

# MEMO

Date **June 10, 2020**  
To **Nevada Environmental Response Trust**  
From **John Pekala, Scott Warner, and Chris Ritchie**  
Copy to **Nevada Division of Environmental Protection**  
**United States Environmental Protection Agency**  
Subject **Las Vegas Wash ZVI-Enhanced Bioremediation Treatability**  
**Study Monthly Progress Report**

## **TASK PROGRESS UPDATE: APRIL 2020**

At the direction of the Nevada Environmental Response Trust (NERT or Trust), Ramboll US Corporation (Ramboll) has prepared this memorandum which summarizes Ramboll's progress during April 2020 toward successfully implementing the Las Vegas Wash Zero-Valent Iron (ZVI)-Enhanced Bioremediation Treatability Study, formerly known as the Galleria Drive ZVI-Enhanced Bioremediation Treatability Study. Treatability laboratory testing was performed by PRIMA Environmental via subcontract with Ramboll on behalf of NERT.

## **TASK M18 – LAS VEGAS WASH ZVI-ENHANCED BIOREMEDIATION TREATABILITY STUDY**

- Task Leaders – Scott Warner / Chris Ritchie
- Current Status
  - As previously reported, Phase 1 of the treatability study was completed in June 2019. Phase 2 (design and implementation of a field test) is planned to be completed in the vicinity of Las Vegas Wash Transect 1A (Transect 1A) pending completion of a data gap evaluation initiated in November 2019 consistent with Treatability/Pilot Study Modification No. 9, which was submitted to the Nevada Division of Environmental Protection (NDEP) on October 8, 2019 and approved by NDEP on October 14, 2019.
  - Transect 1A field activities associated with the implementation of Treatability/Pilot Study Modification No. 9 were completed in January 2020.
  - Streamlined bench-scale testing associated with the implementation of Treatability/Pilot Study Modification No. 9 was conducted to evaluate the performance of coarse-grain granular ZVI under conditions present in Transect 1A. Transect 1A bench-scale testing was completed in April 2020. These bench-scale tests were conducted for two different microcosm groups defined by test objectives. Details on the main objectives, initiation dates, and sampling dates for each soil microcosm group are provided in the following table. Multiple microcosms were inoculated with sludge from the on-site fluidized bed reactors (FBRs) to prevent potential lags in microbial stimulation that can result from disturbance of the samples during sampling, transportation, and microcosm preparation activities.

Microcosm Group Number	Main Objective	Testing Initiation Date	April Sampling Dates
Group 1	Evaluate granular ZVI's ability to reduce perchlorate, chlorate, and nitrate under Transect 1A conditions	1/25/2020	Week 12 – 4/21/2020
Group 2	Evaluate the effects of carrier agents, additives, and nutrient/carbon amendments on granular ZVI's performance in reducing perchlorate, chlorate, and nitrate <sup>[1]</sup>	1/16/2020	Week 14 – 4/21/2020
<b>Note:</b> 1. Carrier agents include guar powder, additives include cross-linker and enzyme breaker, nutrients include vitamin B12 and diammonium phosphate, and carbon includes Emulsified Oil Substrate (EOS) 100.			

– Microcosm Test Results:

- **Group 1:** Cumulative results from the full 12-week period of soil microcosm testing for Group 1, which includes application of varying doses of ZVI to Transect 1A alluvium soil and Transect 1A Upper Muddy Creek formation (UMCf) soil, are presented on Figures 1 through 3. A summary of the Group 1 microcosm data follows:
  - Concentrations of perchlorate, chlorate, and nitrate were all reduced to below reporting limits in both alluvium and UMCf microcosms for all granular ZVI dose levels. These results corroborate previous bench-scale data that ZVI is effective as a groundwater treatment amendment for NERT contaminants.
  - The data presented in Figures 1 through 3 demonstrate that Transect 1A alluvium soil and Transect 1A UMCf soil are both geochemically suitable for perchlorate, chlorate, and nitrate reduction in groundwater using granular ZVI at all dose levels evaluated.
- **Group 2:** Cumulative results from the full 14-week period of soil microcosm testing for Group 2, which includes application of granular ZVI, carrier agent, additives, and/or nutrient/carbon amendments to mixed Transect 1A alluvium and UMCf soil, are presented on Figures 4 through 6. A summary of Group 2 microcosm data follows:
  - Concentrations of perchlorate, chlorate, and nitrate were all reduced to below reporting limits in all microcosms except for the control (i.e., no treatment) microcosm, further substantiating previous data that ZVI is effective as a groundwater treatment amendment for NERT contaminants.
  - The sustained lack of contaminant reduction in the control (no granular ZVI) microcosm confirms that granular ZVI is responsible for the perchlorate, chlorate, and nitrate removal in the other microcosms.

- Perchlorate and chlorate concentrations were reduced to below reporting limits in the Test 11 (uninoculated) microcosm within eight weeks compared to the inoculated microcosms where complete perchlorate reduction was observed within 4 weeks. This demonstrates that inoculation can accelerate the onset of perchlorate reduction by providing a head start on developing a microbial community with the necessary functional diversity.
  - The additions of carrier agents, additives, and nutrient amendments did not significantly affect perchlorate, chlorate, and nitrate reduction.
  - The data presented in Figures 4 through 6 clearly demonstrate that the various combinations of carrier agent and amendments do not significantly affect ZVI's ability to promote the reduction of perchlorate, chlorate, and nitrate in Transect 1A groundwater.
  - Collectively, the Group 1 and Group 2 microcosm data confirm data from previous bench-scale testing performed at UNLV (in the Galleria Drive area) and further support field evaluation of granular ZVI for treatment of perchlorate, chlorate, and nitrate in groundwater. The results of the Phase 1 laboratory testing and supplemental testing and data evaluation from Treatability/Pilot Study Modification No. 9 demonstrate the technology has met the overall objective in showing that ZVI alone can promote the biological reduction of perchlorate, chlorate, and other site co-contaminants in OU-3 groundwater.
- Schedule and Progress Updates
    - Streamlined bench-scale testing associated with the implementation of Treatability/Pilot Study Modification No. 9 was completed in April 2020. Bench-scale testing data collected through April 2020 support field testing of coarse-grain granular ZVI in the Transect 1A area and are being used to inform the Phase 2 field test design.
    - A Work Plan Addendum, which will include Transect 1A field investigation results, bench-scale testing findings, and the Phase 2 field test design, is anticipated to be submitted to NDEP in third quarter 2020.
    - A Stakeholder Roundtable is anticipated to be held during third quarter 2020 to present Phase 1 field and laboratory/bench-scale data and Phase 2 details of the treatability study.
  - Health and Safety
    - No safety incidents occurred during April 2020.

**Attachments**

Figure 1: Perchlorate Concentrations in Transect 1A Microcosms (Group 1 – Alluvium and UMCf Soil)

Figure 2: Chlorate Concentrations in Transect 1A Microcosms (Group 1 – Alluvium and UMCf Soil)

Figure 3: Nitrate Concentrations in Transect 1A Microcosms (Group 1 – Alluvium and UMCf Soil)

Figure 4: Perchlorate Concentrations in Transect 1A Microcosms (Group 2 – Mixed Soil)

Figure 5: Chlorate Concentrations in Transect 1A Microcosms (Group 2 – Mixed Soil)

Figure 6: Nitrate Concentrations in Transect 1A Microcosms (Group 2 – Mixed Soil)

## Las Vegas Wash ZVI-Enhanced Bioremediation Treatability Study Progress Update

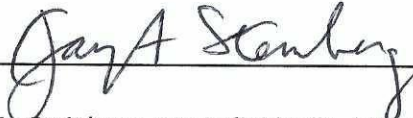
### Nevada Environmental Response Trust Site (Former Tronox LLC Site) Henderson, Nevada

#### 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 system(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, Inc., not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

**Signature:**  **Not Individually, but Solely  
as President of the 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:** 6/10/2020

## **Las Vegas Wash ZVI-Enhanced Bioremediation Treatability Study Progress Update**

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

### **Responsible Certified Environmental Manager (CEM) for this project**

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 provided 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.

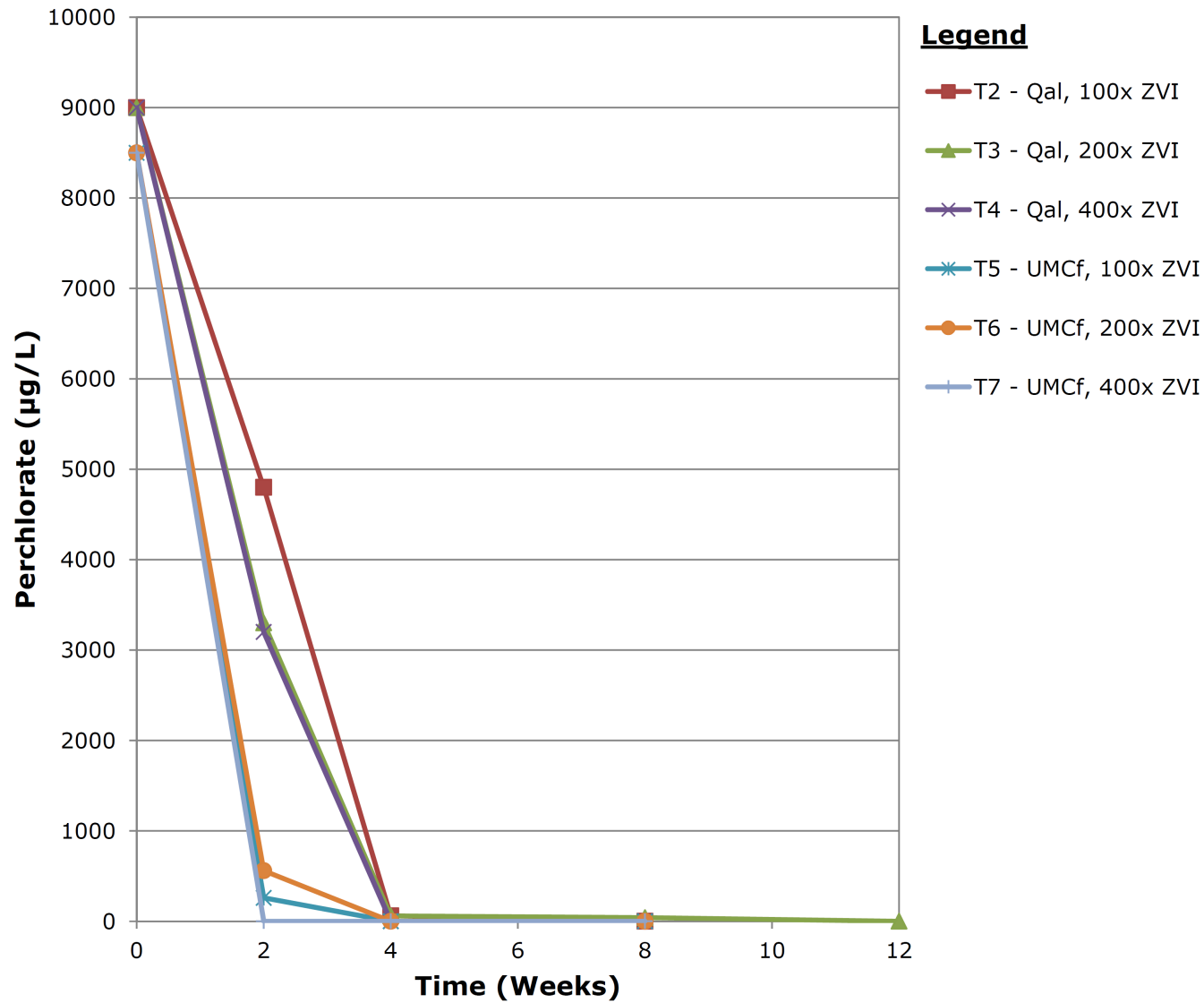


**John M. Pekala, PG  
Principal**

6/10/2020

**Date**

Certified Environmental Manager  
Ramboll US Corporation  
CEM Certificate Number: 2347  
CEM Expiration Date: September 20, 2020



**Notes:**

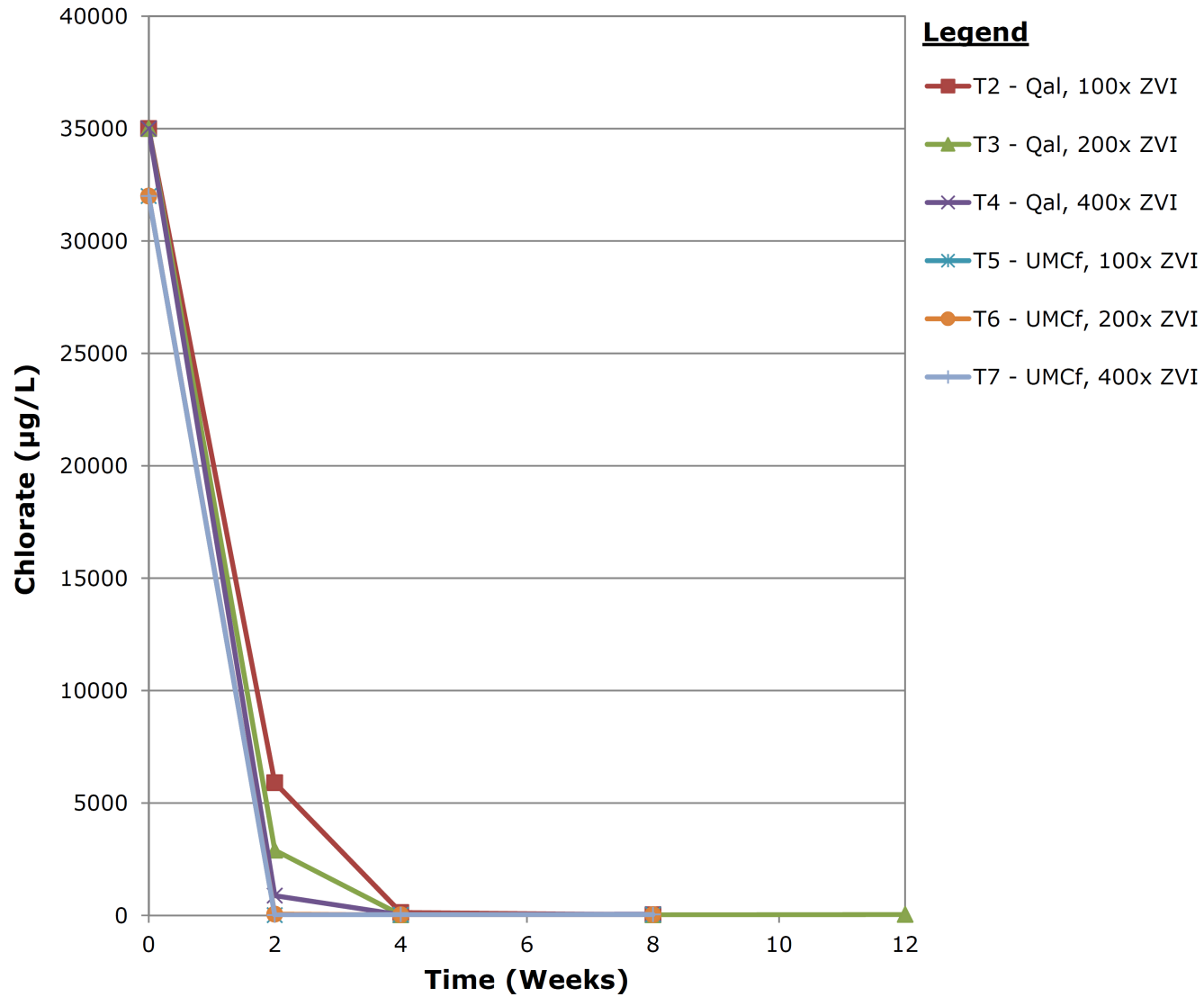
1. Tests T2 through T7 were inoculated upon test initiation.
- µg/L = micrograms per liter; Qal = Alluvium; UMCf = Upper Muddy Creek formation



**Perchlorate Concentrations in Transect 1A Microcosms (Group 1 - Alluvium and UMCf Soil)**  
 Nevada Environmental Response Trust Site  
 Henderson, Nevada

Figure

**1**



**Notes:**

1. Tests T2 through T7 were inoculated upon test initiation.  
 µg/L = micrograms per liter; Qal = Alluvium; UMCf = Upper Muddy Creek formation

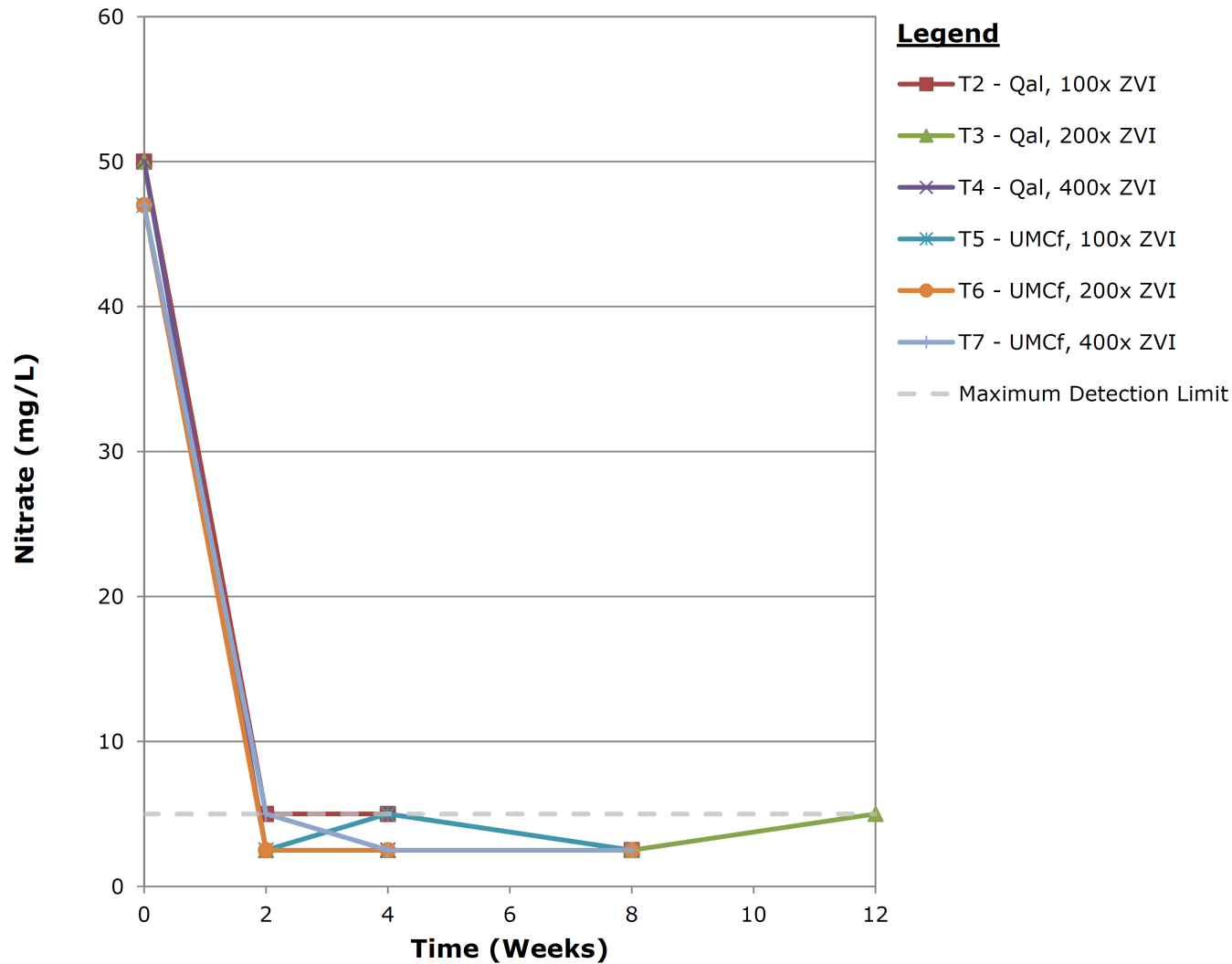


**Chlorate Concentrations in Transect 1A Microcosms (Group 1 - Alluvium and UMCf Soil)**  
 Nevada Environmental Response Trust Site  
 Henderson, Nevada

Figure

**2**





**Notes:**

1. Tests T2 through T7 were inoculated upon test initiation.
2. Due to dilution of select samples, method detection limits for nitrate ranged from 2.5 mg/L to 5 mg/L. Nitrate concentrations shown at or below 5 mg/L were all non-detect.

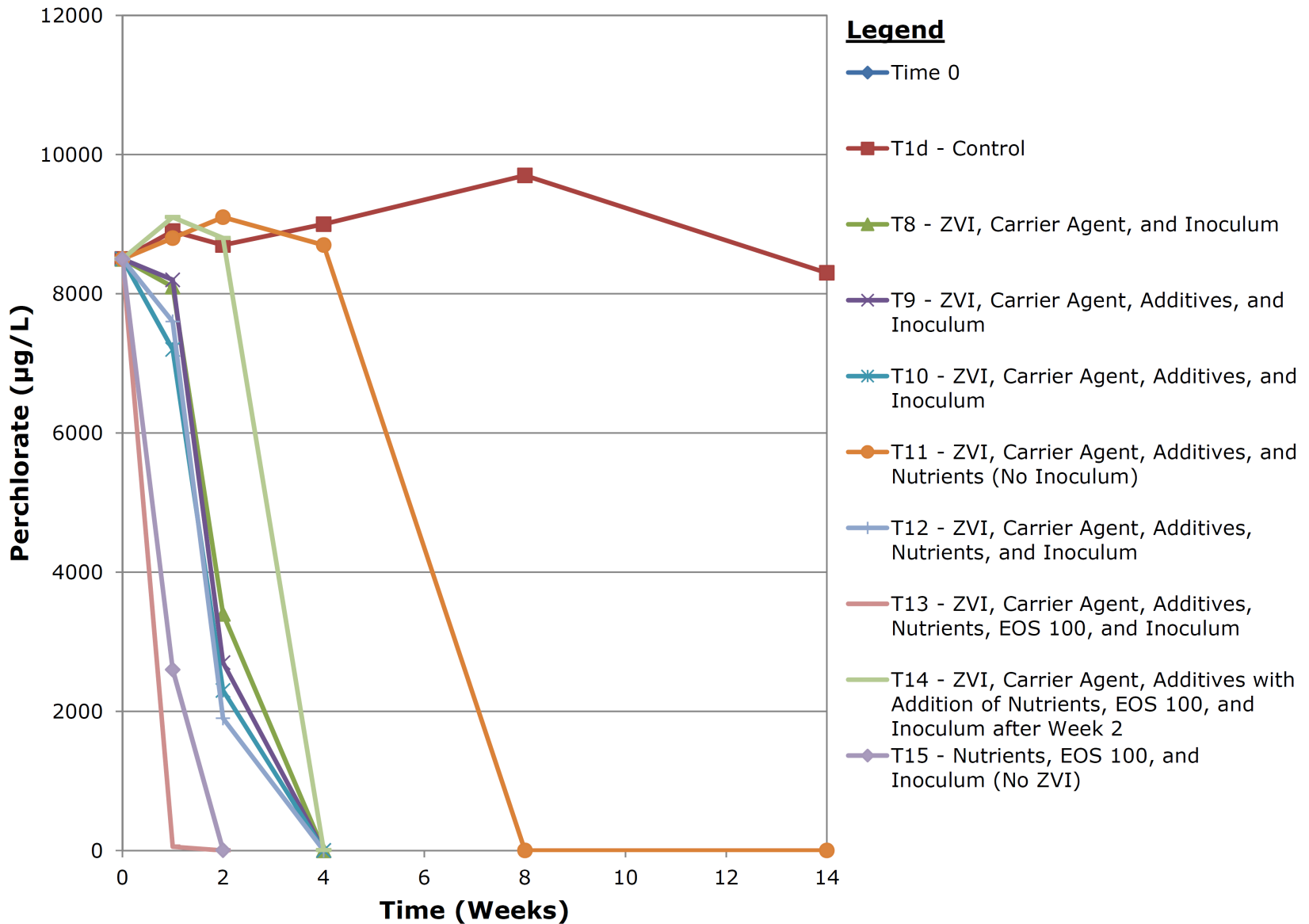
mg/L = milligrams per liter; Qal = Alluvium; UMCf = Upper Muddy Creek formation



**Nitrate Concentrations in Transect 1A Microcosms (Group 1- Alluvium and UMCf Soil)**  
 Nevada Environmental Response Trust Site  
 Henderson, Nevada

Figure

**3**



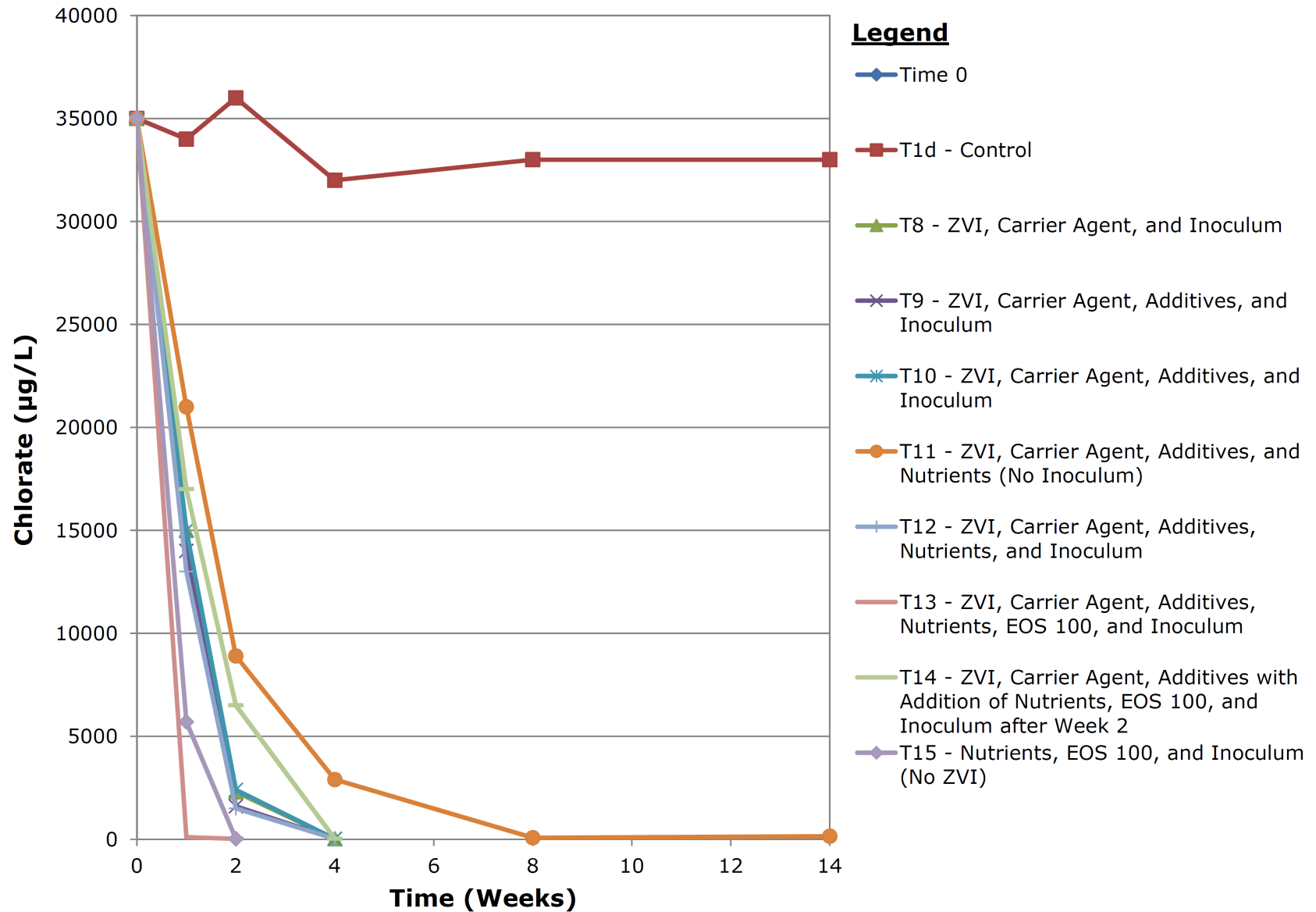
**Note:**  
µg/L = micrograms per liter



**Perchlorate Concentrations in Transect 1A Microcosms (Group 2 - Mixed Soil)**  
Nevada Environmental Response Trust Site  
Henderson, Nevada

Figure

**4**



**Note:**  
µg/L = micrograms per liter



**Chlorate Concentrations in Transect 1A Microcosms (Group 2 - Mixed Soil)**  
Nevada Environmental Response Trust Site  
Henderson, Nevada

Figure

**5**

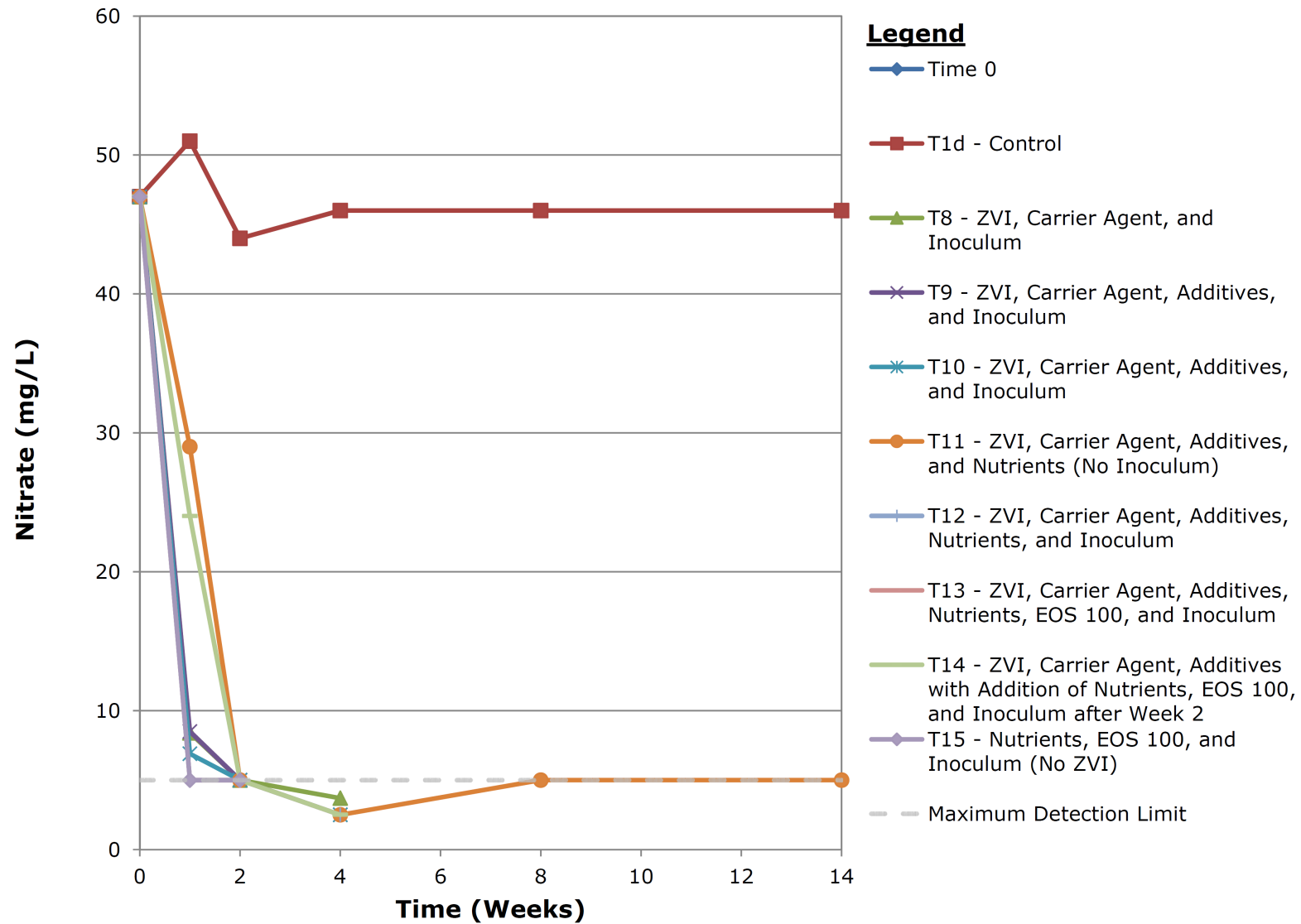
Drafter: UP

Date: 05/14/20

Contract Number: 1690016064

Approved:

Revised:



**Notes:**  
 1. Due to dilution of select samples, method detection limits for nitrate ranged from 2.5 mg/L to 5 mg/L. Nitrate concentrations shown at or below 5 mg/L were all non-detect.  
 mg/L = milligrams per liter



**Nitrate Concentrations in Transect 1A Microcosms (Group 2 - Mixed Soil)**  
 Nevada Environmental Response Trust Site  
 Henderson, Nevada

Figure

**6**