):  
  
see pg 1

ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):

- 1145 Break for lunch.
- 1255 Return from lunch. NM replacing pressure gauge. JM+BZ mob to get diesel.
- 1325 Pulling rods at 4-6. Removing cap and filling 4-9. 4-6 capped.  
Test O<sub>2</sub> at 500 gal tank: O<sub>2</sub> = 0.0 mg/L
- 1420 ~~Pushing~~ Pushing rods at 7-2 to 115 ft.
- 1424 Begin injecting at 4-13. Change O-ring on pump at 1450 due to leak.
- 1509 Surfacing after last injection at 4-13 when flushing line w/ water. Surfacing stops when pump stops. Cap pulled at 4-6, filled. Pull rods at 4-13 and cap.
- 1520 Filling tank (1200 gal).
- 1600 ~~Pushing rods at 7-7 to 115 ft~~ set up to push rods at 7-7 on 9/27/19 with large rig and pull rods/inject at 7-2 using small rig.
- 1615 AEC continues filling tanks, prepping for 9/27/19.  
Note - 7-9 and 7-10 are flagged in field; 7-10 not on table; 7-9 and 7-10 not on map. Call J. Frain to determine which, if either, need injection
- 1800 AEC leaves site

ITEMS NEEDING ATTENTION:

SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:

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### Injection data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

<b>PROJECT NAME:</b>	<b>CLIENT:</b>	<b>DATE:</b> 9/26/19	<b>Report #:</b> 141	<b>PAGE</b> 3 <b>OF</b> 4
Boomsnub In-situ Treatment	Messer	<b>DAY:</b> Thurs.		
<b>EA PROJECT No:</b> 1524092	<b>LOCATION:</b> AOC-2			

Note: Focus on EXCEPTIONS to work plan

Injection Point ID and Time	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes
		Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)			
4-9							
1000	90	40		64		0-200	
1007	88	40		64		0-175	
1010	86	40		64		0-175	
1014	84	40		64		25-200	
1020	82	40		64		25-200	
1028	80	40		64		25-225	
1032	78	40		64		25-250	
1040	76	40		64		25-225	
Complete injection at 4-9.							
4-6							
1047	90	40		64		0-175	
1050	88	40		64		50-300	
1053	86	40		64		50-300	
1100	84	40		64		50-250	
1104	82	40		64		50-250	
1109	80	40		64		50-275	
1115	78	40		64		Pressure gauge not working	
1119	76	40		64		"	
Complete injection at 4-6.							
4-13	84					50-300	
1422	90	40		64		150-300	New pressure
1429	88	40		64		150-300	gauge consistently
1433	86	40		64		175-300	reads @ higher
1438	84	40		64		200-325	& more stable values

note: microbes added into de-oxygenated water just prior to first injection.

Rate 0.45 liters/1200 gal tank

0.19 liters for each 500 gallon tank

Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.





# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 9/27/19 DAY: Friday	Report #: 15	PAGE 1 OF 2
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER: 55 Mostly sunny		
REPORT PREPARED BY: H. Dennis		TEMP: 55-65		
PROJECT MANAGER: Jill Frain		WIND: 5 mph W		
TIME ON-SITE: 0700		TIME DEPARTED SITE: 1140		

**PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):**

EA: H. Dennis

AEC: N. Manard, J. Manard, B. Zander

**ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):**

700 - Arrive at trailer. Load product, prep for day. Mob to AOC-2.

735 - Test 500 gal tanks. O<sub>2</sub> for both = 0.0 mg/L. Add microbes.

740 - Use large rig to push rods to 115 ft at 7-7.

815 - Begin injecting at 7-2 at 115 ft (bottom-up). Pressure gauge not reading correctly - assume 0 is at approximately 500 PSI mark (i.e. when pump is off, reads ~500; when on, reads 500-700 (0-200)).

915 - Finish injection at 7-2. Leave rods.

933 - Begin injecting at 7-7 at 115 ft. (bottom-up)

1035 - Injection at 7-7 complete. Leave rods.

1055 - Mob to trailer. AEC filling both 500 gal tanks

1140 - AEC leaving site

**ITEMS NEEDING ATTENTION:**

**SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:**

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### Injection data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment	<b>CLIENT:</b> Messer	<b>DATE:</b> 9/27/19	<b>Report #:</b> 15	<b>PAGE</b> 2 OF 2
		<b>DAY:</b> Friday		
<b>EA PROJECT No:</b> 1524092	<b>LOCATION:</b> AOC-2			

Note: Focus on EXCEPTIONS to work plan

Injection Point ID and Time	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes	
		Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)				
7-2	115							
815	115	40		64	<del>300-500</del> 0-175	Supply for note re: pressure		
823	113	40		64	0-200			
827	111	40		64	0-200			
836	109	40		64	0-150			
839	107	40		64	0-150			
844	105	40		64	25-175			
848	103	40		64	25-200			
853	101	40		64	25-225			
856	99	40		64	25-225			
905	97	40		64	50-225			
909	95	40		64	50-225			
Injection at 7-2 complete								
7-7								
933	115	40		64	0-225			
938	113	40		64	0-275			
943	111	40		64	0-275			
950	109	40		64	0-225			
954	107	40		64	0-225			
1000	105	40		64	0-225			
1007	103	40		64	0-200			
1011	101	40		64	0-200			
1016	99	40		64	0-175			
1024	97	40		64	0-175			
1029	95	40		64	0-175			
Injection at 7-7 complete								

note: microbes added into de-oxygenated water just prior to first injection.

Rate 0.45 liters/1200 gal tank

0.19 liters for each 500 gallon tank

Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 9/30/19 DAY: Monday	Report #: 16	PAGE 1 OF 2
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER: 41°F, MOSTLY SUNNY		
REPORT PREPARED BY: G. LEE		TEMP: 41°F		
PROJECT MANAGER: Jil Frain		WIND: E 3 MPH		
TIME ON-SITE: 0700		TIME DEPARTED SITE:		

PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):  
 EA: G. LEE  
 AEC: N. MAINARD, J. MAINARD, B. ZANDER

ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):

0700 ARRIVE ONSITE  
 0830 AEC STARTS ARRIVING  
 0930 ALL AEC ONSITE, FILLING WATER TRUCK  
 0940 AEC HEADING TO AOC-2 TO PULL & RESET ROVS. TESTED WATER IN TANK @ 0.0 MG/L  
 1021 DONE PULLING ROVS, ~~BEGAN DRILLING AT~~ AT FIRST PT, ~~AND~~ AT SECOND PT.  
 1030 FINISHED PULLING @ PT 2. GRouting PTE closed.  
 1100 BEGAN DRILLING AT 4-15 & 4-18.  
 1130 AEC TOOK LUNCH.  
 1200 CONTINUED DRILLING.  
 1345 MICROBES ADDED TO ANAEROBIC WATER.  
 1400 STARTED INJECTING AT 4-18.  
 1450 INJECTION COMPLETE AT 4-18.  
 1500 BEGAN INJECTING AT 4-15.  
 1512 ROV PULLED AT 4-18.  
 1525 BEGAN DRILLING AT 4-20  
 1544 INJECTION COMPLETE AT 4-18.  
 1615 AEC LEFT SITE.

ITEMS NEEDING ATTENTION:  
 WILL WE HAVE ENOUGH MICROBES IF WE RE-DOSE EVERYDAY.

SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:

### Injection data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

PROJECT NAME:	CLIENT:	DATE: 9/30/19	Report #: 16	PAGE 2 OF 2
Boomsnub In-situ Treatment	Messer	DAY: MONDAY		
EA PROJECT No: 1524092	LOCATION: AOC-2			

Note: Focus on EXCEPTIONS to work plan

Injection Point ID and Time	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes
		Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)			
4-18 1408	90	35-40	0.45	~64		500-600	PRESSURE GAUGE BROKEN
1415	88		0.45	water mix		---	GAUGE BROKEN
1420	86		0.45			---	
1428	84		0.45			---	
1433	82		0.45			---	
1440	80		0.45			---	
1448	78		0.45			---	
1448	76		0.45			---	
	74						
	72						
4-15 1504	90	~40	0.45	~64		---	
1507	88		0.45			---	
1510	86		0.45			---	
1517	84		0.45		3 min / 35 gal		
1521	82	~40	0.45	~64			
1525	80		0.45		3 min / 35-40 gal		
1533	78		0.45				
1536	76		0.45				

note: microbes added into de-oxygenated water just prior to first injection.

Rate 0.45 liters/1200 gal tank

0.19 liters for each 500 gallon tank

Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.



DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
 In-situ Treatment Injections  
 Hazel Dell, Washington

PROJECT NAME:	Boomsnub In-situ Treatment
CLIENT:	Messer
DATE:	10-1-19
DAY:	TUESDAY
Report #:	17
PAGE	1 OF 4
EA PROJECT No:	1524092
CONTRACTOR:	AEC
REPORT PREPARED BY:	G. LEE
PROJECT MANAGER:	Jill Frain
WIND:	WSW @ 10 MPH
TEMP:	39°F
WEATHER:	39°F, CLEAR, SUNNY
LOCATION:	AOC-2
CONTRACTOR:	AEC
TIME ON-SITE:	0700
TIME DEPARTED SITE:	

PERSONNEL ON-SITE (include subcontractors; verify proper PPE & credentials):

EA: G. LEE  
 AEC: NATHAN MATHEWS, JOSH MATHEWS, BRANDI THUNDER

ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):

0740 ARRIVED SITE, AEC RECEIVED FOR DAY (LAWRENCE, FRANK, ETC.)  
 0740 AT AOC-2  
 0749 WATER IN WELL AT 00 WELL → GOOD TO USE.  
 0755 AEC SETTING UP AT 4-15 TO PULL ROOF FROM YESTERDAY, AND AT 4-20 TO INJECT.  
 0845 BEGAN INJECTING AT 4-20.  
 0915 BEGAN DRAINING AT 4-19.  
 0930 INJECTION COMPLETE AT 4-20. AEC TO GET NEW PRESSURE GAUGE & REPAIR PUMP SEAL.  
 1050 AEC SET ASIDE. REPAIRED PRESSURE GAUGE & ROSE LEAK, PULLING ROD AT 4-20.  
 1118 BEGAN INJECTING AT 4-19.  
 1145 BEGAN DRAINING AT 5-4.  
 1200 INJECTING COMPLETE AT 4-19.  
 1220 TESTED MARK IN 500 GALLON TANK DO-COMPLI.  
 1230 POK WOOD  
 1300 BACK FROM WOOD. RESUMED DRAINING AT 5-4. PULLING ROD AT 4-19.  
 1340 COMPROMISED DRAINING AT 5-4.  
 1346 BEGAN INJECTING AT 5-4. PULLING ROD AT 4-19.  
 1430 BEGAN DRAINING AT 4-19.  
 1443 INJECTING COMPLETE AT 5-4. PULLING ROD AT 5-4.  
 ITEMS NEEDING ATTENTION:  
 ① PRESSURE GAUGE NOT FUNCTIONING, GETTING CLOGGED BY SLURRY MIXTURE → FIXED @ 1100  
 ② HOSES FREEZING: NEED TO PATCH AT END IF OVERNIGHT TEMPS ARE AT OR NEAR FREEZING

SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:

DAILY PHOTOS: Download to project folder



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 10-1-14 DAY: TUESDAY	Report #: 17	PAGE 2 OF 4
EA PROJECT No: 1524092		LOCATION:		
CONTRACTOR: AEC		WEATHER:		
REPORT PREPARED BY: SEE PG 1		TEMP: SEE PG 1		
PROJECT MANAGER: Jil Frain		WIND:		
TIME ON-SITE:		TIME DEPARTED SITE:		
PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):  SEE PAGE 1				
ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):  1500 DRILLING COMPLETE AT 4-17. 1512 BEGAN INJECTIONS AT 4-17. 1554 INJECTION COMPLETE AT 4-17. ROW 4 IS COMPLETE. 1615 AEC MOVING WATER TANKS, FUELING TANKS, & DRILLING AT 5-12. 1709 DRILLING AT 5-12 COMPLETE. 1730 AEC LEFT SITE.				
ITEMS NEEDING ATTENTION:				
SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:				

DAILY PHOTOS: Download to project folder

**Injection data Summary Table**  
 Boomsnub/Airco Superfund Site  
 In-situ Treatment Injections  
 Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment	<b>CLIENT:</b> Messer	<b>DATE:</b> 10-1-19	<b>Report #:</b> 17	<b>PAGE</b> 3 <b>OF</b> 4
<b>EA PROJECT No:</b> 1524092	<b>LOCATION:</b> AOC 2	<b>DAY:</b> TUESDAY		

Note: Focus on EXCEPTIONS to work plan

Injection Point ID and Time	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes
		~40 Anaerobic Water (gal)	Microbes (L)-see notes	~44 Product (lb)			
4-20 0845	90	~45	.017	64	~11.3	—	PRESSURE GAUGE NOT WORKING
0853	88	40	.015		11.3	—	
0857	86	45	.017		10	—	
0907	84	40	.015		11	—	
0911	82	40	.015		11	—	
0914	80	45	.017		11.5	—	
0922	78	40	.015		10	—	
0925	76	45	.017		11	—	
4-19 1121	90	45	.017	64	~12	200-400	NEW PRESSURE GAUGE
1125	88	40	.015	64		300-450	
1129	86	45	.017	64	~11	~400	
1136	84	40	.015	64		200	
1141	82	40	.015			200-300	
1144	80	45	.017		~12	100-250	
1151	78	40	.015			100-200	
1154	76	45	.017			100-250	

note: microbes added into de-oxygenated water just prior to first injection.

Rate 0.45 liters/1200 gal tank .000345 L/g

0.19 liters for each 500 gallon tank

Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.

**Injection data Summary Table**  
 Boomsnub/Airco Superfund Site  
 In-situ Treatment Injections  
 Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment	<b>CLIENT:</b> Messer	<b>DATE:</b> 10-1-19	<b>Report #:</b> 17	<b>PAGE</b> 4 OF 4
<b>EA PROJECT No:</b> 1524092	<b>LOCATION:</b> AOC-2	<b>DAY:</b> TUESDAY		

Note: Focus on EXCEPTIONS to work plan

Injection Point ID and Time	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes
		Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)			
5-4 1349	115	45	.017	64	AVG AT 11 GPM	250	
1353	113	40	.015			200	
1357	111	45	.017			250	
1403	109	40	.015			150	
1406	107	40	.015			200	
1410	105	45	.017			200	
1418	103	40	.015			200	
1421	101	45	.017			200	
1428	99	40	.015			200	
<del>1428</del> 1432	97	40	.015			300	
1437	95	45	.017		300		
4-17 1514	90	40	.015	64	AVG AT 11 GPM	400	
1518	88	40	.015			300	
1522	86	45	.017			400	
1529	84	40	.015			200	
1532	82	35	.013			250	
1535	80	45	.017			250	
1543	78	40	.015			150	
1546	76	45	.017			200	

note: microbes added into de-oxygenated water just prior to first injection.

Rate 0.45 liters/1200 gal tank

0.19 liters for each 500 gallon tank      0-0152 140

Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 10-2-19 DAY: WEDNESDAY	Report #: 10	PAGE 1 OF 3
EA PROJECT No: 1524092		LOCATION: ABC-2		
CONTRACTOR: AEC		WEATHER: CLEAR, SUNNY		
REPORT PREPARED BY: G. LEE		TEMP: 40° F		
PROJECT MANAGER: Jil Frain		WIND: SW 1 MPH		
TIME ON-SITE: 0700	TIME DEPARTED SITE:			

PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):  
 EA: G. LEE  
 AEC: N. MAENARD, B. ZAVOCC, J. MAENARD

ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):

0700 ARRIVED ONSITE. AEC ONSITE

0730 PREPARED EQUIPMENT, MOBBED TO SITE.

0805 DO = 0.7 MG/L FOR LARGE TANK. WILL ADD A LITTLE MORE NEWMANOS A ROW W/ PUMP FROM TO USE.

0822 WATER BELOW 0.5 MG/L, BEGAN INJECTING AT 5-12.

0858 NOZZLE IS CLOGGED; NEED TO PULL RODS AND RESET.

0951 RODS PULLED & NOZZLE CLEANED, BEGAN INJECTING AT 5-12.

1022 DRILLING COMPLETED AT 5-12. SETTING UP FOR INJECTION.

1031 RESUMED INJECTION. PULLING ROD AT 4-17.

1145 INJECTION COMPLETE AT 5-12. FUELING REGS/EQUIPMENT.

1210 TOOK LUNCH.

1240 BACK FROM LUNCH, DRILLING AT 5-11.

1340 DRILLING COMPLETE AT 5-11. BEGAN INJECTING. PULLING ROD AT 5-12.

1428 INJECTING COMPLETE AT 5-11. ROW 5 COMPLETE. BEGAN DRILLING AT 7-6.

1532 DRILLING COMPLETE AT 7-6. BEGAN INJECTION. PULLING ROD AT 5-11.

1626 INJECTION COMPLETE AT 7-6.

1630 WRAPPING UP FOR DAY. PREPPING/FUELING WATER TANKS, STAGING EQUIPMENT.

1655 AEC LEFT SITE.

ITEMS NEEDING ATTENTION:

SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:

### Injection data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 10-2-19 DAY: WEDNESDAY	Report #: 18	PAGE 2 OF 3
EA PROJECT No: 1524092		LOCATION: AOC-2		

Note: Focus on EXCEPTIONS to work plan

Injection Point ID and Time	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes
		Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)			
5-12 0830	115	45	.017	64	AVG AT	400 100	→ STOP, NOZZLE IS CLOGGED UP RESUME AT 115'
1040	113	40	.015		8 GPM	100	
1053	111	45	.017		+	200	
1103	109	40	.015		+	300	
1107	107	40	.015		AVG AT	300	
1112	105	45	.017		11 GPM	300	
1119	103	40	.015			200	
1126	101	45	.017			250	
1132	99	40	.015		+	300	
1136	97	40	.015			400	
1140	95	45	.017			350	
5-11 1342	115	40	.015	64	AVG	350	
1346	113	40	.015			350	
1349	111	45	.017		e 11 GPM	300	
1355	109	40	.015			150	
1358	107	40	.015			150	
1400	105	45	.017			250	
1407	103	40	.015			200	
1411	101	40	.015			200	
1415	99	45	.017			250	
1420	97	40	.015			200	
1424	95	40	.015			250	

note: microbes added into de-oxygenated water just prior to first injection.

Rate 0.45 liters/1200 gal tank

0.19 liters for each 500 gallon tank

Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.



**Injection data Summary Table**  
**Boomsnub/Airco Superfund Site**  
**In-situ Treatment Injections**  
**Hazel Dell, Washington**

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment	<b>CLIENT:</b> Messer	<b>DATE:</b> 10-3-19	<b>Report #:</b> 10	<b>PAGE 2 OF 2</b>
<b>EA PROJECT No:</b> 1524092	<b>LOCATION:</b> AOC-2	<b>DAY:</b> THURSDAY		

Note: Focus on EXCEPTIONS to work plan

Injection Point ID and Time	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes
		Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)			
7-10 0958	115	40	.015	64	AVG AT	350	
1006	113	40	.015			400	
1009	111	45	.017		10 GPM	300	
1019	109	40	.015			200	
1024	107	40	.015			200	
1028	105	45	.017			350	
1037	103	40	.015		@ 10	200	
1042	101	45	.017			250	
1050	99	40	.015		@ 11	250	
1053	97	40	.015			250	
1056	95	45	.017			300	
7-5 1401	115	40	.015	64	AVG AT	300	
1404	113	40	.015		11.5 GPM	400	
1407	111	45	.017			200	
1415	109	40	.015			150	
1417	107	40	.015			350	
1421	105	45	.017			350	STOP WORK. THUNDER & LIGHTNING
1507	103	40	.015			350	RESUME AT 1507
1512	101	40	.015			200	
1515	99	45	.017			300	
1521	97	40	.015			200	
1524	95	45	.017			200	

note: microbes added into de-oxygenated water just prior to first injection.

Rate 0.45 liters/1200 gal tank

0.19 liters for each 500 gallon tank

Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 10-3-19 DAY: THURSDAY	Report #: 19	PAGE   OF 2
EA PROJECT No: 1524092		LOCATION: Boomsnub AOC-2		
CONTRACTOR: AEC		WEATHER: 52°F, CLOUDY, SLIGHT RAIN		
REPORT PREPARED BY: G. LEE		TEMP: 52°F		
PROJECT MANAGER: Jil Frain		WIND: E 2 MPH		
TIME ON-SITE: 0700		TIME DEPARTED SITE: 1600		

**PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):**  
 EA: G. LEE  
 AEC: N. MAINARD, J. MAINARD, B. BANDER

**ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):**

0700 ARRIVED ONSITE.  
 0745 AEC MOVING TO THE SITE.  
 0824 BEGAN DRILLING AT 7-10. ALSO PULLING WATER TRACK. AND PULLING RODS AT 7-6.  
 0915 TESTED WATER. LARGE TANK = 0.7 MG/L, SMALL TANK 1 = 1.3 MG/L, SMALL TANK 2 = 0.8 MG/L.  
 ADDED MORE OS TO TANKS, WELL LRT SET AND RESET.  
 0928 DRILLING COMPLETE AT 7-10. WATER IN LARGE TANK AT 0.5 MG/L.  
 0951 BEGAN INJECTING AT 7-10.  
 1058 INJECTION COMPLETE AT 7-10. PULLING ROD AT 7-6.  
 1135 TOOK LUNCH.  
 1230 DRILLING AT 7-5.  
 1335 DRILLING COMPLETE AT 7-5.  
 1352 BEGAN DRILLING AT 6-6.  
 1400 BEGAN INJECTING AT 7-5.  
 1427 STOP WORK. THUNDER AND LIGHTNING.  
 1507 RESUME WORK.  
 1530 INJECTION COMPLETE AT 7-5. DRILLED TO 1105' AT 6-6.  
 1538 AEC WRAPPING UP AT SITE, HEADING TO TRUCK.  
 1600 AEC LEFT SITE.

**ITEMS NEEDING ATTENTION:**

**SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:**

DAILY PHOTOS: Download to project folder



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 10/14/19 DAY: FRIDAY	Report #: 19	PAGE 1 OF 2
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER: PARTLY CLOUDY		
REPORT PREPARED BY: G. LEE		TEMP: 51°F		
PROJECT MANAGER: Jill Frain		WIND: ESE 3 MPH		
TIME ON-SITE: 0700		TIME DEPARTED SITE: 1235		

PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):  
 EA: G. LEE.  
 AEC: T. MAINARD, N. MAINARD, B. ZANDER

ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):

0700 AEC ONSITE  
 0745 LOADING EQUIPMENT, MOVING TO AOC-2.  
 0810 AT AOC-2. WATER IN TANK @ DB=0.5 mg/L  
 0845 RESUMED DRILLING AT 6-6. PULLING RODS AT 7-5.  
 0853 DRILLING AT 6-6 COMPLETED. GROUTING AT 7-5.  
 0915 BEGAN INJECTING AT 6-6.  
 0930 BEGAN DRILLING AT 7-9.  
 1005 INJECTION COMPLETE AT 6-6. DRILLING COMPLETE AT 7-9.  
 1020 ATTEMPTED INJECTION @ 7-9; BUT NOZZLE IS CLOGGED. NEED TO PULL & RESET.  
 110 INJECTION AT 7-9.  
 1207 INJECTION COMPLETE AT 7-9.  
 1225 DEMOS FOR DAY.  
 1235 LEFT SITE.

ITEMS NEEDING ATTENTION:

SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:

**Injection data Summary Table**  
**Boomsnub/Airco Superfund Site**  
**In-situ Treatment Injections**  
**Hazel Dell, Washington**

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment	<b>CLIENT:</b> Messer	<b>DATE:</b> <del>9/24/19</del> 10/4/19	<b>Report #:</b> 19	<b>PAGE</b> 2 <b>OF</b> 2
<b>EA PROJECT No:</b> 1524092	<b>LOCATION:</b> AOC-2			

Note: Focus on EXCEPTIONS to work plan

Injection Point ID and Time	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes
		Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)			
6-b 0917	115	40	.015	64	AVG	400	
0921	113	40	.015		10 GPM	400	
0925	111	45	.017			300	
0931	109	40	.015			200	
0934	107	40	.015		+10	250	
0937	105	45	.017			300	
0944	103	40	.015			200	
0947	101	45	.017			200	
0952	99	40	.015		T	400	
0955	97	40	.015		e 11	350	
0958	95	45	.017		I	300	
7-9 1110	115	40	.015	64	AVG	400	
1113	113	45	.017		AT 10 GPM	400	
1119	111	40	.015			300	
1122	109	40	.015			350	
1125	107	45	.017			400	
<del>1129</del> 1134	105	40	.015			150	
1138	103	40	.015		+11	250	
1142	101	45	.017			250	
1151	99	40	.015			200	
1154	97	45	.017			200	
1202	95	45	.017			150	

note: microbes added into de-oxygenated water just prior to first injection.

Rate 0.45 liters/1200 gal tank

0.19 liters for each 500 gallon tank

Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment	<b>CLIENT:</b> Messer	<b>DATE:</b> 10/7/19 <b>DAY:</b> MONDAY	<b>Report #:</b> 20	<b>PAGE</b>   OF 2
<b>EA PROJECT No:</b> 1524092		<b>LOCATION:</b> AOC-2		
<b>CONTRACTOR:</b> AEC		<b>WEATHER:</b> PARTLY CLOUDY		
<b>REPORT PREPARED BY:</b> H. Peterson		<b>TEMP:</b> 55° F		
<b>PROJECT MANAGER:</b> Jil Frain		<b>WIND:</b> SW ~2 MPH		
<b>TIME ON-SITE:</b> 0800	<b>TIME DEPARTED SITE:</b> 1630			

**PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):**

H. Peterson EA	N. Mainard AEC	B. Zander AEC
R. Read EA	J. Mainard AEC	
Jonathan Williams EPA	D. Phillips AEC	

**ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):**

0800 Arrive at EA trailer.

0900 AEC arrive at worksite and begin setting up equipment. Mob to AOC-2.

1100 DD tested at end of day Friday. Begin drilling at 6-5. Also setting up at 6-8.

1130 Injection point (tip) stuck at bottom of 6-5. AEC finishes pushing rods in 6-8. Begin injection at 6-8.

1238 Injection complete at 6-8. Drilling complete (and point is recovered) at 6-5.

1245 Break for lunch.

1345 AEC getting fuel.

1435 Begin injection at 6-5.

1450 Begin drilling hole 6-7.

1530 Injection at 6-5 is complete.

1600 Drilling to 115' is complete at 6-7. Ready to begin injection here tomorrow. AEC refills water tanks (with oxygen scavenger). Leave site.

**ITEMS NEEDING ATTENTION:**

**SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:**

DAILY PHOTOS: Download to project folder

### Injection data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

<b>PROJECT NAME:</b>	<b>CLIENT:</b>	<b>DATE:</b> 10/7/19	<b>Report #:</b> 20	<b>PAGE</b> 2 <b>OF</b> 2
Boomsnub In-situ Treatment	Messer	<b>DAY:</b> MONDAY		
<b>EA PROJECT No:</b> 1524092	<b>LOCATION:</b> AOC-2			

Note: Focus on EXCEPTIONS to work plan

Injection Point ID and Time	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes
		Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)			
6-8 1150	115	40	0.015	64	10	410	
1154	113	40	0.015	64	8	210	
1159	111	40	0.015	64	10	275	
1202	109	40	0.015	64	13	210	
1207	107	40	0.015	64		200	
1210	105	40	0.015	64	average	275	
1214	103	40	0.015	64	=	300	
1219	101	40	0.015	64	10 or 11	200	
1223	99	40	0.015	64	gpm	175	
1227	97	40	0.015	64		300	
1232	95	45 <del>40</del> HP	0.017	64		210	
6-5 1435	115	40	0.015	64		250	
1441	113	40	0.015	64		250	
1444	111	40	0.015	64		275	
1447	109	40	0.015	64		275	
1456	107	40	0.015	64		275	
1500	105	40	0.015	64		250	
1503	103	40	0.015	64		250	
1509	101	40	0.015	64		200	
1512	99	40	0.015	64		180	
1516	97	40	0.015	64		210	
1523	95	45	0.017	64		210	

note: microbes added into de-oxygenated water just prior to first injection.

Rate 0.45 liters/1200 gal tank

0.19 liters for each 500 gallon tank

Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: DAY: TUESDAY	Report #: 21	PAGE   OF 2
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER: PARTLY CLOUDY, SOME SHOWERS		
REPORT PREPARED BY: H. Peterson		TEMP: 49° F		
PROJECT MANAGER: Jil Frain		WIND: SW, 2 MPH		
TIME ON-SITE: 0700	TIME DEPARTED SITE: 1430			

**PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):**

H. Peterson EA	N. Mainard AEC	D. Phillips AEC
B. Zander AEC	J. Mainard AEC	R. Arad EA (afternoon)

**ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):**

0700 Arrive at trailer to prepare for day.

0800 Mob to AOC-2. AEC setting up equipment. Measured DO in large water tank and one 500 gal tank. Both were between 1.2-4.0 mg/L. Hooking up trash pump/hose to large water tank and adding 4 more L of oxygen scavenger to circulate for an hour. AEC pulling rods at 6-5 to begin drilling next point (6-3).

0845 Filled in 6-5 with 1 bag of bentonite chips.

0900 Park vac truck up by row 8 to begin vac clearing holes 8-1 through 8-8.

0920 Begin drilling 6-3.

0945 Measured DO again. Still above 0.5 mg/L. Large tank is 1.4 mg/L. Finished drilling 6-3.

1000 Drive back to trailer to get more tubes for DO measurements and to fill in Rick about the water situation. Picked up water truck to refill water tanks.

1020 Back onsite at AOC-2. AEC vac clearing at top of row 8 still.

1130 Break for lunch. 3 holes left in row 8 to vac clear.

1230 Back onsite.

1300 Tested DO of large water tank again: 2.1 mg/L (used brand new vials). Drillers to work on completing the vac clearing at top of row 8.

**ITEMS NEEDING ATTENTION:** DO measurements of water in 1200 gal and 500 gal tank were too high to perform injections today. No injections took place today. We will test again in the morning.

**SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:**



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 10/8/19 DAY: TUESDAY	Report #: 21	PAGE 2 OF 2
EA PROJECT No: 1524092		LOCATION: ADC-2		
CONTRACTOR: AEC		WEATHER: PARTLY CLOUDY, SOME SHOWERS		
REPORT PREPARED BY: H. Peterson		TEMP: 49°F		
PROJECT MANAGER: Jil Frain		WIND: SW, 2-8 MPH		
TIME ON-SITE: 0700		TIME DEPARTED SITE: 1430		
PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials): H. Peterson EA → see page 1 of 2.				
ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS): 1330 Walk around with R. head to check row 3 holes for possible vac clearing. Determined no vac clearing necessary at row 3. Vac clearing complete at Row 8. 1400 Moved one 500 gal water tank to Row 8. 1420 AEC to refuel drill rigs and demob back to trailer. 1430 Back at trailer.				
ITEMS NEEDING ATTENTION: See page 1 of 2.				
SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:				

DAILY PHOTOS: Download to project folder



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 10/9/19 DAY: WEDNESDAY	Report #: 22	PAGE 1 OF 4
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER: Sunny, clear		
REPORT PREPARED BY: H. Peterson		TEMP: 36° F (MORNING)		
PROJECT MANAGER: Jil Frain		WIND: NW 1 mph		
TIME ON-SITE: 0700		TIME DEPARTED SITE: 1700		

**PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):**

H. Peterson EA	J. Mamard AEC	D. Phillips AEC
B. Zander AEC	N. Mamard AEC	

**ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):**

- 0700 Arrive at trailer to prepare for the day.
- 0750 Arrive at work site AOC-2. Test water in 1200 gal tank = 1.3 mg/L. 500 gal water tank at row 6 = 3.1 mg/L. 500 gal water tank at row 8 = 1.0 mg/L.
- 0800 Communicated with Jil about possible solutions. She will call OS vendor for other possible solutions.
- 0815 took up trash pump to 1200 gal water tank after adding 2L more OS (as a slurry) to circulate tank.
- 0915 Tested 1200 gal tank for DO after ~1 hr circulation = 1.3 mg/L (no change).
- 1000 Receive word from OS vendor (through Jil) that microbes will still survive in water with 1-3 mg/L DO. Will proceed with injections.
- 1010 Begin injecting at 6-7 hole. Add 2L more OS to 500 gal tank at row 6. Add 1L more OS to 500 gal tank at row 8.
- 1107 6-7 injection complete.
- 1118 Finished pulling rods at 6-7.
- 1128 Begin injecting at 6-3 hole.
- 1145 Clear area around 6-2.

**ITEMS NEEDING ATTENTION:**

**SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:**

DAILY PHOTOS: Download to project folder



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 10/9/19 DAY: WEDNESDAY	Report #: 22	PAGE 2 OF 4
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER: SUNNY, CLEAR		
REPORT PREPARED BY: H. Peterson		TEMP: 55°F (AFTERNOON)		
PROJECT MANAGER: Jill Frain		WIND: SW 3 MPH		
TIME ON-SITE: 0700		TIME DEPARTED SITE: 1700		

PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):

H. Peterson EA	J. Mamard AEC	D. Phillips AEC
B. Zander AEC	N. Mamard AEC	

ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):

- 1218 Injection at 6-3 complete.
- 1230 Break for lunch.
- 1335 Back onsite. Begin drilling down at 6-2.
- 1415 Drilling complete at 6-2. Replace grout discharge pump seal. Tested DO of 500 gal tank at row 6 = 1.2 mg/L. (Decreased to 3 mg/L in 6 hrs sitting in the sun in 55°F).
- 1420 Setting up to push rods at 6-4.
- 1428 Begin injection at 6-2. Begin drilling at 6-4.
- 1514 Injection complete at 6-2.
- 1520 Drilling complete at 6-4 (after pulling rods from 6-2).
- 1535 Begin injection at ~~6-2~~ 6-4.
- 1634 Injection complete at 6-4.
- 1645 Move 1200 gal water tank to row 8 in preparation for tomorrow. AEC filling water tank.
- 1700 Leave site.

ITEMS NEEDING ATTENTION:

SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:

DAILY PHOTOS: Download to project folder

**Injection data Summary Table**  
**Boomsnub/Airco Superfund Site**  
**In-situ Treatment Injections**  
**Hazel Dell, Washington**

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment	<b>CLIENT:</b> Messer	<b>DATE:</b> 10/8/19 <sup>HP</sup> 10/9/19 <b>DAY:</b> TUESDAY <sup>HP</sup> WEDNESDAY	<b>Report #:</b> 22	<b>PAGE</b> 3 <b>OF</b> 4
<b>EA PROJECT No:</b> 1524092	<b>LOCATION:</b> A06-2			

Note: Focus on EXCEPTIONS to work plan

Injection Point ID and Time	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes
		Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)			
6-7 1012	115	40	0.015	64	~10	425	
1016	113	40	0.015	64	~8	375	
1021	111	40	0.015	64	~5	400	
1029	109	40	0.015	64	~10	400	
1033	107	40	0.015	64	~10	350	
1037	105	40	0.015	64	~5	375	
1045	103	40	0.015	64	~13	350	
1048	101	40	0.015	64	~5	350	
1057	99	40	0.015	64	~13	325	
1100	97	40	0.015	64	~13	325	
1103	95	<del>40</del> 45	0.017	64		375	
6-3 1128	115	40	0.015	64	~9 ave	525	
1130	113	40	0.015	64		425	
1134	111	40	0.015	64		500	
1138	109	40	0.015	64		500	
1147	107	40	0.015	64		475	
1151	105	40	0.015	64		575	
1154	103	40	0.015	64		550	
1201	101	40	0.015	64		400	
1205	99	40	0.015	64		500	
1208	97	40	0.015	64		525	
1215	95	40	0.015	64		400	

note: microbes added into de-oxygenated water just prior to first injection.

Rate 0.45 liters/1200 gal tank

0.19 liters for each 500 gallon tank

Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.

### Injection data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

<b>PROJECT NAME:</b>	<b>CLIENT:</b>	<b>DATE:</b> 10/9/19	<b>Report #:</b> 22	<b>PAGE</b> 4 <b>OF</b> 4
Boomsnub In-situ Treatment	Messer	<b>DAY:</b> WEDNESDAY		
<b>EA PROJECT No:</b> 1524092	<b>LOCATION:</b> ADG-2			

Note: Focus on EXCEPTIONS to work plan

Injection Point ID and Time	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes
		Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)			
6-2 1428	115	40	0.015	64	10.5 ave	500	
1431	113	40	0.015	64	 ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	500	
1435	111	40	0.015	64		450	
1438	109	40	0.015	64		450	
1444	107	40	0.015	64		400	
1447	105	40	0.015	64		450	
1450	103	40	0.015	64		450	
1455	101	40	0.015	64		375	
<del>1458</del>	99	40	0.015	64		475	
1501	97	40	0.015	64		500	
1510	95	40	0.015	64		425	
6-4 1535	115	40	0.015	64	8 ave	250	
1539	113	40	0.015	64	 ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	PRESSURE GAUGE BROKE	
1545	111	40	0.015	64		↓ REPLACED	
1549	109	40	0.015	64		375	
1559	107	40	0.015	64		375	
1603	105	40	0.015	64		450	
1607	103	40	0.015	64		425	
1614	101	40	0.015	64		400	
1618	99	40	0.015	64		375	
1623	97	40	0.015	64		350	
1629	95	45	0.017	64			

note: microbes added into de-oxygenated water just prior to first injection.

Rate 0.45 liters/1200 gal tank

0.19 liters for each 500 gallon tank

Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 10/10/19 DAY: THURSDAY	Report #: 23	PAGE 1 OF 4
EA PROJECT No: 1524092		LOCATION: ADC-2		
CONTRACTOR: AEC		WEATHER: SUNNY, CLEAR (		
REPORT PREPARED BY: H. Peterson		TEMP: 33°F (MORNING)		
PROJECT MANAGER: Jill Frain		WIND: 0-3mph from SW		
TIME ON-SITE: 0700		TIME DEPARTED SITE: 1630		

**PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):**  
 H. Peterson EA      J. Mamard AEC      D. Phillips AEC  
 B. Zander AEC      N. Mamard AEC

**ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):**

0700 Arrive at work trailer to load supplies and prepare for the day.  
 0800 Mobilize to ADC-2. AEC pulling rods at 6-2. Fill hole with bentonite. Test 00m 500gal water tank = 5.0 mg/L (at row 6).  
 0815 Test 00m 1200gal water tank (at row 8) = 0.4 mg/L!  
 0830 JM drives to get new fuse for rig. Head back to trailer to talk with Bill about tank insulation possibilities for the coming week(s).  
 0900 Back at ADC-2. AEC moves big rig to row 8 and set up at 8-15.  
 0925 Begin drilling at 8-15.  
 1005 Drilling complete at 8-15.  
 1015 Begin drilling at 8-11.  
 1035 Added 0.45 microbes to 1200 gal water tank.  
 1039 Begin injection at 8-15.  
 1128 Injection complete at 8-15.  
 1130 Break for lunch.  
 1230 Back onsite. Pulling rods from 8-15.  
 1245 Finish drilling to 115' at 8-11.  
 1257 Begin injecting at 8-11. Continue pulling rods from 8-15.  
 1320 Fill 8-15 with bentonite.

**ITEMS NEEDING ATTENTION:**  
 See page 2.

**SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:**

DAILY PHOTOS: Download to project folder

### Injection data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

PROJECT NAME:	CLIENT:	DATE: 10/10/19	Report #: 23	PAGE 3 OF 4
Boomsnub In-situ Treatment	Messer	DAY: THURSDAY		
EA PROJECT No: 1524092	LOCATION: A06-2			

Note: Focus on EXCEPTIONS to work plan

Injection Point ID and Time	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes
		Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)			
8-15 1039	115	40	0.015	64		425	
1042	113	40	0.015	64		325	
1045	111	40	0.015	64		350	
1048	109	40	0.015	64		350	
1056	107	40	0.015	64		300	
1100	105	40	0.015	64		300	
1103	103	40	0.015	64		375	
1110	101	40	0.015	64		225	
1113	99	40	0.015	64		300	
1117	97	40	0.015	64		325	
1124	95	40	0.015	64		400	
8-11 1257	115	40	0.015	64		410	
1259	113	40	0.015	64		325	
1304	111	40	0.015	64		350	
1307	109	40	0.015	64		350	
1313	107	40	0.015	64		275	
1316	105	40	0.015	64		350	
1319	103	40	0.015	64		375	
1325	101	40	0.015	64		275	
1328	99	40	0.015	64		325	
1331	97	40	0.015	64		400	
1338	95	40	0.015	64		275	

note: microbes added into de-oxygenated water just prior to first injection.

Rate 0.45 liters/1200 gal tank

0.19 liters for each 500 gallon tank

Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.





# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 10/11/19 DAY: FRIDAY	Report #: 24	PAGE 1 OF 2
EA PROJECT No: 1524092		LOCATION: ADC-2		
CONTRACTOR: AEC		WEATHER: SUNNY, CLEAR		
REPORT PREPARED BY: H. Peterson		TEMP: 41°F		
PROJECT MANAGER: Jil Frain		WIND: SE ~1 MPH		
TIME ON-SITE: 0700		TIME DEPARTED SITE: 1300		

**PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):**

H. Peterson	EA	J. Mamard	AEC	D. Phillips	AEC
B. Zander	EAC <sup>HP</sup> AEC	N. Mamard	AEC		

**ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):**

- 0700 Arrive at trailer to gather supplies and prepare for day.
- 0745 Arrive at ADC-2. Test DO of water at row 8 = 0.0 mg/L. Warming up the drill rigs. 0.192 microbes added to water (500gal tank).
- 0804 Begin injecting at 8-9.
- 0854 Complete injection at 8-9. Pulling rods.
- 0905 Complete drilling to 115' at 8-12.
- 0915 Begin injection at 8-12.
- 1018 Complete injection at 8-12.
- 1020 Surfacing occurring ~40' west of hole 8-15. Product is not surfacing from any injection point.
- 1030 Mob to row 3. AEC gets water truck to fill 1200 gal tank in preparation for Monday's injections.
- 1100 After monitoring the surfacing leak, made contact with Jil. Checked the vault - empty of product. Discussed with Jil and NM (AEC) and decided to dig a hole at the source of the ooze and plug with bentonite.
- 1120 Bentonite is applied to surfacing point.
- 1130 Surfacing has ceased.
- 1200 Surfacing area cased off with caution tape.
- 1300 Leave site.

**ITEMS NEEDING ATTENTION:** Chem Grout pump part 10c (seal) still leaking, still minor (25gal). Part will be replaced on Monday morning. Surfacing near row 8 is under control after plugging with bentonite. ~20 gal product is cased off as of 1200.

**SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:**

DAILY PHOTOS: Download to project folder

### Injection data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

PROJECT NAME:	CLIENT:	DATE: 10/11/19	Report #: 24	PAGE 2 OF 2
Boomsnub In-situ Treatment	Messer	DAY: FRIDAY		
EA PROJECT No: 1524092	LOCATION: AOC-2			

Note: Focus on EXCEPTIONS to work plan

Injection Point ID and Time	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes
		Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)			
8-9 0804	115	40	0.015	64		400	
0809	113	40	0.015	64		350	
0811	111	40	0.015	64		225	
0816	109	40	0.015	64		200	
0822	107	40	0.015	64		225	
0826	105	40	0.015	64		325	
0831	103	40	0.015	64		250	
0835	101	40	0.015	64		250	
0838	99	40	0.015	64		275	
0845	97	40	0.015	64		225	
0848	95	45	0.017	64		300	
8-12 0915	115	40	0.015	64		350	
0918	113	40	0.015	64		210	
0921	111	40	0.015	64		250	
0925	109	40	0.015	64		200	
0934	107	40	0.015	64		280	
0944	105	40	0.015	64		300	
0948	103	40	0.015	64		300	
0955	101	40	0.015	64		175	
1000	99	40	0.015	64		200	
1009	97	40	0.015	64		175	
1013	95	45	0.017	64		190	

note: microbes added into de-oxygenated water just prior to first injection.

Rate 0.45 liters/1200 gal tank

0.19 liters for each 500 gallon tank

Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 10-14-19 DAY: Monday	Report #: 25	PAGE 1 OF 2
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER: 50-62, Sunny; Fog in morning		
REPORT PREPARED BY: Aaron Bugher		TEMP: 50-62°F		
PROJECT MANAGER: Jil Frain		WIND: 0-5 mph		
TIME ON-SITE: 0745		TIME DEPARTED SITE: 1700		

**PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):**

EA: R Reed, A Bugher  
AEC: N Mainard, J. Mainard, B Zauder

**ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):**

08:45 Arrive on site  
09:00 AEC onsite, cannot inject until pump is fixed  
10:00 JM + BZ Drilling Rods  
12:10 Depart for trailer, collected sump pump & WL meter  
12:30 At AOC-2, measured water in the tank, WL in MW-190 = 11.91'  
AEC Working on Groot pump  
JM + BZ drilling 3-2 to 3-4 to 95' bgs  
1454 Start injecting in 3-2 after issues with pump  
400+ psi  
Could not pull up rod, switched rigs  
1519 restarted injection  
1550 injection complete  
JM + BZ pulled rods from 3-2  
1620 Depart for trailer

**ITEMS NEEDING ATTENTION:** Talk about ants in safety meeting

**SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:**



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 10-15-19 DAY: Tuesday	Report #: 26	PAGE 1 OF 3
EA PROJECT No: 1524092		LOCATION: AOC-2		
CONTRACTOR: AEC		WEATHER: Cloudy, some wind		
REPORT PREPARED BY: Aaron Bugher		TEMP: 41 °F - 64 °F		
PROJECT MANAGER: Jil Frain		WIND: 8 mph - 5 mph ESE		
TIME ON-SITE: 0650		TIME DEPARTED SITE: 1745		

**PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):**

EA: A Bugher, Rick Read  
AEC: N. Maihord, J. Maihord, D. Zander

**ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):**

0645 At trailer  
0700 AEC on site  
0820 At AOC-2  
0830 Begin drilling 3-3 (to 90' bgs) JM DZ, check DO in tank 0.0  
0916 Begin injecting 3-4 JM DZ, monitoring MW-19D (11.91' baseline)  
1000 3-4 injection complete  
~~pull rods from 3-4~~  
1020 Begin injecting 3-3 JM NM  
1030 pulling rods from 3-4, then move rig to 3-5 DZ  
1050 surfacing at 3-2, stopped before final interval  
Drilling 3-5<sup>th</sup>, pulling rods from 3-3 JM (90' bgs)  
1130 Start injecting 3-5 JM NM  
start drilling 3-1 (90' bgs) DZ  
1214 Injection complete 3-5  
1400 start injecting 3-1 NM, JM; pulling rods 3-5 DZ  
1440 Injection complete 3-1  
1500 start drilling 6-1 DZ, filling up tanks NM  
1645 At trailer

**ITEMS NEEDING ATTENTION:**

**SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:**

DAILY PHOTOS: Download to project folder

**Injection Data Summary Table**  
**Boomsnub/Airco Superfund Site**  
**In-situ Treatment Injections**  
**Hazel Dell, Washington**

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 10-15-19 DAY: Tuesday	Report #: 26	PAGE 2 of 3
EA PROJECT No: 1524092	LOCATION: AOC-2			

Note: Focus on EXCEPTIONS to work plan

Start

0916  
0921  
0925  
0931  
0938  
0942  
0945  
0948  
0952  
1000

Injection Point ID	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes
		Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)			
3-4	90	40		62	225	WL=11.91' MW-170	
3-4	88	40		62	275	WL=11.91' 0919	
3-4	86	40		62	300	WL=11.85' 0922	
3-4	84	45		62	375	WL=11.95' 0926	
3-4	82	40		62	300	WL=11.87' 0929	
3-4	80	40		62	-	WL=12.03' 0932	
3-4	78	40		62	275	WL=11.91' 0934	
3-4	76	45		62	250	WL=11.98' 0946	
Pump off						WL=12.02' 0953	
						WL=11.96' 1001	
						WL=11.92' 1003	
3-3	90	40		62	350	WL=11.93' 1022	
3-3	88	40		62	350		
3-3	86	45		62	350		
3-3	84	40		62	325		
3-3	82	40		62	325	WL=12.02' 1037	
3-3	80	40		62	350		
3-3	78	40		62	350		
3-3	76 *			62		* Stopped right before, surface of 3-4 + 3-2 1052 WL=11.96	

baseline

not pumping  
WL=11.98' 0937

095  
WL=12.87

note: microbes added into de-oxygenated water just prior to first injection.  
 Rate: 0.45 liters OS/1,200 gal tank, 0.19 liters for each 500 gallon tank  
 Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.

**Injection Data Summary Table**  
 Boomsnub/Airco Superfund Site  
 In-situ Treatment Injections  
 Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment	<b>CLIENT:</b> Messer	<b>DATE:</b> 10-15-19	<b>Report #:</b> 26	<b>PAGE</b> 3 of 3
<b>EA PROJECT No:</b> 1524092	<b>LOCATION:</b> A06-2	<b>DAY:</b> Tuesday		

Note: Focus on EXCEPTIONS to work plan

Injection Point ID	Depth (ft bgs)	Quantity			Injection Rate (gpm)	Injection Pressure (psi) at pump	Notes
		Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)			
1130	3-5	90	80	124		325	Extra pounds from 3-3
1138	3-5	88	40	62		350	
1143	3-5	86	45	62		350	
1148	3-5	84	40	62		325	
1151	3-5	82	40	62		350	
1156	3-5	80	40	62		325	
1200	3-5	78	40	62		325	
1208	3-5	76	45	62		350	
1208	Complete						
1214	Complete						
1400	3-1	90	40	62		375	WL=11.91' 13:56 MU-197
1404	3-1	88	40	62		375	WL=11.90' 14:02
1410	3-1	86	40	62		350	WL=11.95' 14:04
1420	3-1	84	45	62		325	WL=11.84' 14:10
1424	3-1	82	40	62		300	WL=11.85' 14:14
1428	3-1	80	40	62		275	WL=11.85' 14:21
1434	3-1	78	40	62		275	WL=11.90' 14:29
1437	3-1	76	50	62		250	
1440	Complete						

note: microbes added into de-oxygenated water just prior to first injection.  
 Rate: 0.45 liters OS/1,200 gal tank, 0.19 liters for each 500 gallon tank  
 Confirm O2 < 0.5 mg/l using test kit before adding bugs. Take dip from top of tank.



# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 10-16-19 DAY: Wednesday	Report #: 27	PAGE 1 OF 3
EA PROJECT No: 1524092		LOCATION: ACC-2		
CONTRACTOR: AEC		WEATHER: Rain		
REPORT PREPARED BY:		TEMP: 53F - 57F		
PROJECT MANAGER: Jil Frain		WIND: 5mph - 10mph SSE		
TIME ON-SITE: 0645		TIME DEPARTED SITE: 1745		

### PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):

EA: A Bayher, R Read, G Lee, P Ehlman, H Dennis  
 AEC: N Mairned SM<sup>a</sup>, B Zander

### ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):

0645 At trailer  
 0700 AEC on site  
 0830 Tested tanks 1.6 for row 6 tank, 2.4 for tank 8  
 0950 Start injecting 6-1  
 1041 Injection complete  
 1105 Begin drilling 8-2 to 80'  
 1130 Break  
 1300 move rig to pull rods from 6-1, then push to 80' on 8-2  
 1400 Finished drilling 8-2  
 1500 Start injecting at 80' 8-2  
 1520 Injection complete, start drilling to 135'  
 1540 Start injecting at 135'  
 1604 Injection complete  
 1610 Pulling rods from 8-2  
 1630 setting up to drill 8-3  
 1645 Start drilling 8-3 to 140'  
 1730 off site

### ITEMS NEEDING ATTENTION:

### SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:

DAILY PHOTOS: Download to project folder







## Injection Summary

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 10-17-19 DAY: Thursday	Report #: 28	PAGE 2 OF 3
EA PROJECT No: 1524092		LOCATION: AOC-2		

**Note: Only record exceptions to work plan**

Injection Point ID (Row-ID)	Time	Depth (ft bgs)	Quantity Injected			Injection Rates (gpm)	Injection Pressure (psi)
			Anaerobic Water (gal)	Microbes (L)	Product Slurry (gal) (lbs)		
<del>110</del> 8-3	0924	140	40		62		350
8-3	0927	138	40		62		375
8-3	0930	136	40		62		350
8-3	0933	134	40+5		62		375
8-3	0939	132	40		62		375
8-3	0942	130	40		62		375
8-3	0945	128	40		62		375
8-3	0948	126	40+5		62		350
8-3	0954	124	40		62		375
8-3	0959	122	40		62		350
8-3	1002	120	40+5		62		375
	1006	Complete					
8-6	1053	126	30		50		300
8-6	1056	124	30		50		275
8-6	1059	122	30+5		50		275
8-6	1102	120	30		50		300
8-6	1106	118	30		50		275
8-6	1110	116	30+5		50		275
8-6	1114	114	30		50		250
8-6	1117	112	30		50		250
8-6	1120	110	30+5		50		250
	1123	Complete					

0928  
 Amw-59  
 21.46  
 0930  
 MW-14E  
 21.45  
 0940  
 MW-14E  
 21.41  
 0956  
 Amw-59  
 20.93  
 0957  
 MW-14E  
 21.35  
 1102  
 WL MW-14E  
 13.7  
 1107  
 MW-14E  
 13.5





# DAILY CONSTRUCTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment	CLIENT: Messer	DATE: 10-17-19 DAY: Thursday	Report #: 28	PAGE 1 OF 3
EA PROJECT No: 1524092		LOCATION: AOC-7		
CONTRACTOR: AEC		WEATHER: Cloudy, Rain		
REPORT PREPARED BY: ABugher		TEMP: 51-55		
PROJECT MANAGER: Jil Frain		WIND: 5-10 mph SSE		
TIME ON-SITE: 0650		TIME DEPARTED SITE: 1830		

### PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials):

AEC: N Matnard, B Zando, T Anderson  
EA: ABugher, R Lead, C Lee, P Ehtman, M Dennis, J Frain

### ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):

0700 AEC on site  
0910 DO 1.1 tank B  
0924 Start injecting 8-3  
1006 Finished injecting 8-3, drilling 8-6 (at 95' ran out of rods)  
Pulling rods from 8-3, Filled small tank (7.1 DO)  
1042 Drilling complete 8-6  
1053 Start injecting 8-6  
1055 Pulling remaining rods from 8-3, start drilling 8-8 (126')  
1123 injection complete 8-6  
1339 start injecting 8-8  
1350 Start drilling 8-1 (140')  
1421 injection complete 8-8, small tanks DO 0.7  
1540 Drilling complete 8-1  
1546 start injecting 8-1  
1605 Rapid water increase in Apr 55, shut off pump, put cap in well, water turned black, well cap popped off, product in vault/well.

### ITEMS NEEDING ATTENTION:

### SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:

DAILY PHOTOS: Download to project folder

## **Appendix C**

### **Phase IIB Round 1 Daily Injection Reports**



# DAILY INJECTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment Phase IIB	<b>CLIENT:</b> Messer, LLC	<b>DATE:</b> 4/28/20	<b>Report #:</b> 1	<b>PAGE:</b> OF: 1 of 2
<b>EA PROJECT No:</b> 1524099	<b>LOCATION:</b> AOC-3 <b>Property:</b>			
<b>CONTRACTOR:</b> Anderson Env. Contracting	<b>WEATHER:</b> Scattered clouds, partly Sunny			
<b>REPORT PREPARED BY:</b> RICK REAP	<b>TEMP:</b> 52-72			
<b>PROJECT MANAGER:</b> J. Reeve	<b>WIND:</b> SW 5-10 mph			
<b>TIME ON-SITE:</b> 7:00	<b>TIME DEPARTED SITE:</b> 5:00			
<b>PERSONNEL ONSITE (include subcontractors; verify proper PPE &amp; credentials):</b> Nathan Mainard - AEC, Brian Zander - AEC, Blake Philips - AEC Brooke Haines - EA				
<b>ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):</b> Row 3 - POINT 1 9:00 Begin pushing rods to 90ft Bgs. Water Tested DO = 0.6 10:00 Pumped water into grout pump & hoses to check for leaks. Pump seals below Hopper leaking, Sent Brian Zander to Kelso to get seal kit. 13:20 Pump back together and working. No leaks. Tip stuck shut on Rod point. No injection product pumping into formation. 13:30 Pulling rods to fix tip. <del>14:10</del> 14:10 Rods pushed back down to 90ft. Injected one hopper full and saw product surfacing 14:23 Pulling rods. Going to plug hole and move to another point. 14:34 Rods pulled, Lost injection point.				
<b>ITEMS NEEDING ATTENTION:</b>				
<b>SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:</b>				

DAILY PHOTOS: Upload to project folder

### Injection data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

<b>PROJECT NAME:</b>	<b>CLIENT:</b>	<b>Report #:</b>	<b>PAGE:</b> 2
Boomsnub In-situ Treatment Phase IIB	Messer, LLC	<b>DATE:</b> 4/29/20	2 <b>OF:</b> 2
<b>EA PROJECT No:</b> 1524099	<b>LOCATION:</b> AOC-3 Property:		<b>Name:</b> Brooke Haines

Note: Focus on EXCEPTIONS to work plan

Injection Row - Point ID and Time	Depth (ft bgs)	Injection Rate (gpm)	Injection Pressure (psi) at pump	Quantity			Injection Notes
				Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)	
3-14/10:04	90	Pushing rod					
10:32	90	7	L/H	64		62	
10:37	88	21	L/H	64		62	
10:40	86	21	L/H	64		62	
10:43	84	16	300	64		62	
10:49	82	21	300	64		62	
10:52	80	21	L/H	64		62	
10:55	78	21	L/H	64		62	
10:58	76	32	L/H	64		62	
3-11/12:14			L/H - 300	64		62	Sur Facing, stopped
12:27	76	21	300	64		62	
12:36	78	12.8	L/H	64		62	
12:47	80	21	L/H	64		62	
12:55	82	12.8	L/H	64		62	
2:15 1:04	84	12.8	L/H	64		62	
2:20	86	21	L/H	64		62	
2:23	88	21	L/H	64		62	
2:26	90	21	L/H	64		62	
3-6/4:23	76	21	L/H	64		62	
4:26	78	16	L/H	64		62	
4:32	80	16	L/H	64		62	
4:37	82	12.8	L/H	64		62	
4:42	84	12.8	L/H	64		62	
4:50	86	12.8	L/H	64		62	
4:55	88	12.8	L/H	64		62	
4:58	90	12.8	L/H	64		62	

**Slurry mixing rates and notes:**

0.45 liters microbes/1200 gal tank, or 0.19 liters microbes for each 500 gallon tote

Approximately 64 lbs of EHC Plus per interval

2 dry quart NZOS per 500 gallons water (1 g/L is most accurate). Follow mixing flyer



# DAILY INJECTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment Phase IIB	<b>CLIENT:</b> Messer, LLC	<b>DATE:</b> 4/29/20	<b>Report #:</b> 2	<b>PAGE:</b> 1 <b>OF:</b> 2
<b>EA PROJECT No:</b> 1524099		<b>LOCATION:</b> AOC-3 <b>Property:</b>		
<b>CONTRACTOR:</b> Anderson Env. Contracting		<b>WEATHER:</b> Partly cloudy - Sunny		
<b>REPORT PREPARED BY:</b> Brooke Haines		<b>TEMP:</b> 53°		
<b>PROJECT MANAGER:</b> J. Reeve		<b>WIND:</b> breeze		
<b>TIME ON-SITE:</b> 9:00		<b>TIME DEPARTED SITE:</b> 5:35		
<b>PERSONNEL ONSITE (include subcontractors; verify proper PPE &amp; credentials):</b>				
Nathan Mainard - AEC, Brian Zandor - AEC, Blake Phillips - AEC Brooke Haines - EA, Jonathan Reeve - EA				
<b>ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):</b>				
water tested DO = 0.8				
9:55 - Row 3 - Point 14, Begin pushing rods to 90 ft Bgs.				
10:32 - started pumping				
11:10 - Pulling rod to move to next hole. Used larger rod to seal hole after product began to surface.				
11:45 - Row 3 - Point 11, Begin pushing rods to 90 ft Bgs				
12:15 - started surfacing. Pulled up to next interval and still surfaced.				
1:02 - issues with check valve				
2:15 - started pumping again. Interval 84.				
3:55 - Row 3 - Point 6 Begin pushing rods to 70 ft Bgs				
4:23 - Began pumping.				
5:01 - Finished pumping 3-6				
<b>ITEMS NEEDING ATTENTION:</b>				
<b>SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:</b>				

DAILY PHOTOS: Upload to project folder



### Injection data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

<b>PROJECT NAME:</b>	<b>CLIENT:</b>	<b>DATE:</b> 4/30/20	<b>Report #:</b>	<b>PAGE:</b> 2
Boomsnub In-situ Treatment Phase IIB	Messer, LLC		3	<b>OF:</b> 3
<b>EA PROJECT No:</b> 1524099	<b>LOCATION: AOC-3 Property:</b>		<b>Name:</b> Brooke Haines	

Note: Focus on EXCEPTIONS to work plan

Injection Row - Point ID and Time	Depth (ft bgs)	Injection Rate (gpm)	Injection Pressure (psi) at pump	Quantity			Injection Notes
				Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)	
3-5/8:20	76	21.3	L/H	64		62	
8:23	78	21.3	L/H	64		62	
8:28	80	21.3	L/H	64		62	
8:31	82	12.8	L/H	64		62	
8:39	84	21.3	L/H	64		62	
8:42	86	16	L/H	64		62	
8:46	88	16	L/H	64		62	
8:49	90	12.8	L/H	64		62	
3-10/10:18	76		L/H	64		62	Top of tal leaking
3-10/12:00	<del>78</del> <sup>76</sup>	21.3	L/H	64		62	
12:04	<del>80</del> <sup>78</sup>	21.3	L/H	64		62	
12:10	<del>82</del> <sup>80</sup>	21.3	L/H	64		62	
12:14	<del>84</del> <sup>82</sup>	21.3	L/H	64		62	
12:18	<del>86</del> <sup>84</sup>	21.3	L/H	64		62	
12:21	<del>88</del> <sup>86</sup>	21.3	L/H	64		62	
12:25	<del>90</del> <sup>88</sup>	21.3	L/H	64		62	
12:27	90	21.3	L/H	64		62	
2:00/39	76	21.3	300	64		62	
2:03	78	21.3	300	64		62	leak at T.
2:34	80	16	300	64		62	
2:38	82	21.3	300	64		62	
2:41	84	21.3	300	64		62	
2:52	86	21.3	L/H	64		62	
2:55	88	21.3	L/H	64		62	
2:59	90	21.3	L/H	64		62	

Slurry mixing rates and notes: Replaced Rubber Seal/Injection Fittings.  
 0.45 liters microbes/1200 gal tank, or 0.19 liters microbes for each 500 gallon tote  
 Approximately 64 lbs of EHC Plus per interval  
 2 dry quart NZOS per 500 gallons water (1 g/L is most accurate). Follow mixing flyer



# DAILY INJECTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment Phase IIB	<b>CLIENT:</b> Messer, LLC	<b>DATE:</b> 8/30/20	<b>Report #:</b> 3	<b>PAGE:</b> 1 <b>OF:</b> 3
<b>EA PROJECT No:</b> 1524099		<b>LOCATION:</b> AOC-3 <b>Property:</b>		
<b>CONTRACTOR:</b> Anderson Env. Contracting		<b>WEATHER:</b> 50°, partly cloudy		
<b>REPORT PREPARED BY:</b> Brooke Haines		<b>TEMP:</b> 50-53°		
<b>PROJECT MANAGER:</b> J. Reeve		<b>WIND:</b> none		
<b>TIME ON-SITE:</b> 7:00		<b>TIME DEPARTED SITE:</b> 5:20		
<b>PERSONNEL ONSITE (include subcontractors; verify proper PPE &amp; credentials):</b> Nathan Mainard - AEC, Brian Zander - AEC, Blake Philips - AEC, Brooke Haines - EA				
<b>ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):</b>				
7:34 - removed plug from 3-6 After getting supplies for day from storage building at 7:00				
7:40 - Row 3, point 5 <sup>th</sup> Tested water DO = 0.5, Added microbes, Health and Safety meeting				
7:50 - Row 3 point 5 - pushing in drill.				
8:20 - started pumping				
8:55 - finished pumping 3-5, pulled rods, refilled Geoprobe with liquid in truck bed				
9:40 - started pushing in rods at 3-10				
10:18 - started pumping, 10:23 top of rod started leaking, stopped pumping, tightened pump hose.				
10:58 - Nate went to hydraulic shop to buy new piece. Injection fitting broke				
12:00 - started pumping 3-10				
12:29 - finished pumping 3-10				
1:21 - started pushing rods for Row 3, point 9				
2:00 - started pumping 3-9				
2:07 - Leaking at metal T on chem brot. stopped pumping, replaced rubber seal.				
2:34 - started pumping, no leak				
3:06 - pulled rods removed plug from 3-10 end put in 3-9, moved to 3-1 to set up.				
3:49 - started pushing rods for Row 3, point 1				
4:05 - started pumping 3-1				
4:35 - finished pumping 3-1, Filled water tank on site, packed up and went to trailer.				
<b>ITEMS NEEDING ATTENTION:</b>				
<b>SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:</b> Replaced injection fitting and rubber seal.				

DAILY PHOTOS: Upload to project folder





# DAILY INJECTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment Phase IIB	<b>CLIENT:</b> Messer, LLC	<b>DATE:</b> 5/12/20	<b>Report #:</b> 4	<b>PAGE:</b> 1 <b>OF:</b> 2
<b>EA PROJECT No:</b> 1524099		<b>LOCATION:</b> AOC-3 <b>Property:</b>		
<b>CONTRACTOR:</b> Anderson Env. Contracting		<b>WEATHER:</b> Sunny		
<b>REPORT PREPARED BY:</b> Brooke Haines		<b>TEMP:</b> 39°		
<b>PROJECT MANAGER:</b> J. Reeve		<b>WIND:</b> none		
<b>TIME ON-SITE:</b> 7:00		<b>TIME DEPARTED SITE:</b> 12:00		
<b>PERSONNEL ONSITE (include subcontractors; verify proper PPE &amp; credentials):</b>				
Brian Zander, Blake Phillips, Nate Mainard, Brooke Haines Blake was called to another job.				
<b>ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):</b>				
Arrived at trailer at 7:00. Got equipment for day and arrived at row 3 at 7:14. Brian pulled rods from 3-1 while Blake and Nate got more carbon product.				
8:12 - started pushing in rods for row 3, point 12 (filled with <sup>BH</sup> water when Nate came back with materials)				
Tested water DO = 0.9				
8:33 - started pushing rods for row 3, point 12. Finished at 8:53				
9:11 - started injecting.				
9:20 - pump broke. Halted work. Pump was leaking, decided to finish 3-12 and then stop work.				
9:36 - resumed pumping 3-12.				
9:45 - stopped at 5 <sup>th</sup> interval due to high leakage. Packed up equipment				
11:30 - Arrived at trailer to put away equipment and leave site.				
<b>ITEMS NEEDING ATTENTION:</b>				
<b>SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:</b>				

DAILY PHOTOS: Upload to project folder



# DAILY INJECTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment Phase IIB	<b>CLIENT:</b> Messer, LLC	<b>DATE:</b> 5/4/20	<b>Report #:</b> 5	<b>PAGE:</b> 1
		<b>OF:</b> 2		
<b>EA PROJECT No:</b> 1524099		<b>LOCATION:</b> AOC-3 <b>Property:</b>		
<b>CONTRACTOR:</b> Anderson Env. Contracting		<b>WEATHER:</b> Partly Sunny to mostly cloudy		
<b>REPORT PREPARED BY:</b> RICK READ		<b>TEMP:</b> 42-70°		
<b>PROJECT MANAGER:</b> J. Reeve		<b>WIND:</b> SW 0-10		
<b>TIME ON-SITE:</b> 9:00		<b>TIME DEPARTED SITE:</b> 17:00		
<b>PERSONNEL ONSITE (include subcontractors; verify proper PPE &amp; credentials):</b>				
Nathan Mainard-AEC, Daniel Philipos-AEC				
AEC stepped up safety measures for Covid-19 (Handwashing station, masks, social distancing)				
<b>ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):</b>				
9:00-10:00 Discussing last week progress and issues, loading EHC+				
10:00 Set up grout pump				
10:15 Safety Meeting				
11:05 Pulling Rods at 3-12, 11:27 Chipping hole with bentonite.				
11:40-12:40 Lunch				
12:40 Setting up to Push Rods at 3-8				
13:20 Start injecting at 3-8				
14:09 Pulling Rods at 3-8				
14:30 Getting more EHC+ from Warehouse				
15:00 Setting up on 3-4, 15:05 Pushing Rods at 3-4				
16:32 Finished last interval at 3-4, Refilling Water tank and adding Newman's Zone, cleaning up.				
17:00 Done for the day.				
<b>ITEMS NEEDING ATTENTION:</b>				
<b>SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:</b>				

DAILY PHOTOS: Upload to project folder

### Injection data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

<b>PROJECT NAME:</b>	<b>CLIENT:</b>	<b>DATE:</b> 5/4/20	<b>Report #:</b>	<b>PAGE:</b> 2
Boomsnub In-situ Treatment Phase IIB	Messer, LLC		5	<b>OF:</b> 2
<b>EA PROJECT No:</b> 1524099	<b>LOCATION:</b> AOC-3 <b>Property:</b>		<b>Name:</b> Rick READ	

Note: Focus on EXCEPTIONS to work plan

	Injection Row - Point ID and Time	Depth (ft bgs)	Injection Rate (gpm)	Injection Pressure (psi) at pump	Quantity			Injection Notes
					Anaerobic Water (gal)	Microbes (L-see notes)	Product (lb)	
10:46	3-12	80	9	225-325	64		62	
10:53	3-12	78	9	200-350	64		62	
11:02	3-12	76	9	200-350	64		62	
	—	—	—	<del>250-350</del>	—	—	—	
13:20	3-8	90	9	250-350	64		62	
13:29	3-8	88	9	250-350	64		62	
13:38	3-8	86	9	200-325	64		62	
13:45	3-8	84	9	200-300	64		62	
13:52	3-8	82	9	200-300	64		62	
13:58	3-8	80	10	225-300	64		62	
14:04	3-8	78	10	200-300	64		62	
14:09	3-8	76	11	200-300	64		62	
15:43	3-4	90	9	225-325	64		62	
15:50	3-4	88	9	200-350	64		62	
15:57	3-4	86	9	200-325	64		62	
16:04	3-4	84	9	200-300	64		62	
16:14	3-4	82	9	200-300	64		62	
16:19	3-4	80	9	200-300	64		62	
16:25	3-4	78	9	200-300	64		62	
16:32	3-4	76	9	200-300	64		62	

**Slurry mixing rates and notes:**  
 0.45 liters microbes/1200 gal tank, or 0.19 liters microbes for each 500 gallon tote  
 Approximately 64 lbs of EHC Plus per interval  
 2 dry quart NZOS per 500 gallons water (1 g/L is most accurate). Follow mixing flyer

**TAILGATE SAFETY MEETING FORM**

Date: 5/4/20 Time: 10:00 Job Number: 1524099

Client: Messer - In-Situ Treatment OU3 Phase II

Site Specific Location: Padden

**Safety Topics Presented**

Protective Clothing/Equipment: Masks, gloves, hard hats, Safety glasses, high visibility Vests.

Chemical Hazards: \_\_\_\_\_

Physical Hazards: Pinch points, trips/falls

Special Equipment: \_\_\_\_\_

Other (Accident Prevention Program): \_\_\_\_\_

Emergency Procedures: \_\_\_\_\_

Hospital: \_\_\_\_\_ Phone: \_\_\_\_\_ Ambulance Phone: \_\_\_\_\_

Hospital Address and Route: \_\_\_\_\_

**ATTENDEES**

NAME PRINTED	FIRM	SIGNATURE
<u>Daniel Phillips</u>	<u>AEC</u>	
<u>Nathan Mainard</u>	<u>AEC</u>	

Meeting Conducted By: \_\_\_\_\_  
Name Printed Signature

Project Safety Officer: Rick READ Project Manager: Jonathan Reeve



# DAILY INJECTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment Phase IIB	<b>CLIENT:</b> Messer, LLC	<b>DATE:</b> 5/5/20	<b>Report #:</b> 6	<b>PAGE:</b> 1
		<b>OF:</b> 2		
<b>EA PROJECT No:</b> 1524099		<b>LOCATION:</b> AOC-3	<b>Property:</b> Padden	
<b>CONTRACTOR:</b> Anderson Env. Contracting		<b>WEATHER:</b> Sunny		
<b>REPORT PREPARED BY:</b> Rick READ		<b>TEMP:</b> 50-70		
<b>PROJECT MANAGER:</b> J. Reeve		<b>WIND:</b> SW 0-5		
<b>TIME ON-SITE:</b> 7:00 Am		<b>TIME DEPARTED SITE:</b> 5:00 Pm		
<b>PERSONNEL ONSITE (include subcontractors; verify proper PPE &amp; credentials):</b>				
Nathan Mainard - AEC, Daniel Phillips - AEC				
<b>ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):</b>				
7:00 AEC Arrived Loaded EHL+, Water tested at 0.2				
7:20 Begin Pulling Rods at 3-4				
8:00 Moving Rig to 3-3				
8:10 Pushing Rods at 3-3 to 90'				
9:36 Begin injecting				
10:45 Pulling Rods at 3-3				
11:10 Moved Rig to 3-13				
11:15 Pushing Rod to 90' at 3-13				
11:55 Lunch				
AEC out of gloves				
14:20 Worker from AEC Kelso office brought more gloves & ppe				
15:15 AEC grinding off mushrooming on rods that are getting worn.				
15:20 Check valve at top of rods not working. Letting rods sit at 80' till pressure resides.				
16:32 Finished 3-4				
AEC Cleaning up				
17:00 Done				
<b>ITEMS NEEDING ATTENTION:</b>				
<b>SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:</b>				

DAILY PHOTOS: Upload to project folder



**TAILGATE SAFETY MEETING FORM**

Date: 5/5/20 Time: 7:10 Job Number: 1524099

Client: MESSER

Site Specific Location: Padden

**Safety Topics Presented**

Protective Clothing/Equipment: Hard hat, Vest, Mask, gloves

Chemical Hazards: \_\_\_\_\_

Physical Hazards: Pinch Points, trips/falls

Special Equipment: Hand washing station and hand sanitizer

Other (Accident Prevention Program): Social Distancing 6'

Emergency Procedures: \_\_\_\_\_

Hospital: \_\_\_\_\_ Phone: \_\_\_\_\_ Ambulance Phone: \_\_\_\_\_

Hospital Address and Route: \_\_\_\_\_

**ATTENDEES**

NAME PRINTED	FIRM	SIGNATURE
<u>Nathan Mainard</u>	<u>AEC</u>	
<u>Daniel Phillips</u>	<u>AEC</u>	

Meeting Conducted By: Rick READ  
Name Printed Signature

Project Safety Officer: Richard Read Project Manager: Jonathan REEVE





# DAILY INJECTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment Phase IIB	<b>CLIENT:</b> Messer, LLC	<b>DATE:</b> 5/6/20	<b>Report #:</b> 7	<b>PAGE:</b> 1 <b>OF:</b> 2
<b>EA PROJECT No:</b> 1524099		<b>LOCATION:</b> AOC-3 <b>Property:</b> Padden		
<b>CONTRACTOR:</b> Anderson Env. Contracting		<b>WEATHER:</b> <del>50-70</del> Partly Cloudy		
<b>REPORT PREPARED BY:</b> Rick READ		<b>TEMP:</b> 50-70		
<b>PROJECT MANAGER:</b> J. Reeve		<b>WIND:</b> 10-15 SW		
<b>TIME ON-SITE:</b> 7:00		<b>TIME DEPARTED SITE:</b>		
<b>PERSONNEL ONSITE (include subcontractors; verify proper PPE &amp; credentials):</b> Daniel Phillips - AEC, Nathan Mainard - AEC, Brian Zander - AEC				
<b>ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):</b>				
7:00 Loading EHC +				
7:20 Pulling Rods, Water tested at 0.2				
8:10 Dremel Rods for tighter <del>connections</del> Connections, fixing leaky gasket on Pump				
9:51 Setting up on 3-7 and Pushing Rods to 90'				
10:10 Begin injecting at 3-7				
10:40 AEC having problem with throttle on Geoprobe Rig.				
11:00 Got Probe Rig working				
11:10 Resumed injecting at 3-7				
11:34 Finished 3-7, Pulling Rods				
12:30 Lunch				
13:22 Pushing Rod at 3-2 to 90'				
<b>ITEMS NEEDING ATTENTION:</b>				
<b>SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:</b>				

DAILY PHOTOS: Upload to project folder

### Injection data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

<b>PROJECT NAME:</b>	<b>CLIENT:</b>	<b>DATE:</b> 5-8-20	<b>Report #:</b>	<b>PAGE:</b> 2
Boomsnub In-situ Treatment Phase IIB	Messer, LLC		8	OF: 2
<b>EA PROJECT No:</b> 1524099	<b>LOCATION:</b> AOC-3 Property: <i>County Park</i>		<b>Name:</b> <i>Rick READ</i>	

Note: Focus on EXCEPTIONS to work plan

	Injection Row - Point ID and Time	Depth (ft bgs)	Injection Rate (gpm)	Injection Pressure (psi) at pump	Quantity			Injection Notes
					Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)	
9:14	1-1	90		250-325	62		64	
9:18	1-1	88		250-325	62		64	
9:22	1-1	86		225-300	62		64	
9:28	1-1	84		200-300	62		64	
10:34	1-1	82		200-300	62		64	
10:39	1-1	80		200-300	62		64	
11:10	1-1	78		200-300	62		64	
11:18	1-1	76		200-300	62		64	
14:12	1-2	90		250-325	62		64	
14:16	1-2	88		250-325	62		64	
14:19	1-2	86		225-300	62		64	
14:24	1-2	84		200-300	62		64	
14:28	1-2	82		200-300	62		64	
14:34	1-2	80		200-300	62		64	
14:39	1-2	78						
14:45	1-2	76						
	1-2	Leaving Rods in						

**Slurry mixing rates and notes:**

0.45 liters microbes/1200 gal tank, or 0.19 liters microbes for each 500 gallon tote  
 Approximately 64 lbs of EHC Plus per interval  
 2 dry quart NZOS per 500 gallons water (1 g/L is most accurate). Follow mixing flyer



# DAILY INJECTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment Phase IIB	<b>CLIENT:</b> Messer, LLC	<b>DATE:</b> 5-8-20	<b>Report #:</b> 8	<b>PAGE:</b> 1 <b>OF:</b> 2
<b>EA PROJECT No:</b> 1524099		<b>LOCATION:</b> AOC-3 <b>Property:</b> County Park		
<b>CONTRACTOR:</b> Anderson Env. Contracting		<b>WEATHER:</b> Clear, Sunny		
<b>REPORT PREPARED BY:</b>		<b>TEMP:</b> 60-83		
<b>PROJECT MANAGER:</b> J. Reeve		<b>WIND:</b> 20 mph E		
<b>TIME ON-SITE:</b> 7:00		<b>TIME DEPARTED SITE:</b>		
<b>PERSONNEL ONSITE (include subcontractors; verify proper PPE &amp; credentials):</b> Nathan Mainard - AEC, Brian Zander - AEC, Daniel Philips - AEC				
<b>ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):</b> 7:30 Mobilizing to Luke Jensen Park, setting up, Water at 0.2 8:42 Begin pushing Rod at 1-1 9:30 stopped to let pressure at 1-1 come down before breaking rods to prevent product from spraying out. 10:40 Stopped to let pressure subside 11:10 Resumed injecting at 1-1 11:25 Finished last interval at 1-1 and begin slowly pulling rods 11:50 Lunch 13:30 Finish Pulling Rods at 1-1 moving to 1-2 13:46 Begin Pushing Rods at 1-2 to 90'. 14:10 Finish Pushing Rods at 1-2 15:07 Wrapping up at park.				
<b>ITEMS NEEDING ATTENTION:</b>				
<b>SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:</b>				

DAILY PHOTOS: Upload to project folder

### Injection data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

<b>PROJECT NAME:</b>	<b>CLIENT:</b>	<b>DATE:</b> 5/11/20	<b>Report #:</b>	<b>PAGE:</b> 2
Boomsnub In-situ Treatment Phase IIB	Messer, LLC		9	<b>OF:</b> 2
<b>EA PROJECT No:</b> 1524099	<b>LOCATION:</b> AOC-3 <b>Property:</b> <i>County Park</i>		<b>Name:</b> <i>Rick READ</i>	

Note: Focus on EXCEPTIONS to work plan

Injection Row - Point ID and Time	Depth (ft bgs)	Injection Rate (gpm)	Injection Pressure (psi) at pump	Quantity			Injection Notes
				Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)	
10:00	1-3	90	250-350	62		64	
10:07		88	225-325	62		64	
10:12		86	225-200	62		64	
10:15		84	225-300	62		64	
10:20		82	200-300	62		64	
10:25		80	200-300	62		64	
10:29		78	200-300	62		64	
10:35		76	200-300	62		64	
13:07	1-5	90	250-350	62		64	
13:11		88	250-350	62		64	
13:18		86	225-325	62		64	
13:23		84	225-325	62		64	
13:27		82	200-300	62		64	
13:34		80	200-300	62		64	
13:43		78	200-300	62		64	
13:49		76	200-300	62		64	
						64	
14:58	1-4	90	250-350	62		64	
15:04		88	250-350	62		64	
15:08		86	250-350	62		64	
15:14		84	250-350	62		64	
15:20		82	200-325	62		64	
15:25		80	200-300	62		64	
15:30		78	200-300	62		64	
15:35		76	200-300	62		64	

**Slurry mixing rates and notes:**

0.45 liters microbes/1200 gal tank, or 0.19 liters microbes for each 500 gallon tote  
 Approximately 64 lbs of EHC Plus per interval  
 2 dry quart NZOS per 500 gallons water (1 g/L is most accurate). Follow mixing flyer



# DAILY INJECTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment Phase IIB	<b>CLIENT:</b> Messer, LLC	<b>DATE:</b> 5/11/20	<b>Report #:</b> 9	<b>PAGE:</b> 1 <b>OF:</b> 2
<b>EA PROJECT No:</b> 1524099		<b>LOCATION:</b> AOC-3	<b>Property:</b> County Park	
<b>CONTRACTOR:</b> Anderson Env. Contracting		<b>WEATHER:</b> cloudy		
<b>REPORT PREPARED BY:</b>		<b>TEMP:</b> 61		
<b>PROJECT MANAGER:</b> J. Reeve		<b>WIND:</b> 0-5 SW		
<b>TIME ON-SITE:</b> 8:00		<b>TIME DEPARTED SITE:</b> 5:00		
<b>PERSONNEL ONSITE (include subcontractors; verify proper PPE &amp; credentials):</b>				
Nathan Mainard - AEC, Brian Zander, AEC, Daniel Phillips - AEC				
Billy Lynn - NW Traffic Control				
<b>ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):</b>				
8:00 AEC arrived, Loading EMCT, Water Tested at 0.8 DD				
8:25 Pulling rods from 1-2 and 1-1				
9:25 Pushing rods at 1-3				
10:00 Begin injecting at 1-3				
10:43 Pulling rods at 1-3				
11:00 A lot of product spilled when pulling Rods into planter area, Vacuumed and shoveled and raked to clean up spill.				
11:40 moved to 1-5, pushing rods to 90'				
12-1 Lunch				
13:07 Begin injecting at 1-5				
13:50 Finished 1-5 and pulling rods				
14:15 Moved to 1-4				
15:30 Product surfacing in cracks in asphalt parking area north of injection area				
15:40 Pulling most of the rods out of 1-4				
15:50 Still significant oozing of product from 1-3 cleaned up most of spill and mounded bentonite on top of hole				
16:30 wrapping up				
17:00 Leave Park				
<b>ITEMS NEEDING ATTENTION:</b>				
<b>SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:</b>				

DAILY PHOTOS: Upload to project folder

### Injection data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment Phase IIB	<b>CLIENT:</b> Messer, LLC	<b>DATE:</b> 5/12/20	<b>Report #:</b> 10	<b>PAGE:</b> 2 <b>OF:</b> 2
<b>EA PROJECT No:</b> 1524099		<b>LOCATION:</b> AOC-3 <b>Property:</b> County Park <b>Name:</b> Rick READ		

Note: Focus on EXCEPTIONS to work plan

Injection Row - Point ID and Time	Depth (ft bgs)	Injection Rate (gpm)	Injection Pressure (psi) at pump	Quantity			Injection Notes
				Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)	
10:10	1-13	90		62		64	
10:16	1-13	88		62		64	
10:22	1-13	86		62		64	
10:28	1-13	84		62		64	
10:34	1-13	82		62		64	
10:40	1-13	80		62		64	
10:45	1-13	78		62		64	
10:50	1-13	76		62		64	
11:32	1-8	90		62		64	
11:38	1-8	88		62		64	
11:44	1-8	86		62		64	
11:50	1-8	84		62		64	
11:56	1-8	82		62		64	
12:02	1-8	80		62		64	
12:08	1-8	78		62		64	
12:12	1-8	76		62		64	
14:15	1-11	90		62		64	
14:19	1-11	88		62		64	
14:25	1-11	86		62		64	
14:32	1-11	84		62		64	Surfacing
15:20		82		62		64	"
15:26		80		62		64	
15:32		78		62		64	
15:38		76		62		64	

**Slurry mixing rates and notes:**

0.45 liters microbes/1200 gal tank, or 0.19 liters microbes for each 500 gallon tote

Approximately 64 lbs of EHC Plus per interval

2 dry quart NZOS per 500 gallons water (1 g/L is most accurate). Follow mixing flyer



# DAILY INJECTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment Phase IIB	CLIENT: Messer, LLC	DATE: 5/12/20	Report #: 10	PAGE: 1 OF: 2
EA PROJECT No: 1524099	LOCATION: AOC-3	Property:		
CONTRACTOR: Anderson Env. Contracting	WEATHER: Rain			
REPORT PREPARED BY: RICK READ	TEMP: 52°			
PROJECT MANAGER: J. Reeve	WIND: SW = 0-5 mph			
TIME ON-SITE: 7:00	TIME DEPARTED SITE: 5:30			
PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials): Nathan Mainard - AEC, Brian Zander - AEC, Daniel Phillips - AEC				
ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):				
7:00 AEC onsite loading EHL*				
8:10 pulling Rods at 1-4 and 1-3, chipping holes				
8:35 Laying Plywood on lawn moving Rig to 1-13				
9:08 Pushing Rods at 1-13 to 90°				
10:10 Start injecting at 1-13				
10:50 finished injections at 1-13 moving to 1-8				
11:05 Pushing Rods to 90° at 1-8				
11:32 Start injecting at 1-8				
12:12 Finished at 1-8, Lunch				
13:20 Pulling Rods at 1-8				
13:30 Pulling remaining Rods from 1-13				
13:50 pushing Rods to 90° at 1-11				
14:15 Begin injecting at 1-11				
14:32 Surfacing, Cleaning up and capping to stop pressure of product. Significant amount of product (approx 40 gallons) surfaced onto street. Dammed the gutter and vacuumed up spill w/drum-vac. Washed street down w/water truck				
ITEMS NEEDING ATTENTION:				
SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN: Eliminated holes 1-14 1-15 due to proximity to utilities.				

DAILY PHOTOS: Upload to project folder



### Injection data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

<b>PROJECT NAME:</b>	<b>CLIENT:</b>	<b>DATE:</b> 5/13/20	<b>Report #:</b>	<b>PAGE:</b> 2
Boomsnub In-situ Treatment Phase IIB	Messer, LLC		11	<b>OF:</b> 3
<b>EA PROJECT No:</b> 1524099	<b>LOCATION:</b> AOC-3 <b>Property:</b> Clark County Park <b>Name:</b> Rick READ			

Note: Focus on EXCEPTIONS to work plan

Injection Row - Point ID and Time	Depth (ft bgs)	Injection Rate (gpm)	Injection Pressure (psi) at pump	Quantity			Injection Notes
				Anaerobic Water (gal)	Microbes (L-see notes)	Product (lb)	
9:36 1-6	90		250-400				
	88		250-400				
	86		250-350				
	84		225-325				
	82		200-300				
	80		200-300				
	78		200-300				
10:20	76		200-300				
11:50 1-14	90		250-350				
11:56	88		250-350				
12:03	86		250-350				
12:09	84		200-300				
12:12	82		200-300				Surfacing
14:32 2-2	Refusal at 81 feet. Moving to 2-3						
15:10 2-3	90		700+				
15:16 2-3	88		700+				
15:20 2-3	86		700+				
15:24 2-3	82		700+				
15:29 2-3	84		700+				
15:35 2-3	80		700+				
15:40 2-3	78		500-700				
15:46 2-3	76		400-600				

**Slurry mixing rates and notes:**

0.45 liters microbes/1200 gal tank, or 0.19 liters microbes for each 500 gallon tote  
 Approximately 64 lbs of EHC Plus per interval  
 2 dry quart NZOS per 500 gallons water (1 g/L is most accurate). Follow mixing flyer



# DAILY INJECTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment Phase IIB	<b>CLIENT:</b> Messer, LLC	<b>DATE:</b> 5/13/20	<b>Report #:</b> 11	<b>PAGE:</b> 1 <b>OF:</b> 3
<b>EA PROJECT No:</b> 1524099		<b>LOCATION:</b> AOC-3	<b>Property:</b> County Park	
<b>CONTRACTOR:</b> Anderson Env. Contracting		<b>WEATHER:</b> Rain		
<b>REPORT PREPARED BY:</b> Rick READ		<b>TEMP:</b> 50-60		
<b>PROJECT MANAGER:</b> J. Reeve		<b>WIND:</b> SW 5-10		
<b>TIME ON-SITE:</b> 7:00		<b>TIME DEPARTED SITE:</b>		
<b>PERSONNEL ONSITE (include subcontractors; verify proper PPE &amp; credentials):</b>				
<b>ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):</b>				
7:00 Loaded EHC + For today				
7:20 Pulled Rods at 1-11 and chipped hole. Water at 0.300				
8:50 Set up Rig on 1-6				
9:06 Begin pushing rods to 90' at 1-6				
9:30 Finished pushing Rods at 1-6				
10:25 Pulling Rods at 1-6. Some surfacing when rods removed Plugged w/4" Rod.				
10:30 Cleaning up overflow. Lost 1/2 volume from 76' interval.				
11:00 Moving Rig to 1-14.				
11:10 Begin pushing Rod at 1-14 to 90'				
11:50 Begin injecting at 1-14. Product surfacing, stopped pumping til after lunch.				
12:15 Lunch				
13:20 Tried at 1-14 and Product started surfacing again around Rods. Cleaned up and Moved equipment East. Moved Rig to 2-2				
14:30 Begin pushing Rods at 2-2 Got Refusal at 81'. Moving to 2-3				
14:42 Pushing Rods at 2-3				
15:10 Injecting at 2-3				
15:50 Finished 2-3. Pulled most of rods left last 20 ft 4" below street for night				
17:00 Wrapping up at Park				
<b>ITEMS NEEDING ATTENTION:</b>				
<b>SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:</b>				

DAILY PHOTOS: Upload to project folder





# DAILY INJECTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment Phase IIB	<b>CLIENT:</b> Messer, LLC	<b>DATE:</b> 5/14/20	<b>Report #:</b> 12	<b>PAGE:</b> 1 <b>OF:</b> 2
<b>EA PROJECT No:</b> 1524099		<b>LOCATION:</b> AOC-3 <b>Property:</b>		
<b>CONTRACTOR:</b> Anderson Env. Contracting		<b>WEATHER:</b> 53° cloudy-rain for most of day		
<b>REPORT PREPARED BY:</b> Brooke Haines		<b>TEMP:</b> 53°		
<b>PROJECT MANAGER:</b> J. Reeve		<b>WIND:</b> light - none		
<b>TIME ON-SITE:</b> 7:30		<b>TIME DEPARTED SITE:</b> 3:00		
<b>PERSONNEL ONSITE (include subcontractors; verify proper PPE &amp; credentials):</b>				
Brian Zander, Nate, Daniel Phillips, Brooke Haines				
<b>ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):</b>				
Arrived at trailer, packed truck, Health and Safety, drove to site				
7:30 - Arrived at site, Tested water DO = 0.3 mg/L				
7:43 - moved Geoprobe to 2-4 and set up for injecting				
8:43 - started push drilling into 2-4, Finisher at 9:27				
10:17 - started injecting product into 2-4. stop at 10:19 to adjust chem grout, started again at 10:25				
11:04 - Finished injecting product at 2-4, pulled tubing				
11:31 - started push drilling 2-6, Finished at 12:26, break for lunch				
13:04 - turn on chem grout, started injecting at 13:42				
13:45 - stopped injections. Equipment issues. Pressure too high, could be from tight geo-formation				
13:54 - Begin to pull rods and pack up for day.				
15:00 - left site				
<b>ITEMS NEEDING ATTENTION:</b>				
<b>SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:</b>				

DAILY PHOTOS: Upload to project folder



# DAILY INJECTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment Phase IIB	<b>CLIENT:</b> Messer, LLC	<b>DATE:</b> 5/15/20	<b>Report #:</b> 12	<b>PAGE:</b> 1 <b>OF:</b> 1
<b>EA PROJECT No:</b> 1524099		<b>LOCATION:</b> AOC-3	<b>Property:</b> 10.15	
<b>CONTRACTOR:</b> Anderson Env. Contracting		<b>WEATHER:</b> cloudy		
<b>REPORT PREPARED BY:</b> Brooke Haines		<b>TEMP:</b> 54°		
<b>PROJECT MANAGER:</b> J. Reeve		<b>WIND:</b> none		
<b>TIME ON-SITE:</b> 7:20 am		<b>TIME DEPARTED SITE:</b>		
<b>PERSONNEL ONSITE (include subcontractors; verify proper PPE &amp; credentials):</b> Levi Oblist, Daniel Philips, Nate Mannard, Brooke Haines				
<b>ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):</b> 7:20 - Arrived on site, crew began getting ready for injections - issues getting rig to start, needs attention and cannot be worked with on site. packed up early for the day 10:00 - came back to trailer to put equipment away.				
<b>ITEMS NEEDING ATTENTION:</b>				
<b>SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:</b>				

DAILY PHOTOS: Upload to project folder



# DAILY INJECTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

PROJECT NAME: Boomsnub In-situ Treatment Phase IIB	CLIENT: Messer, LLC	DATE: 5/20/20	Report #: 16	PAGE: 1 OF:
EA PROJECT No: 1524099		LOCATION: AOC-3	Property: County Park	
CONTRACTOR: Anderson Env. Contracting		WEATHER:		
REPORT PREPARED BY: Rick READ		TEMP: 52-60		
PROJECT MANAGER: J. Reeve		WIND: SW 5-10		
TIME ON-SITE: 7:00		TIME DEPARTED SITE: 18:30		
PERSONNEL ONSITE (include subcontractors; verify proper PPE & credentials): AEC - Natan Mainard, Brian Zander, Daniel Phillips				
ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):				
7:15 Loading Product and Moving to park				
7:30 Setup traffic Control				
8:27 Set Rig at hole 1-10				
8:40 Injecting at 1-10. Took 1/2 of 1 interval Batch and began Surfacing				
8:49 Pulling Rods from 1-10				
9:10 Pulling Rods from 1-12				
9:35 Setting up on 2-5				
10:39 Injecting at 2-5				
11:28 Finished injecting at 2-5				
Lunch				
12:30 Pulling Rods at 2-5				
12:50 Pushing Rods at 2-7				
13:40 Injecting at 2-7				
14:00 Getting More Product				
15:10 Pulling Rods at 2-7				
16:00 Pushing Rods at 2-4				
16:48 injecting at 2-4				
17:36 Finished 2-4, Cleaning up Surfacing at 2-5 & 2-7				
18:00 Cleaning up, Moving tank from Park to Padden field and refilling with water for 5/21.				
ITEMS NEEDING ATTENTION:				
SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:				

DAILY PHOTOS: Upload to project folder

### Injection data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

<b>PROJECT NAME:</b>	<b>CLIENT:</b>	<b>DATE:</b> 5/20/20	<b>Report #:</b>	<b>PAGE:</b> 2
Boomsnub In-situ Treatment Phase IIB	Messer, LLC		16	<b>OF:</b> 2
<b>EA PROJECT No:</b> 1524099	<b>LOCATION:</b> AOC-3 Property: <i>County Park</i>		<b>Name:</b> Rick REA	

Note: Focus on EXCEPTIONS to work plan

	Injection Row - Point ID and Time	Depth (ft bgs)	Injection Rate (gpm)	Injection Pressure (psi) at pump	Quantity			Injection Notes
					Anaerobic Water (gal)	Microbes (L)-see notes	Product (lb)	
8:40	1-10	90		700+	30		32	Sealing
10:39	2-5	76		700+	62		64	
		74		700+	62		64	
		72		550-700	62		64	
		70		400-600	62		64	
		68		350-450	62		64	
11:28		66		250-350	62		64	
13:40	2-7	80		700+	62		64	
		78		700+	62		64	
		76		700+	62		64	
		74		600-700+	62		64	
		72		550-700	62		64	
		70		400-600	62		64	
		68		300-500	62		64	
16:48	2-4	76		700+	62		64	
		74		700+	62		64	
		72		600-700	62		64	
		70		600-700	62		64	
		68		500-600	62		64	
		66		500-600	62		64	

**Slurry mixing rates and notes:**

0.45 liters microbes/1200 gal tank, or 0.19 liters microbes for each 500 gallon tote  
 Approximately 64 lbs of EHC Plus per interval  
 2 dry quart NZOS per 500 gallons water (1 g/L is most accurate). Follow mixing flyer



# DAILY INJECTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment Phase IIB	<b>CLIENT:</b> Messer, LLC	<b>DATE:</b> 5/21/20	<b>Report #:</b> 17	<b>PAGE:</b> 1 <b>OF:</b> 2
<b>EA PROJECT No:</b> 1524099		<b>LOCATION:</b> AOC-3	<b>Property:</b> Padden	
<b>CONTRACTOR:</b> Anderson Env. Contracting		<b>WEATHER:</b> Showers		
<b>REPORT PREPARED BY:</b> Rick READ		<b>TEMP:</b> 50		
<b>PROJECT MANAGER:</b> J. Reeve		<b>WIND:</b> W 5-10		
<b>TIME ON-SITE:</b> 7:00		<b>TIME DEPARTED SITE:</b> 17:30		
<b>PERSONNEL ONSITE (include subcontractors; verify proper PPE &amp; credentials):</b> Nathan Mainard-AEC, Brian Zander-AEC, Daniel Phillips-AEC				
<b>ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):</b>				
7:20 Pulling Rods at 2-4, 2-5 and 2-7				
9:00 Setting up at Padden Property to use up remaining EHC+				
9:10 Marking injection points 16 ft apart Parallel to Sidewalk				
9:55 Begin Pushing Rods at Row 3B-1 to 95°				
10:50 Begin injecting at 3b-1				
11:50 Finished injecting at 3b-1, Lunch				
12:50 Pulling Rods at 3b-1				
13:30 Pushing Rods at 3b-3				
14:10 <del>Pushing</del> Injecting at 3b-3				
15:00 Finished				
15:05 Pulling Rods at 3b-3				
15:45 Pushing Rods at 3b-4				
16:27 Injecting at 3b-4				
16:48 Finishe at 3b-4				
16:50 Pulling Rods at 3b4				
<b>ITEMS NEEDING ATTENTION:</b>				
<b>SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:</b>				

DAILY PHOTOS: Upload to project folder

### Injection data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

<b>PROJECT NAME:</b>	<b>CLIENT:</b>	<b>DATE:</b> 5/21/20	<b>Report #:</b>	<b>PAGE:</b> 2
Boomsnub In-situ Treatment Phase IIB	Messer, LLC		17	<b>OF:</b> 2
<b>EA PROJECT No:</b> 1524099	<b>LOCATION:</b> AOC-3 Property: Padden Name: R. & K. READ			

Note: Focus on EXCEPTIONS to work plan

Injection Row - Point ID and Time	Depth (ft bgs)	Injection Rate (gpm)	Injection Pressure (psi) at pump	Quantity			Injection Notes
				Anaerobic Water (gal)	Microbes (L-see notes)	Product (lb)	
10:50 36-1	95		250-350	62		64	
	92		250-350	62		64	
	90		200-350	62		64	
	88		200-300	62		64	
	86		200-300	62		64	
	84		200-300	62		64	
	82		200-300	62		64	
	80		200-300	62		64	
	78		200-300	62		64	
11:46	76		200-300	62		64	
14:10 36-3	95		250-300	62		64	
	92		250-300	62		64	
	90		250-300	62		64	
	88		250-300	62		64	
	86		200-300	62		64	
	84		200-300	62		64	
	82		200-300	62		64	
	80		200-300	62		64	
	78		200-300	62		64	
	76		200-300	62		64	

**Slurry mixing rates and notes:**

0.45 liters microbes/1200 gal tank, or 0.19 liters microbes for each 500 gallon tote  
 Approximately 64 lbs of EHC Plus per interval  
 2 dry quart NZOS per 500 gallons water (1 g/L is most accurate). Follow mixing flyer





# DAILY INJECTION REPORT

Boomsnub/Airco Superfund Site  
In-situ Treatment Injections  
Hazel Dell, Washington

<b>PROJECT NAME:</b> Boomsnub In-situ Treatment Phase IIB	<b>CLIENT:</b> Messer, LLC	<b>DATE:</b> 5/22/20	<b>Report #:</b> 18	<b>PAGE:</b> 1 <b>OF:</b> 3
<b>EA PROJECT No:</b> 1524099		<b>LOCATION:</b> AOC-3	<b>Property:</b> Padden	
<b>CONTRACTOR:</b> Anderson Env. Contracting		<b>WEATHER:</b> Cloudy		
<b>REPORT PREPARED BY:</b> Rick READ		<b>TEMP:</b> 50-		
<b>PROJECT MANAGER:</b> J. Reeve		<b>WIND:</b> WNW 3-5 mph		
<b>TIME ON-SITE:</b> 7:00		<b>TIME DEPARTED SITE:</b> 16:30		
<b>PERSONNEL ONSITE (include subcontractors; verify proper PPE &amp; credentials):</b> Nathan Mainard - AEC, Brian Zander - AEC, Daniel Phillips - AEC				
<b>ACTIVITIES WORKED TODAY (OBSERVATIONS/GENERAL COMMENTS/PROJECT STATUS):</b>				
7:00 AEC onsite				
Loading last of the EHC+				
8:00 Pushing Rods at 3b-2 to 95'				
8:46 Finished Pushing Rods at 3b-2				
8:50 Injecting at 3b-2				
9:38 Finished 3b-2, Pulling Rods				
10:00 Moving Rig to 3B-5				
10:10 Pushing Rods a 3b-5				
10:56 Injecting, daylighting on 4th interval				
11:27 Pulling Rods				
11:48 Pushing Rods 3B-6 Moved 3B-6 approx 25' east of 3b-5 to prevent Surfacing				
12:08 Lunch				
12:48 Injecting at 3B-6				
13:30 Finished 3b-6 Pulling Rods				
13:54 Moving Rig to 3B-7				
14:00 Pushing Rod				
14:35 Injecting				
15:05 Finished 3b-7 Last hole!				
15:10 Pulling Rods & Cleaning up				
<b>ITEMS NEEDING ATTENTION:</b>				
<b>SAFETY OR QUALITY PROBLEMS NOTED/CORRECTIVE ACTION TAKEN:</b>				

DAILY PHOTOS: Upload to project folder

### Injection data Summary Table

Boomsnub/Airco Superfund Site

In-situ Treatment Injections

Hazel Dell, Washington

<b>PROJECT NAME:</b>	<b>CLIENT:</b>	<b>DATE:</b> 5/22/20	<b>Report #:</b>	<b>PAGE:</b> 2
Boomsnub In-situ Treatment Phase IIB	Messer, LLC		18	<b>OF:</b> 3
<b>EA PROJECT No:</b> 1524099	<b>LOCATION:</b> AOC-3 Property: Padden		<b>Name:</b> Rick READ	

Note: Focus on EXCEPTIONS to work plan

Injection Row - Point ID and Time	Depth (ft bgs)	Injection Rate (gpm)	Injection Pressure (psi) at pump	Quantity			Injection Notes
				Anaerobic Water (gal)	Microbes (L-see notes)	Product (lb)	
8:50 3b-2	94		300-350	62		64	
	92		250-350	62		64	
	90		250-300	62		64	
	88		200-300	62		64	
	86		200-300	62		64	
	84		200-300	62		64	
	82		200-300	62		64	
	80		200-300	62		64	
	78		200-300	62		64	
9:38 76		200-300	62		64		
10:56 3b-5	94		250-300	62		64	
	92		250-300	62		64	
	90		250-300	62		64	
	88		250-300	62		64	Daylighting
12:48 3b-6	90						
	88						
	86						
	84						
	82						
	80						
13:30 78							
	76						

**Slurry mixing rates and notes:**

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