

TECHNICAL MEMORANDUM

To: Nevada Environmental Response Trust

Cc: Nevada Division of Environmental Protection

From: Dan Pastor and Dana Grady, Tetra Tech, Inc.

Date: December 15, 2017

Subject: Seep Well Field Area Bioremediation Treatability Study Progress Update

At the direction of the Nevada Environmental Response Trust (NERT or Trust), Tetra Tech, Inc. (Tetra Tech) has prepared this memorandum which summarizes Tetra Tech's progress during November 2017 toward successfully implementing the Seep Well Field (SWF) Area Bioremediation Treatability Study.

Task Progress Update: November 2017

Task M11 – Seep Well Field Area Bioremediation Treatability Study (SWFTS)

- Task Leader – Dana Grady/Dan Pastor
- Current Status
 - Final column tests at the University of Nevada, Las Vegas (UNLV) laboratory for both the alluvium and Upper Muddy Creek formation (UMCf) have been completed. Columns were opened to measure residual oil concentrations and estimate emulsified vegetable oil mass balances for final sorption/desorption determinations. The draft study report is being completed by UNLV for Tetra Tech's review. The final report will be included in the treatability study report submitted following completion of the field implementation.
 - The second of two biweekly groundwater sampling events was completed on November 17, 2017.
 - Results from the ongoing effectiveness monitoring program continue to indicate sustained decreases in perchlorate and chlorate concentrations in groundwater following completion of the first injection event in August and September 2017. Key downgradient monitoring wells continue to show concentrations well below baseline concentrations, with 15 of the 20 downgradient monitoring wells observing a greater than 50 percent reduction in perchlorate concentrations. Of these 15 wells, nine observed a greater than 90 percent reductions in perchlorate concentrations. These nine wells include those that are as much as 500 feet downgradient of the injection well transect. Perchlorate concentrations in four wells have been reduced to non-detect levels, including the well with the highest baseline concentration of 23,000 µg/L. Non-detect levels of

chlorate were observed in seven wells, including wells with baseline chlorate concentrations as high as 54,000 µg/L.

- During the November sampling event, groundwater samples were collected from select injection wells and analyzed for total organic carbon (TOC) to aid in the design process for the upcoming second injection event, which is scheduled in the first quarter of 2018. Initial evaluation of TOC in the injection wells indicates that significant organic carbon (greater than 5,000 mg/L in some wells) remains in the vicinity of the formation surrounding the injection transect, and should continue to provide carbon substrate to the perchlorate-reducing microorganisms as upgradient perchlorate-laden groundwater flows past the transect.
- The second round of Bio-Traps® was removed from the wells on November 29th and sent to Microbial Insights for analysis of phospholipid fatty acids (PLFA) and perchlorate reductase gene to monitor the microbial response following the first injection event. A brief summary of the Bio-Trap® results will be provided in the December monthly status report.
- Schedule and Progress Updates
 - This task remains on schedule.
 - The second biweekly sampling event was completed on November 17, 2017.
 - The next groundwater sampling event is scheduled for the week of December 11, 2017.
 - Slug testing will be performed the week of December 18, 2017.
 - The second injection event is tentatively scheduled to begin on January 22, 2018. The date will be finalized following the results of the December 11, 2017 sampling event.
- Health and Safety
 - There were no safety incidents related to Task M11 during November 2017.

CERTIFICATION

I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been prepared in a manner consistent with the current standards of the profession, and to the best of my knowledge, comply with all applicable federal, state, and local statutes, regulations, and ordinances. I hereby certify that all laboratory analytical data was generated by a laboratory certified by the NDEP for each constituent and media presented herein.

Description of Services Provided: Seep Well Field Area Bioremediation Treatability Study Progress Update, Nevada Environmental Response Trust Site, Henderson, Nevada



December 15, 2017

Kyle Hansen, CEM
Field Operations Manager/Geologist
Tetra Tech, Inc.

Date

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