

MEMO

Date **April 6, 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: FEBRUARY 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 February 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 is currently being 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 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 is being conducted to evaluate the performance of ZVI under conditions present in Transect 1A. Transect 1A bench-scale testing continued during February 2020 and included ongoing soil microcosm testing using Transect 1A soil and groundwater. Transect 1A bench-scale tests are being 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	February Sampling Dates
Group 1	Evaluate ZVI's ability to reduce perchlorate, chlorate, and nitrate under Transect 1A conditions	1/25/2020	Week 2 – 2/10/2020 Week 4 – 2/24/2020
Group 2	Evaluate the effects of carrier agents, additives, and nutrient/carbon amendments on ZVI's performance in reducing perchlorate, chlorate, and nitrate ^[1]	1/16/2020	Week 4 – 2/13/2020
Note: 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:** Initial results from the first four weeks 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. Group 1 microcosm results show the following trends:
 - Nearly complete reduction of perchlorate, chlorate, and nitrate in both alluvium and UMCf microcosms for all ZVI dose levels after four weeks.
 - Little correlation between reaction rates and ZVI dose.
 - More rapid reduction of perchlorate and chlorate in the UMCf microcosms in the first two weeks compared to the alluvium microcosms.

Group 1 microcosms will continue to be sampled in March, and associated data will be provided in the March progress report.
- **Group 2:** Initial results from the first four weeks of soil microcosm testing for Group 2, which includes application of ZVI, carrier agent, additives, and/or nutrient/carbon amendments to mixed Transect 1A alluvium and UMCf soil, are presented on Figures 4 through 6. Group 2 microcosm results show the following trends:
 - Nearly complete reduction of chlorate and nitrate under all tested conditions except for the control (i.e., no treatment) microcosm.

- Complete reduction of perchlorate for all conditions in which inoculum was provided to the microcosms but no distinctive perchlorate reduction for microcosms in which no inoculum was added, confirming evidence that removal of perchlorate was biological reduction.

Group 2 microcosms with remaining detections of perchlorate and chlorate will continue to be sampled in March, and associated data will be provided in the March progress report.

- Schedule and Progress Updates
 - Streamlined bench-scale testing associated with the implementation of Treatability/Pilot Study Modification No. 9 is anticipated to be completed in April 2020. Data from bench-scale testing activities will continue to be summarized in forthcoming progress reports and will be used to inform the Phase 2 field test design.
 - 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 February 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: Jay A Steinberg 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: 4/6/2020

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.

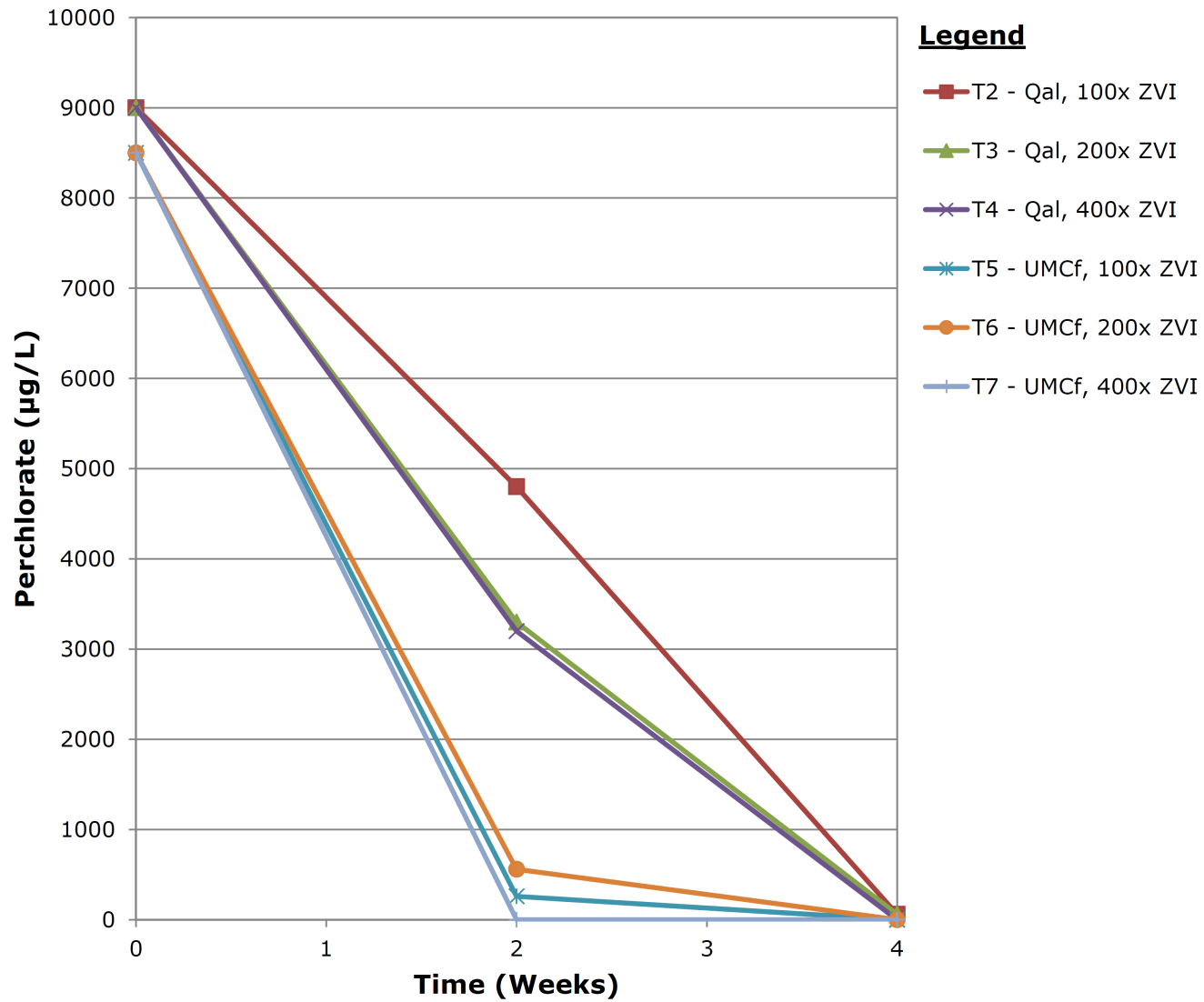


John M. Pekala, PG
Principal

April 6, 2020

Date

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



Notes:

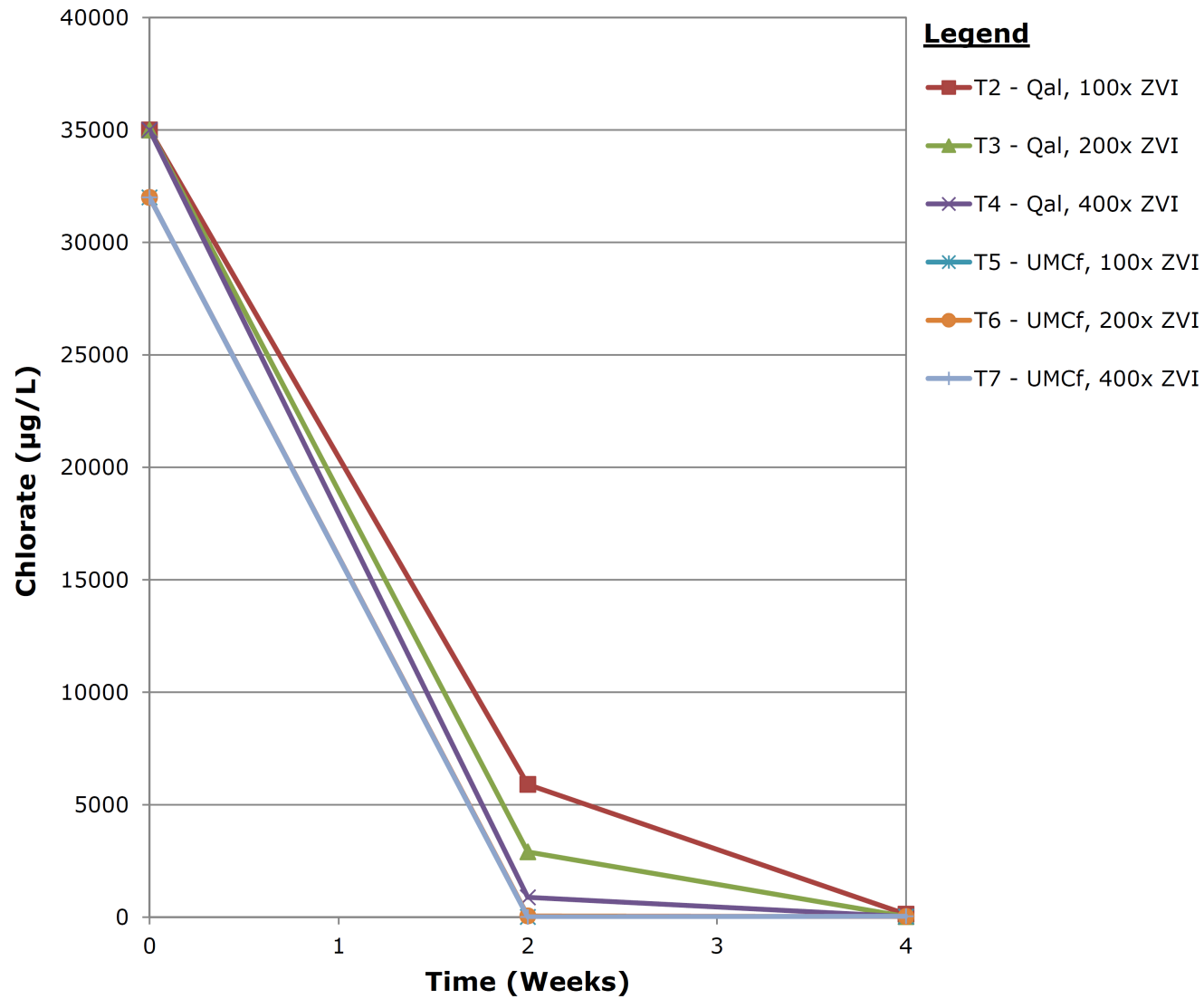
1. Tests T2 through T7 were inoculated upon test initiation.
- µg/L = micrograms per liter; Qal = Alluvium; UMCf = Upper Muddy Creek formation



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

Figure

1



Notes:

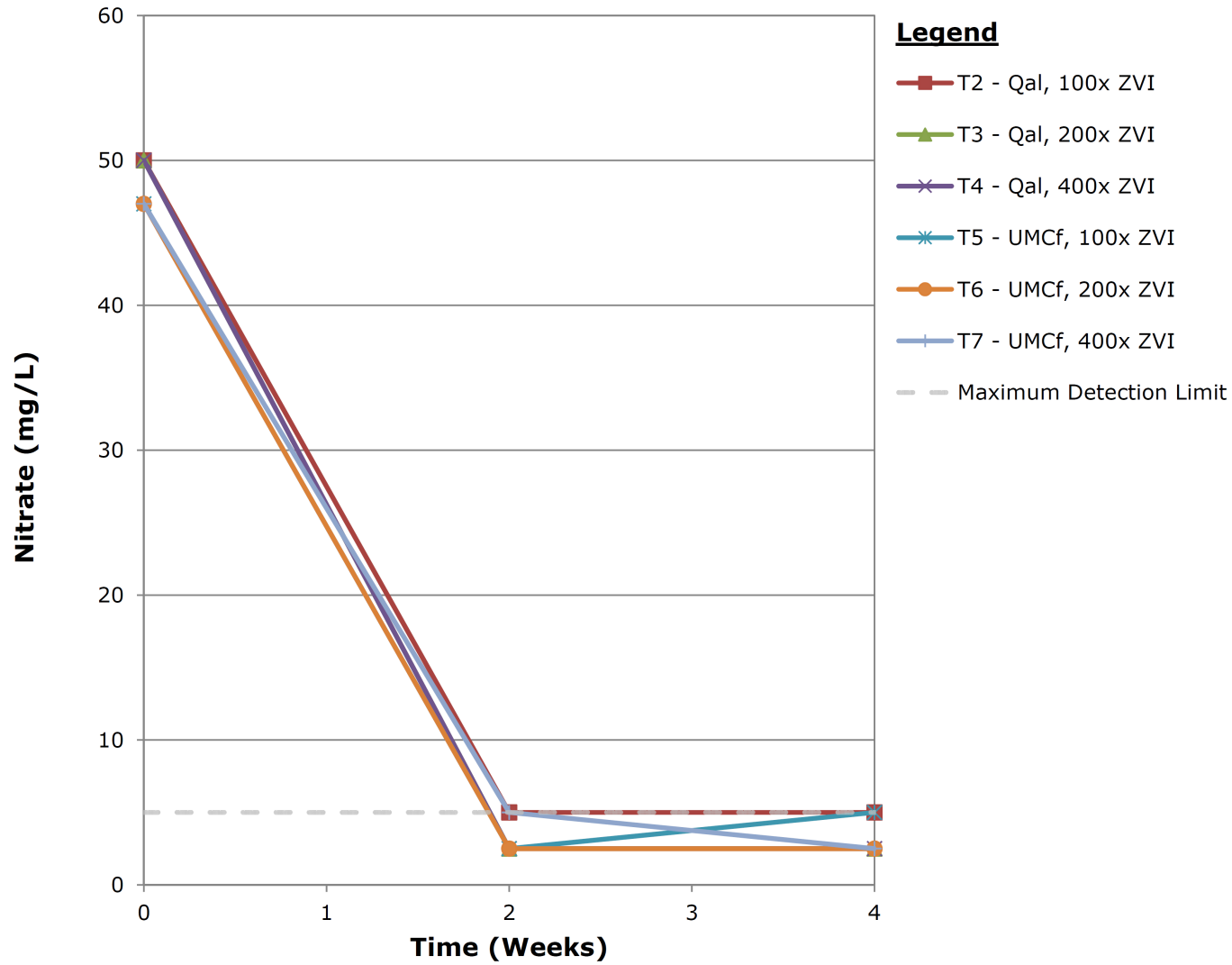
1. Tests T2 through T7 were inoculated upon test initiation.
- µg/L = micrograms per liter; Qal = Alluvium; UMCf = Upper Muddy Creek formation



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

Figure

2



Notes:

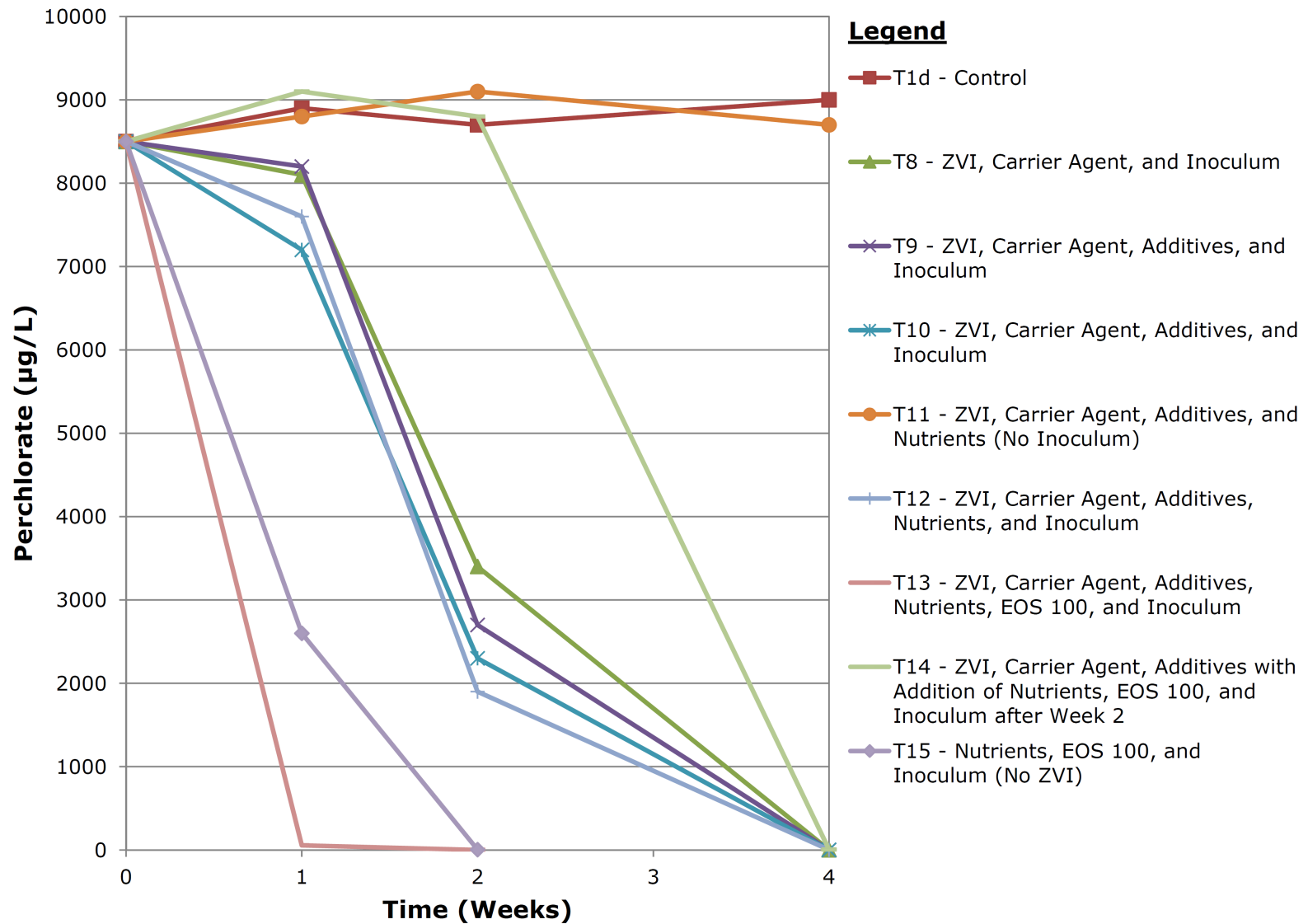
1. Tests T2 through T7 were inoculated upon test initiation.
 2. Non-detect nitrate concentrations are plotted at or below the maximum detection limit of 5 mg/L.
- mg/L = milligrams per liter; Qal = Alluvium; UMCf = Upper Muddy Creek formation



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

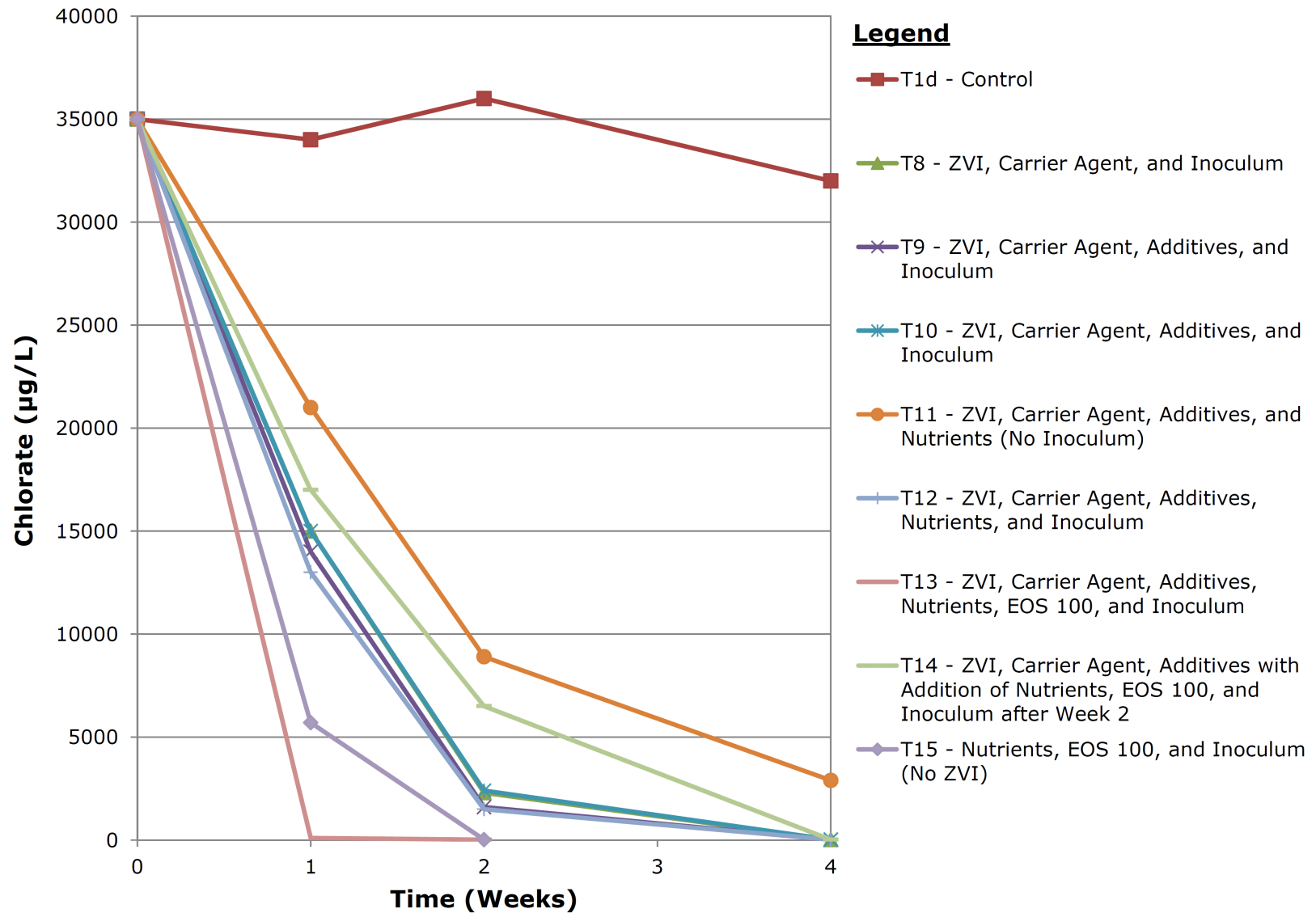
Drafter: UP

Date: 03/09/20

Contract Number: 1690016064

Approved:

Revised:



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

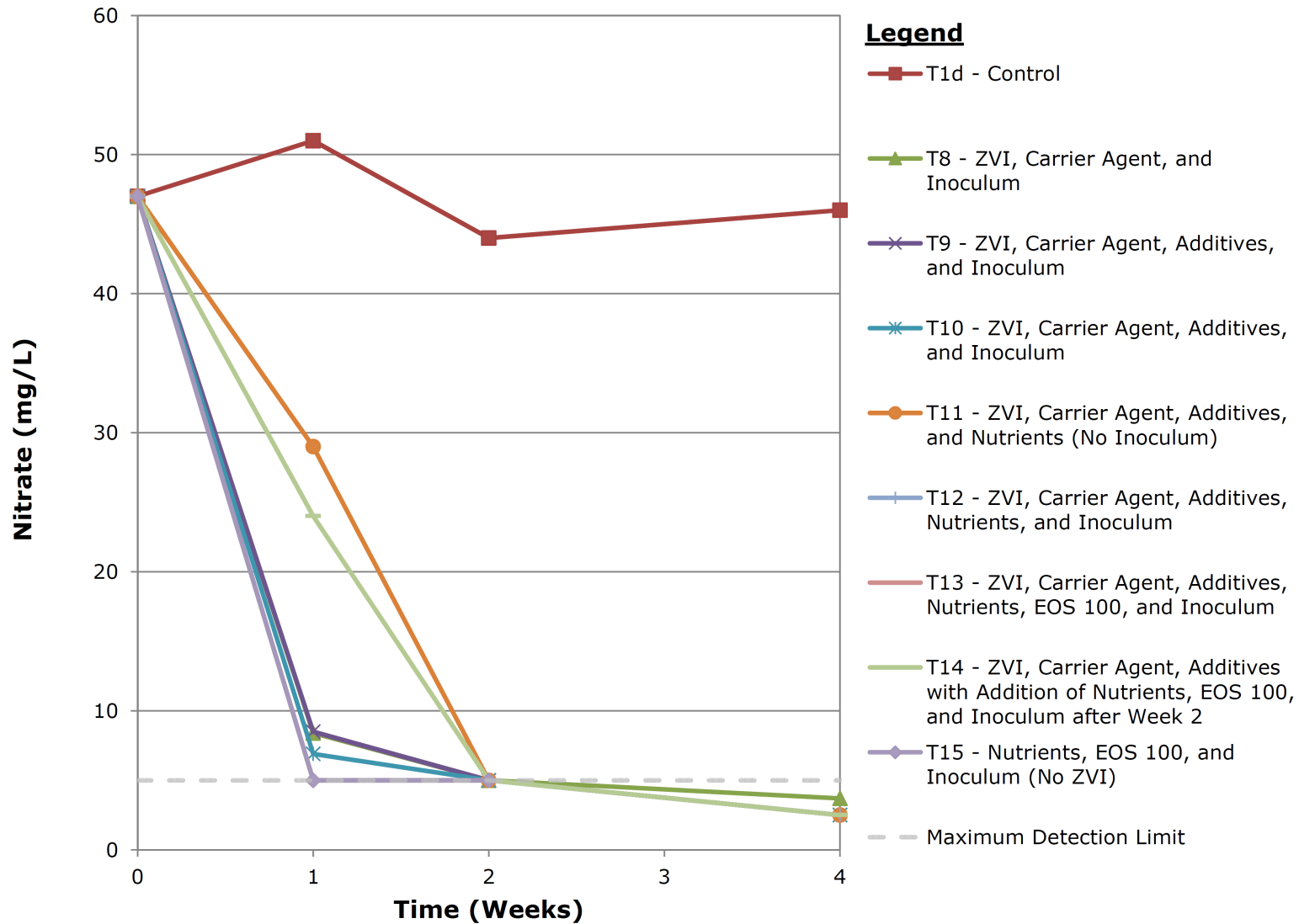
Drafter: UP

Date: 03/09/20

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Approved:

Revised:



Notes:

1. Non-detect nitrate concentrations are plotted at or below the maximum detection limit of 5 mg/L.
mg/L = milligrams per liter



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

Figure

6