

# TECHNICAL MEMORANDUM

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**To:** Nevada Environmental Response Trust

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

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**From:** Dan Pastor and Dana Grady

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**Date:** November 15, 2018

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**Subject:** **Galleria Drive Bioremediation Treatability Study Monthly Progress Report**

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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 September 2018 toward successfully implementing the Galleria Drive Bioremediation Treatability Study.

## Task Progress Update: September 2018

### Task M17 – Galleria Drive Bioremediation Treatability Study

- Task Leader – Dana Grady/Dan Pastor
- Current Status
  - Phase 1 pre-design field activities were performed from April to June 2018 to gather relevant data and information required to optimize the final treatability study design (targeted treatment interval and depth, contaminant concentrations, etc.). Based on the results of the recent Phase 1 pre-design activities, it was determined that a Phase 1 Work Plan Modification was necessary as Phase 1 investigation results yielded information that perchlorate is deeper than expected, i.e., in the deeper Upper Muddy Creek formation (UMCf) [90 -110 feet below ground surface (ft bgs)]. As a result, a Treatability/Pilot Study Modification No. 3 was submitted to NDEP on August 29, 2018 to recommend bench-scale and step-rate injection testing on the 90 – 110 ft bgs interval. This Modification No. 3 was approved by NDEP on August 30, 2018. Following implementation of this modification, the Phase 1 findings and resulting Phase 2 treatability study design will be presented to NDEP, EPA and the NERT Stakeholders, followed by a third-party cost evaluation and submittal of the Galleria Drive Treatability Study Work Plan Addendum.
  - Activities associated with the Treatability/Pilot Study Modification No. 3 began in September 2018, with the following activities occurring:
    - Step-rate injection tests were performed the week of September 17 – 21, 2018 to evaluate injecting into the 90 – 110 foot below ground surface (bgs) interval within the Galleria Drive bioremediation treatability study area. Because the ability to inject carbon substrate-laden fluids into the subsurface is one of the cornerstones of successful in-situ

bioremediation (ISB) application, the tests are important to evaluate whether injectate can be successfully delivered to the subsurface in this deep, more consolidated/cemented zone of the Upper Muddy Creek formation (UMCf). Step-rate injection tests were performed on each of the previously installed deep monitoring wells, namely, GRTS-MW01B, GRTS-MW02B, GRTS-MW03B, and GRTS-MW04B (shown in Figure 1). As part of this test, water obtained from a nearby City of Henderson fire hydrant was injected into a single monitoring well under varying stepped-up injection pressures (increasing the pressure slowly over 10 psi increments) to a maximum pressure of 60 pounds per square inch (psi). Surrounding monitoring wells that were not being used for injection were monitored during the test to observe the groundwater response to the injections. This process was repeated for all four deep monitoring wells. Table 1 presents a data summary of the step-rate injection tests. The results of the test indicated that limited water could be injected into the subsurface. No measurable groundwater response was observed in surrounding monitoring wells during the injection tests. These results were anticipated due to the deep UMCf being significantly consolidated/cemented and aquifer test results indicating that this 90 – 110 foot bgs interval has an extremely low hydraulic conductivity (estimated at 0.002 ft/day). With these low injection rates at high pressures, tentative inferences at this stage indicate that adding carbon-substrate laden water and follow up distribution water into this lithological zone could take long periods of time that may result in ISB being impractical in the deep UMCf in this area.

- s summarized in the previous monthly report, the batch microcosms focusing on the shallow UMCf (60 – 85 feet bgs) had a favorable microbial response resulting in perchlorate biodegradation to non-detect concentrations in groundwater within 18 days of start-up. Current testing being performed at UNLV is focusing on the biodegradation of perchlorate and chlorate in the deeper horizon from 90 – 110 feet bgs. Initial microcosm testing in this deep zone has not yet shown any degradation of chlorate and perchlorate. The elevated total dissolved solids concentrations (approximately 50,000 milligrams per liter) observed within the deep horizon of the treatability study area could be hindering bioremediation due to lack of native microorganisms with the enzymatic ability to biodegrade perchlorate. As a result, additional testing is being performed to screen for potential factors that are hindering biodegradation and evaluate bioaugmentation. Results will be summarized as they become available in forthcoming monthly reports.
- Schedule and Progress Updates
  - Activities associated with the Treatability/Pilot Study Modification No. 3 will continue through 2018
  - Bench-scale testing is on-going.
  - Phase 1 findings and final Phase 2 design will be presented in the first or second quarter of 2019.
- Health and Safety
  - There were no safety incidents related to Task M17 during September 2018.

## CERTIFICATION

### Galleria Drive Bioremediation Treatability Study Monthly Progress Report

#### Nevada Environmental Response Trust Site (Former Tronox LLC Site) Henderson, Nevada

#### Nevada Environmental Response Trust (NERT) Representative Certification

I certify that this document and all attachments submitted to the Division were prepared at the request of, or under the direction or supervision of NERT. Based on my own involvement and/or my inquiry of the person or persons who manage the systems(s) or those directly responsible for gathering the information or preparing the document, or the immediate supervisor of such person(s), the information submitted and provided herein is, to the best of my knowledge and belief, true, accurate, and complete in all material respects.

Office of the Nevada Environmental Response Trust

Le Petomane XXVII, not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

Signature: Jay A. Steinberg, not individually, but solely in his representative capacity as President of the Nevada Environmental Response Trust Trustee

Name: Jay A. Steinberg, not individually, but solely in his representative capacity as President of the Nevada Environmental Response Trust Trustee

Title: Solely as President and not individually

Company: Le Petomane XXVII, Inc., not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

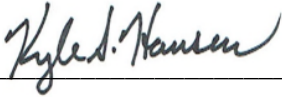
Date: 11/6/18

## CERTIFICATION

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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:** Prepared Galleria Drive Bioremediation Treatability Study Monthly Progress Report.



November 15, 2018

**Kyle Hansen, CEM**

Date

Field Operations Manager/Geologist  
Tetra Tech, Inc.

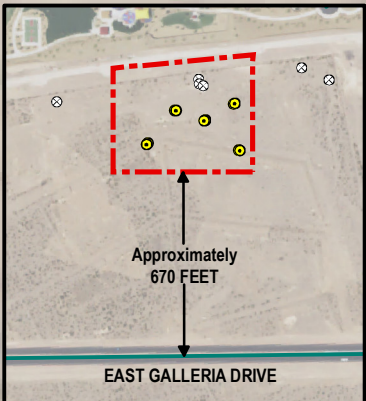
Nevada CEM Certificate Number: 2167

Nevada CEM Expiration Date: September 18, 2020

## Figures

**Legend**

- ⊗ Existing Monitoring Well
- ⊙ Phase 1 Pre-Design Monitoring Well
- - - Galleria Road Bioremediation Study Location



Imagery Source: Esri World Map, June 2015

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 <b>TETRA TECH</b> <a href="http://www.tetratech.com">www.tetratech.com</a> 150 S. 4th Street, Unit A Henderson, Nevada 89015 Phone: (702) 854-2293	NEVADA ENVIRONMENTAL RESPONSE TRUST	Project No.: 117-7502018
	MONTHLY PROGRESS REPORT	Date: OCTOBER 08, 2018
<b>GALLERIA DRIVE BIOREMEDIATION TREATABILITY STUDY MONITORING WELL LOCATIONS</b>		Designed By: SRA
		Figure No. <div style="text-align: center; font-size: 24pt; font-weight: bold;">1</div>

# Tables

**Table 1**  
**Step-Rate Injection Test Summary**  
 Galleria Drive Bioremediation Treatability Study

Injection Well ID	Injection Date and Time <sup>1</sup>	Target Pressure (psi)	Pressure sustained (psi)	Average flow (gpm)	Volume of Potable Hydrant Water Injected (gal)	Remarks
GRTS-MW01B	9/19/2018 11:33	-	-	-	14.2	Amount of water required to fill up the well above the water table
		0	0.0	0.0	0.0	Additional water injected with increase in pressure
		10	10.2	0.0	0.0	
		20	20.5	0.1	1.1	
		30	31.1	0.0	0.3	
		40	40.9	0.0	0.1	
		50	50.8	0.1	1.4	
		60	60.1	0.2	4.6	
		Total volume of water injected				7.5
GRTS-MW02B	9/19/2018 08:51	-	-	-	15.2	Amount of water required to fill up the well above the water table
		0	0.6	0.0	0.0	Additional water injected with increase in pressure
		10	10.9	0.0	0.0	
		20	20.3	0.1	1.2	
		30	31.2	0.0	0.5	
		40	41.1	0.0	0.4	
		50	50.6	0.2	4.4	
		60	59.9	0.4	8.6	
		Total volume of water injected				15.1
GRTS-MW03B	9/18/2018 14:09	-	-	-	27.9	Amount of water required to fill up the well above the water table
		0	0.0	0.0	0.0	Additional water injected with increase in pressure
		10	10.9	0.0	0.0	
		20	20.1	0.1	1.2	
		30	30.8	0.1	0.9	
		40	40.6	0.1	2.7	
		50	50.7	0.2	3.2	
		60	60.5	0.2	2.3	
		Total volume of water injected				10.3



**Table 1**  
**Step-Rate Injection Test Summary**  
 Galleria Drive Bioremediation Treatability Study

Injection Well ID	Injection Date and Time <sup>1</sup>	Target Pressure (psi)	Pressure sustained (psi)	Average flow (gpm)	Volume of Potable Hydrant Water Injected (gal)	Remarks
GRTS-MW04B	9/18/2018 12:45	-	-	-	15.0	Amount of water required to fill up the well above the water table
		0	0.0	0.0	0.0	Additional water injected with increase in pressure
		10	12.5	0.0	0.0	
		20	20.5	0.1	0.6	
		30	33.1	0.0	0.2	
		40	40.3	0.0	0.3	
		50	51.9	0.0	0.3	
		60	60.1	0.2	4.2	
		Total volume of water injected				5.6

Notes:

Well depth: 90 to 110 below ground surface.

<sup>1</sup> Injection start time

Units	gpm	gallons per minute
	psi	pounds per square inch
	gal	gallons