

TECHNICAL MEMORANDUM

To: Nevada Environmental Response Trust

Cc: Nevada Division of Environmental Protection
United States Environmental Protection Agency

From: Dan Pastor and Dana Grady

Date: May 22, 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 made during April 2017 toward successfully implementing the Seep Well Field Area Bioremediation Treatability Study.

Task Progress Update: April 2017

Task M11 – Seep Well Field Area Bioremediation Treatability Study

- Task Leader – Dana Grady
- Current Status
 - UNLV bench-scale studies are ongoing. Batch microcosm perchlorate biodegradation tests and emulsified oil substrate (EOS[®]) adsorption and desorption tests are being currently designed.
 - During the month of April, hydraulic testing (borehole dilution and/or slug tests) were completed in new monitoring wells, including those that were installed in the Upper Muddy Creek formation. Results indicate that groundwater flow velocity varies significantly across the site, from less than 1 ft/day to over 100 ft/day. Slug test results indicate that the hydraulic conductivity also varies across the treatability study area, from about 1 ft/day to over 300 ft/day. The hydraulic conductivity variation generally corresponds to variations in logged lithology, as does the variability in groundwater flow velocity. Analysis of the hydraulic conductivity and flow velocity estimates is ongoing to understand variations in these characteristics and potential preferential flow pathways in the subsurface.
 - The UIC Permit Application Package was submitted to the Trust for review and signature on April 25, 2017.

- Per the conference call between NDEP, Tetra Tech, and the Trust on April 21, 2017, it was requested that Tetra Tech provide a brief statement on potential vertical gradients in the vicinity of the Seep Well Field Area Bioremediation Treatability Study. The depth-to-water measurements collected from each of the new SWFTS wells in March 2017 were used to calculate groundwater elevations based on surveyed measuring points. Based on this data, the vertical gradient between the UMCf wells (SWFTS-MW08C and SWFTS-MW10C) and their paired alluvial wells (SWFTS-MW08A and SWFTS-MW10A) was upward with values ranging from 0.063 to 0.086 ft/ft. This upward gradient was expected based on the existing site conceptual model and is generally consistent with previous estimates for the area.
- NDEP, Tetra Tech, and the Trust also discussed additional concerns on the April 21, 2017 call including:
 - The use of site-specific data to calculate the appropriate dose of electron donor and injection rates.
 - The use of batch microcosm perchlorate biodegradation tests to calculate the appropriate dose of electron donor.
 - The use of accurate baseline information [such as geology, hydrogeology, total porosity, effective porosity, groundwater saturated thickness, groundwater flow direction and velocity, the distribution (lateral and vertical direction) and total mass of perchlorate, the distribution (lateral and vertical direction) and mass of other COPCs].
 - Secondary mobilization of other constituents.
 - Reducing permeability changes due to injections.
 - Independent verification of perchlorate mass biodegradation.

The conference concluded with NDEP's concurrence of how each of these items are being integrated into the Seep Well Field Area Bioremediation Treatability Study.

- Schedule and Progress Updates
 - Nuclear magnetic resonance logging will be performed in May 2017. The exact date is to be determined based on equipment availability.
 - Drilling activities are currently scheduled to begin May 22, 2017.
- Health and Safety
 - There were no safety incidents related to Task M11 during April 2017.