TETRA TECH

# TECHNICAL MEMORANDUM

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| ***To:*** | **Brian Loffman, Andrew Steinberg**<br>**Nevada Environmental Response Trust** |
| ***From:*** | Dana Grady and Dan Pastor, Tetra Tech |
| ***Date:*** | March 27, 2020 |
| ***Subject:*** | Phase 2a Results and Final Closeout – Galleria Drive Bioremediation Treatability Study<br>Nevada Environmental Response Trust Site, Henderson, Nevada |

On behalf of the Nevada Environmental Response Trust (NERT or the Trust), Tetra Tech has prepared this technical memorandum and project closure report to present a summary of the Phase 2a investigation results for the Galleria Drive Bioremediation Treatability Study and justification for termination of the study. As presented in the Nevada Division of Environmental Protection (NDEP)-approved *Galleria Drive Bioremediation Treatability Study Work Plan Addendum* (Work Plan Addendum) (Tetra Tech, 2019a), an in-situ bioremediation (ISB) treatability study was to be performed in the Upper Muddy Creek formation (UMCf) along Galleria Drive (Figure 1) to collect data for the remedial alternatives evaluation in the forthcoming Feasibility Study. Due to the potential sale of the land parcel originally proposed for the treatability study, the Trust directed Tetra Tech to evaluate alternative locations for implementing the study. A new location was identified approximately 1,500 southwest of the previously approved study area (Figure 2). This location was selected due to the potential for similar subsurface conditions with an added advantage of being within a public right-of-way, which will likely be the location of a full-scale remedy due to the existing infrastructure and on-going development in the vicinity of Galleria Drive. Consistent with the scope of work presented in *Treatability/Pilot Study Modification No. 8* (Mod No. 8) (Tetra Tech, 2019b), which was approved by NDEP on July 30, 2019, an investigation (noted as Phase 2a) was performed in September and October 2019 to assess a potential new location for the treatability study. The Phase 2a investigation was required to assess whether site conditions, including groundwater flow patterns, local hydrogeologic conditions, groundwater geochemistry, and perchlorate/chlorate distribution, was sufficiently similar to the previously approved location to support implementing the Work Plan Addendum.

The results of the Phase 2a investigation presented site conditions that were deemed unfavorable for the implementation of this study. Through receipt of this data, coupled with data that has been and will be obtained by the Trust through its ongoing remedial investigation/feasibility study (RI/FS), the Trust has elected to terminate the study as it feels a sufficient data set will be available for the FS. Accordingly, this memorandum presents the results of the Phase 2a investigation and justification for termination of the study.

## 1.0 PHASE 2A ACTIVITIES

This section describes the various field activities that were completed as part of the Phase 2a investigation to evaluate groundwater flow patterns, local hydrogeologic conditions, groundwater geochemistry, and perchlorate/chlorate distribution within the Phase 2a investigation area as presented in Figure 2.

## 1.1 Pre-Drilling Activities

Prior to implementing the field program, the Trust obtained access agreements for all field activities from City of Henderson (COH) and Basic Environmental Company LLC (BEC). Tetra Tech, on behalf of the Trust, prepared applications and facilitated obtaining the permits prior to the installation of soil borings and monitoring wells. A Monitoring Well Drilling Waiver (Nevada Administrative Code [NAC] 534.441) and a Notice of Intent to Drill Card (NAC 534.320) were submitted to the Nevada Division of Water Resources (NDWR). The Monitoring Well Drilling Waiver also included a completed, signed, and notarized Affidavit of Intent to Plug a Monitoring Well as a required attachment.

Prior to drilling activities, Tetra Tech contacted USA North Utility Locating Services, reviewed available utility maps, and retained the services of a geophysical locator to check for underground utility lines. Each drilling location was cleared to a depth of 10 feet below ground surface (bgs) by air knife operations. Because three of the four monitoring wells were located within the public Right-of-Way (ROW) of Galleria Drive, a Traffic Control Plan was prepared and submitted to obtain a Barricade Permit from the COH. The Traffic Control plan was implemented during field activities conducted in the public ROW.

## 1.2 Installation of Soil Boring and Monitoring Wells

Soil borings and monitoring wells were installed to provide information on the lithology, hydrogeology, and contaminant distribution within the Phase 2a investigation area. Phase 2a drilling activities began on September 9, 2019, and were completed on September 19, 2019. Four monitoring wells were installed within the Phase 2a investigation area, as identified in Figure 2. The monitoring well locations were selected to provide a spatial distribution of data for both groundwater concentrations and hydraulic properties. All soil borings and monitoring wells were installed, developed, and sampled in accordance with the approved Mod No. 8 and approved *Field Sampling Plan, Revision 1* (ENVIRON, 2014). Well construction details, soil boring and well construction logs, and soil core photos are included in Attachment A.

Each soil boring was advanced to a depth of 100 feet bgs. Continuous soil cores were logged from ground surface to total depth by a Tetra Tech geologist using the Unified Soil Classification System. Photographs of soil cores were also collected during drilling activities. Soil samples were collected to characterize the distribution of perchlorate in soil with depth. Samples were collected on approximate 10-foot intervals from the top of the water table to the bottom of the boring at each of the four new locations and analyzed for perchlorate using United States Environmental Protection Agency (USEPA) Method 314.0.

Upon completion of each boring, a monitoring well was installed and constructed with 2-inch diameter Schedule 40 polyvinyl chloride (PVC) casing and screened with 2-inch diameter, 0.010-inch slotted PVC well screen. All four monitoring wells were screened in the UMCf. The depth and length of the well screens were determined in the field based on the lithology encountered at each location, but generally were focused from 55- 80 feet bgs. All wells were completed with flush-mounted, traffic-rated well boxes, at an elevation approximately 0.5-inch above grade. Once all monitoring well installation activities were complete, a Nevada-licensed land surveyor surveyed the horizontal coordinates of each monitoring well relative to North American Datum 83 with an accuracy of 0.1 foot. The elevations of the ground surface and top of well casing measuring points relative to North American Vertical Datum 88 were surveyed with accuracies of 0.1 foot and 0.01 foot, respectively.

Following well construction, but no sooner than 48 hours after well construction was complete, the newly installed monitoring wells were developed using a surge block and bailer to swab and surge the filter pack and remove sediment from the wells. This process was followed by pumping with a submersible pump to purge the well of fine-grained sediment. Well development was considered complete when a minimum of three casing volumes of water had been removed from the well and index parameters (consisting of pH, specific conductivity, turbidity and temperature) were stable over three consecutive measurements.

## 1.3 Groundwater Sampling

Following completion of well development, monitoring wells were allowed to equilibrate for 48 to 96 hours and then groundwater levels were gauged on September 20, 2019 in the four newly installed wells (GRTS-MW06, GRTS-MW07, GRTS-MW08, and GRTS-MW09) and in six existing nearby monitoring wells (DM-5, ES-11, ES-36, ES-42, MCF-05, and MCF-20A). During gauging and sampling, the water levels in several of the wells were observed to be recovering very slowly from the well development and sampling activities due to low formation hydraulic conductivity, indicating the need for a longer recovery time to ensure that a representative potentiometric surface and hydraulic gradient were obtained. Thereafter, a second gauging event on November 1, 2019, was conducted after all newly installed monitoring wells had fully recovered from both the well development and the subsequent sampling activities.

From September 20 through September 23, 2019, groundwater samples were collected from the four new monitoring wells using low-flow purging and sampling techniques following the guidance of the *Field Sampling Plan, Revision 1* (ENVIRON, 2014). Groundwater samples were sent to Eurofins Test America Laboratories and analyzed for the following:

- Perchlorate by USEPA Method 314.0
- Chlorate by USEPA Method 300.1
- Nitrate by USEPA Method 300.0
- Total organic carbon by SM5310B
- Sulfate by USEPA Method 300.0
- Total dissolved solids by SM2540C

Field parameters including temperature, pH, turbidity, electrical conductivity, dissolved oxygen, and oxidation-reduction potential were collected during sampling activities. Due to issues with potential laboratory contamination reported by Eurofins Test America, a second groundwater sampling event was conducted on October 23, 2019, which included resampling of all four new monitoring wells for all parameters listed above. Samples collected during this second groundwater sampling event were sent to Eurofins Test America for analysis, with field splits sent to Pace Analytical National Center for Testing & Innovation (Pace Analytical) to confirm results[1].

## 1.4 Slug Testing

Slug testing of the four newly installed monitoring wells was conducted from September 23 to September 26, 2019, to obtain information regarding aquifer hydraulic conductivity in the Phase 2a investigation area. The slug tests were performed in general accordance with ASTM International Standard D 4044-96 (ASTM International, 2008). Prior to conducting each slug test, the water level in the monitoring well was measured manually with an electronic water level probe to determine the static groundwater level. An electronic pressure transducer/data logger was suspended in the monitoring well and water levels were monitored manually until static conditions were reestablished. A falling-head test was then conducted by lowering a length of weighted and sealed PVC pipe (slug) into the monitoring well, securing it in place above the transducer, and recording the rate of water level decline. Once static conditions were reestablished, a rising-head test was conducted by removing the slug and allowing the water level to again recover to static conditions while recording the rate of recovery.

At the end of each test, the pressure transducer was removed from the monitoring well and the water level displacement data were downloaded to a laptop computer and corrected for barometric pressure effects. The corrected data were interpreted using AQTESOLV for Windows (Duffield, 2014). Where possible, both the falling-head and rising-head data were analyzed to cross-check the interpretation results.

[1] No additional charges were incurred by the Trust as all costs associated with the resampling effort (labor, equipment, and sample analysis) were reimbursed by Eurofins Test America.

## 1.5 Management of Investigation-Derived Waste

Investigation-derived waste (IDW) generated was managed in accordance with applicable state, federal, and local regulations and as described in *Field Sampling Plan, Revision 1* (ENVIRON, 2014). During drilling mobilizations, IDW included soil cuttings, personal protective equipment, equipment decontamination water, and groundwater generated during depth-discrete groundwater sampling and monitoring well development. Investigation-derived soil waste was containerized onsite in a plastic-lined, 10-cubic-yard roll-off bin. The roll-off was labeled to indicate contents, source, and date when accumulation began. Soil cuttings were generated from September 9 to September 13, 2019. One composite soil sample was collected from the roll-off for profiling purposes. The sample was analyzed for perchlorate following USEPA Method 314.0; total and toxicity characteristic leaching procedure (TCLP) Resource Recovery and Conservation Act (RCRA) 8 metals following USEPA Method 6010B and USEPA Method 7470A; TCLP volatile organic compounds (VOCs) following USEPA Method 8260B; TCLP semi-volatile organic compounds (SVOCs) following USEPA Method 8270; and ignitability following USEPA Method 7.1.2. Results indicated that the soil cuttings were non-hazardous waste. All IDW was disposed at Apex Landfill, Las Vegas, Nevada.

Waste water generated during purging or decontamination activities was temporarily stored in 55-gallon drums and/or 500-gallon totes and transferred into the onsite GW-11 Pond for treatment in the groundwater extraction and treatment system.

# 2.0 PHASE 2A RESULTS

Data collected during the soil boring and monitoring well installation, groundwater sampling, and slug testing were compiled to provide an overview (for comparison and suitability to the original location) of the geology, hydrogeology, nature and extent of contamination, and hydraulic properties of the Phase 2a investigation area. Monitoring well locations discussed within this section are shown on Figure 2 and well construction information is presented in Attachment A.

## 2.1 Local Geology

Data from the soil boring and monitoring well installation activities were compiled to provide a description of the geology of the Phase 2a investigation area. A review of the lithology indicates that the uppermost 17-20 feet of material within the Phase 2a investigation area consist of unsaturated alluvium ranging from silty fine-grained sand to well graded sand with up to 35 percent gravel. The UMCf underlying the unsaturated alluvium consists predominantly of sandy silt to clay. The lenses of saturated sandy silt that occur in the upper portion of the UMCf were targeted when selecting screened intervals during monitoring well installation. The deeper portions of the UMCf are finer-grained and consist predominantly of organic-rich clays.

Gypsum occurs throughout the UMCf as disseminated very-fine-to-coarse grained crystals up to 4 inches in length and in beds composed almost entirely of gypsum. The deeper, more clay-rich UMCf below approximately 71-75 feet bgs is semi-consolidated. This semi-consolidated UMCf material is typically finer-grained and more strongly cemented with gypsum, and no significant sandy or saturated lenses were identified in this deeper zone during well installation.

## 2.2 Analytical Results

This section provides a summary of the soil and groundwater analytical results and the associated data validation process. Complete analytical results are provided in Attachment B and groundwater sampling field logs are provided in Attachment C. A data validation summary report is provided in Attachment D.

### 2.2.1 Soil Analytical Results

As described in Section 1.2, soil samples were collected at the four soil boring locations on approximate 10-foot intervals from the top of the first saturated interval observed during drilling to the base of the boring at 100 feet bgs. Samples were collected to characterize distribution of perchlorate in soil with depth. Perchlorate concentrations ranged from less than 0.013 to 2.4 milligrams per kilogram (mg/kg) in soil samples collected from the UMCf. Unlike the previously approved treatability study area where perchlorate was detected in soil collected as deep as 110 feet bgs, perchlorate here was detected only as deep as 65 feet bgs in the Phase 2a investigation area. The highest perchlorate concentration of 2.4 mg/kg was detected in the soil sample collected from the GRTS-MW06 at 25 feet bgs. Additionally, perchlorate was not detected in soil deeper than 35 and 49 feet bgs respectively from GRTS-MW06 and GRTS-MW09. Complete soil analytical results are presented in Table B.1 in Attachment B and summarized in ***Table 1***.

***Table 1*** Perchlorate Concentration in Soil – Phase 2a Investigation Area

| Soil Boring Location | Sample Depths (ft bgs) | Perchlorate Concentration (mg/kg) | Deepest Detection of Perchlorate (ft bgs) |
|---|---|---|---|
| GRTS-MW06 | 25 – 97.5 | <0.060 – 2.4 | 35 |
| GRTS-MW07 | 45 – 97 | <0.059 – 1.3 | 65 |
| GRTS-MW08 | 52 – 99 | <0.013 – 1.3 | 60 |
| GRTS-MW09 | 40 – 100 | <0.063 – 2.0 | 49 |

**Notes:**
ft bgs – feet below ground surface
mg/kg – milligrams per kilogram
UMCf – Upper Muddy Creek formation

### 2.2.2 Groundwater Analytical Results

As described in Section 1.3, initial groundwater sampling was performed September 20 – 23, 2019. Due to an anomalous result and suspected laboratory contamination of a groundwater sample, all newly installed monitoring wells were resampled October 23, 2019. To confirm the results of the October 23, 2019, resampling, groundwater samples were submitted to both Eurofins Test America and Pace National. Complete analytical results are provided in Attachment B (Table B.2) and groundwater sampling field logs are provided in Attachment C. Groundwater results are summarized in ***Table 2***.

***Table 2*** Concentrations in Groundwater – Phase 2a Investigation Area
October 23, 2019 (Resample)[1]

| Analyte | Groundwater Results from Newly Installed Monitoring Wells | | | |
|---|---|---|---|---|
| | GRTS-MW06 | GRTS-MW07 | GRTS-MW08 | GRTS-MW09 |
| Perchlorate (µg/L) | <5.0 | 700 | 2,100 | <5.0 |
| Chlorate (µg/L) | 270 J | 1,100 | 3,300 | <100 |
| Nitrate as N (mg/L) | 3.9 J | <5.5 | 6.6 J | 6.0 J |
| Sulfate (mg/L) | 4,500 | 9,300 | 13,000 | 12,000 |

| Analyte | Groundwater Results from Newly Installed Monitoring Wells | | | |
|---|---|---|---|---|
| | GRTS-MW06 | GRTS-MW07 | GRTS-MW08 | GRTS-MW09 |
| TDS (mg/L) | 14,000 | 21,000 | 27,000 | 26,000 |
| TOC (mg/L) | 1.0 | 1.1 | 1.2 | 1.7 |

**Notes:**
(1) Notes presented are reflective of the Eurofins Test America results from the October 23, 2019, resampling effort. Complete analytical results, including the original sampling effort and split samples analyzed by Pace National, are provided in Table B.2, Attachment B.
J – Result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
µg/L – micrograms per liter
mg/L – milligrams per liter
TDS – total dissolved solids
TOC – total organic carbon

During the October 23, 2019, resample event, perchlorate was not detected above the sample detection limit of 5 micrograms per liter (µg/L) in groundwater samples collected from two of the four newly installed monitoring wells screened in the UMCf within the Phase 2a investigation area. The highest perchlorate concentration of 2,100 µg/L was measured in groundwater collected from monitoring well GRTS-MW08. Chlorate concentrations followed a similar pattern with respect to distribution in UMCf, with the highest chlorate concentration of 3,300 µg/L detected in groundwater collected from monitoring well GRTS-MW08.

Nitrate, which is the most likely competing electron acceptor and carbon substrate consumer during bioremediation, was detected at concentrations up to 6.6 J milligrams per liter (mg/L) in groundwater samples collected. Sulfate and total dissolved solids (TDS) were detected at concentrations of up to 13,000 and 27,000 mg/L, respectively, in groundwater samples collected from the four new monitoring wells. The high TDS concentrations are attributed to the sulfate concentrations and associated cations, rather than the chlorate and perchlorate concentrations. High levels of sulfate and TDS could pose a challenge to the microbial community. Often, high TDS may cause a lag to the onset of perchlorate biodegradation or may sometimes even prevent contaminant biodegradation. These elevated sulfate and TDS concentrations are consistent with those observed in the previously planned treatability study area identified in the Work Plan Addendum. Lastly, total organic carbon (TOC) concentrations in groundwater at the four newly installed monitoring wells ranged from 1.0 mg/L to 1.7 mg/L, which are also consistent with the previously planned treatability study area.

### 2.2.3 Data Validation

A Data Validation Summary Report (DVSR) was prepared for the laboratory analytical data collected to assess the validity and usability of laboratory analytical data from well installation activities and groundwater monitoring associated with the Galleria Drive Bioremediation Treatability Study. To aid in assessing data quality, Tetra Tech collected additional quality assurance and quality control (QA/QC) samples, which included equipment blanks, field blanks, field duplicates, and matrix spike/matrix spike duplicates. The QA/QC samples provided information on the effects of sampling procedures and assessed sampling contamination, laboratory performance, and matrix effects.

The DVSR is provided as Attachment D to this technical memorandum. The laboratory analytical data were verified and validated in accordance with procedures described in the *Quality Assurance Project Plan, Revision 2* (Ramboll Environ, 2017), *Quality Assurance Project Plan, Revision 3* (Ramboll, 2019), *NDEP Data Verification and Validation Requirements* (NDEP, 2018), and the references contained therein. Aqueous samples were validated to Stage 2A. For soil samples, 90 percent of the data was validated to Stage 2B and 10 percent to Stage 4. The review process uses professional judgment and National Functional Guidelines (NFG) guidance to determine the final qualifiers, which are added to the database and presented in the DVSR tables.

## 2.3 Local Hydrogeology

Based on data collected during the installation of soil borings and monitoring wells, groundwater was first encountered in the UMCf since there was no saturated alluvium present within the Phase 2a investigation area. The groundwater level gauging event on September 20, 2019, indicated that the depth to groundwater within the Phase 2a investigation area ranged from about 35-45 feet bgs. The second gauging event on November 1, 2019, indicated similar results, with depth to water measurements ranging from approximately 34-43 feet bgs, which reflects nearly 3 feet of additional recovery in water levels in monitoring wells GRTS-MW08 and GRTS-MW09. Groundwater in the UMCf in the Phase 2a investigation area generally flows north-northeast, which is consistent with flow directions observed from monitoring wells screened in a similar interval at the previously planned treatability study area. The calculated average hydraulic gradient in the Phase 2a investigation area for wells screened shallower than 90 feet bgs (both newly installed Phase 2a and existing monitoring wells) was approximately 0.01 feet per foot.

Figure 3 presents a groundwater potentiometric surface map of the Phase 2a investigation area, with depth to water measurements included for the UMCf wells within the general investigation area that are screened less than 90 feet bgs. Depth to water measurements are provided in Table C.1, in Attachment C.

## 2.4 Slug Testing Results

Slug tests were performed to obtain location-specific aquifer hydraulic conductivity in the screened interval of the four newly installed monitoring wells within the Phase 2a investigation area. Slug testing results are shown in ***Table 3***, and supporting AQTESOLV (HydroSOLVE, 2007) interpretation plots are provided in Attachment E.

***Table 3*** Slug Testing Results – Phase 2a Investigation Area

| Well | Date | Mean Hydraulic Conductivity (K) | | Logged Lithology of Screened Interval |
|---|---|---|---|---|
| | | (feet/day) | (cm/sec) | |
| **Phase 1 Results from Previous Location** | | | | |
| Average (60 – 80 ft bgs) | | 0.433 | $1.53 \times 10^{-04}$ | Not applicable |
| Average (90 – 110 ft bgs) | | 0.002 | $8.74 \times 10^{-07}$ | Not applicable |
| **Phase 2a Results** | | | | |
| GRTS-MW06 | 9/23/2019 | 0.02 | 7.06E-06 | Sandy silt to silt |
| GRTS-MW07 | 9/23/2019 | 0.01 | 4.46E-06 | Silt to clay |
| GRTS-MW08 | 9/23/2019 | 0.008 | 2.69E-06 | Silt |
| GRTS-MW09 | 9/24/2019 | 0.009 | 3.06E-06 | Silt to sandy silt |
| | **Average** | **0.012** | **4.32E-06** | |

**Notes:**
cm/sec - centimeters per second

Results indicate that hydraulic conductivity (K) values in the UMCf in the Phase 2a investigation area are lower than those estimated for similar depth intervals in the previously approved treatability study area. Previous results from Phase 1 activities indicated that the average hydraulic conductivity in the upper UMCf (60-80 feet bgs) is 0.5 feet per day (ft/day) (Tetra Tech, 2019a). Estimated hydraulic conductivities in the Phase 2a investigation area ranged from 0.008 ft/day to 0.02 ft/day. The estimated hydraulic conductivities are consistent with the logged

lithology, which was generally fine-grained silt and clay, commonly cemented with gypsum. These low hydraulic conductivities may also suggest that the saturated sandy silt layers targeted during well installation may be isolated zones and not laterally continuous, higher hydraulic conductivity zones.

Many factors can affect slug test results. Some factors determine whether the K from a slug test is representative of the overall formation K. For example, the values estimated from slug tests are strongly influenced by the presence of a low-K well skin, drilling-induced disturbances, highly anisotropic formations, and the quality of well development (Butler 1998; Hyder and Butler 1995). Also, non-instantaneous or incomplete slug removal, accidental transducer or slug movement after the test began, and other factors may affect the interpretation of slug test results. Some of these factors were present in some of the GRTS slug tests, but generally – when both the rising and falling head tests were analyzed, the results were consistent within each well.

Water levels in well GRTS-MW09 appear to have still been recovering from recent well development when the slug tests were performed. For this well, the trend in water level was removed from the data before the tests were analyzed.

# 3.0 RECOMMENDED PATH FORWARD

It is recommended that this treatability study be discontinued based on the data collected within the Phase 2a investigation area. Specifically, the very low hydraulic conductivities (estimated at an average of 0.012 feet/day) within the Phase 2a investigation area indicate that implementation of ISB is likely impractical within this portion of the UMCf. The saturated interval in the Phase 2a investigation area has hydraulic properties that are more similar to those encountered at the 90-110 feet bgs interval at the Phase 1 investigation area. Based on technical experience and previous step-rate testing performed in the 90-110 feet bgs interval as part of the Phase 1 pre-design activities in the previously planned treatability study area, attempting to inject carbon substrate and amendments into this saturated interval is expected to result in prohibitively low injection rates, even at high injection pressures.

Based on the recent Phase 2a results and other RI/FS data that has been collected to date, it appears that the zones within the UMCf that contain elevated TDS and sulfate concentrations in groundwater seem to correlate with extremely low hydraulic conductivity units. One of the original primary objectives of this study was to evaluate ISB effectiveness in a high TDS and sulfate environment. As a result of the data sets collected during the Phase I and 2a activities, ISB in this specific subsurface environment likely no longer requires evaluation due to these unique geochemical conditions primarily being located in an area that will likely not be targeted for full-scale remediation due to the low hydraulic conductivity. Therefore, the results of the Phase 2a investigation, coupled with data that has been collected by the Trust through its ongoing RI/FS, has prompted the Trust to terminate the Galleria Drive Bioremediation Treatability Study. During the forthcoming FS, a full-scale ISB remedy can be evaluated using the dataset collected as part of the on-going Las Vegas Wash Bioremediation Pilot Study, and therefore, this study is no longer warranted.

# 4.0 FINAL CLOSEOUT

Due to on-going RI/FS activities, the monitoring wells installed as part of the Phase 1 and 2a investigation activities will remain in place to allow for future monitoring as warranted. When these monitoring wells are deemed to be no longer required, monitoring well abandonment will be performed in accordance with the provisions contained in NAC 534.4365 and all other applicable rules and regulations for plugging wells in the State of Nevada.

As part of final closeout activities, the following attachments are included to this memorandum:

- Data Validation Summary Report – Per the Work Plan Addendum, a final DVSR would be prepared upon completion of the project that would include all data collected to-date associated with the Galleria Drive

Bioremediation Treatability Study. Attachment D presents this final DVSR, which includes validation of data collected as part of the Phase 1 and Phase 2a activities.

- Final Bench-Scale Study Results Report – A summary of the bench-scale study activities and results associated with the Galleria Drive Bioremediation Treatability Study was presented in the Work Plan Addendum. The Work Plan Addendum concluded that the final bench-scale study results report would be provided as an appendix to the Galleria Drive Bioremediation Treatability Study Results Report to be submitted following completion of the study. Because a final treatability study results report is no longer warranted, the bench-scale study results report prepared by the University of Nevada at Las Vegas (UNLV) has been provided as Attachment F to this technical memorandum.

# 5.0 REFERENCES

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Butler, James J. Jr. (1998). *The Design, Performance, and Analysis of Slug Tests*. CRC Press LLC, 252 pages.

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ENVIRON. (2014). *Field Sampling Plan, Revision 1, Nevada Environmental Response Trust Site, Henderson, Nevada.* July 18, 2014.

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# CERTIFICATION

**Phase 2a Results and Final Closeout**
**Galleria Drive Bioremediation Treatability Study**

**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 as President of the Trustee, 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:** 3/27/2020

# 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:*** Phase 2a Results and Final Closeout Galleria Drive Bioremediation Treatability Study.

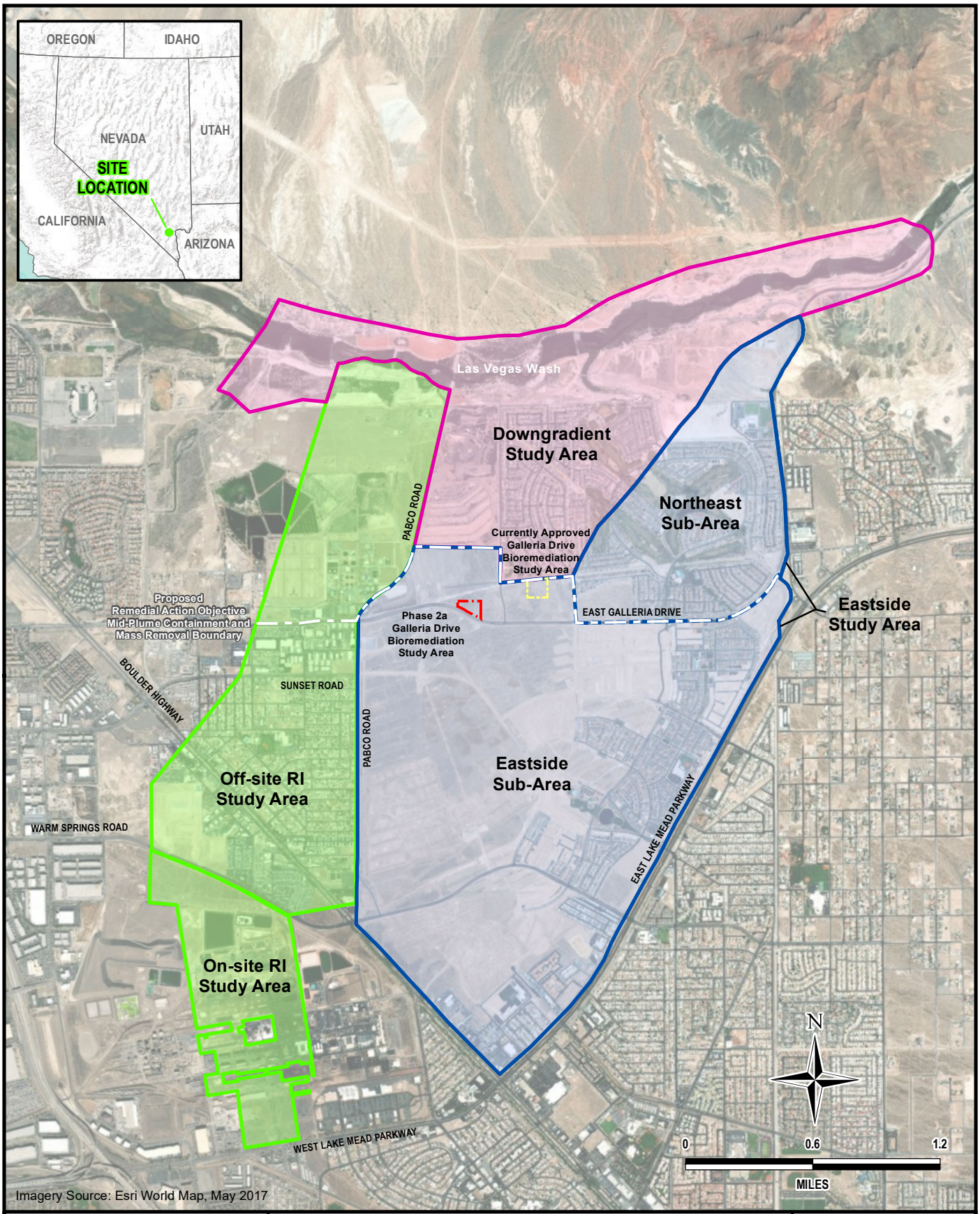
March 27, 2020

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

Date

Nevada CEM Certificate Number: 2167
Nevada CEM Expiration Date: September 18, 2020

# Figures

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NEVADA ENVIRONMENTAL RESPONSE TRUST

PHASE 2A RESULTS AND FINAL CLOSEOUT
GALLERIA DRIVE BIOREMEDIATION TREATABILITY STUDY

**TREATABILITY STUDY LOCATION**

| | |
|---|---|
| PROJECT NO.: | 117-7502019 |
| DATE: | FEBRUARY 14, 2020 |
| DESIGNED BY: | ES |

Figure No.
**1**


Imagery Source: Esri World Map, May 2017.

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NEVADA ENVIRONMENTAL RESPONSE TRUST

PHASE 2A RESULTS AND FINAL CLOSEOUT
GALLERIA DRIVE BIOREMEDIATION TREATABILITY STUDY

## PHASE 2A INVESTIGATION AREA

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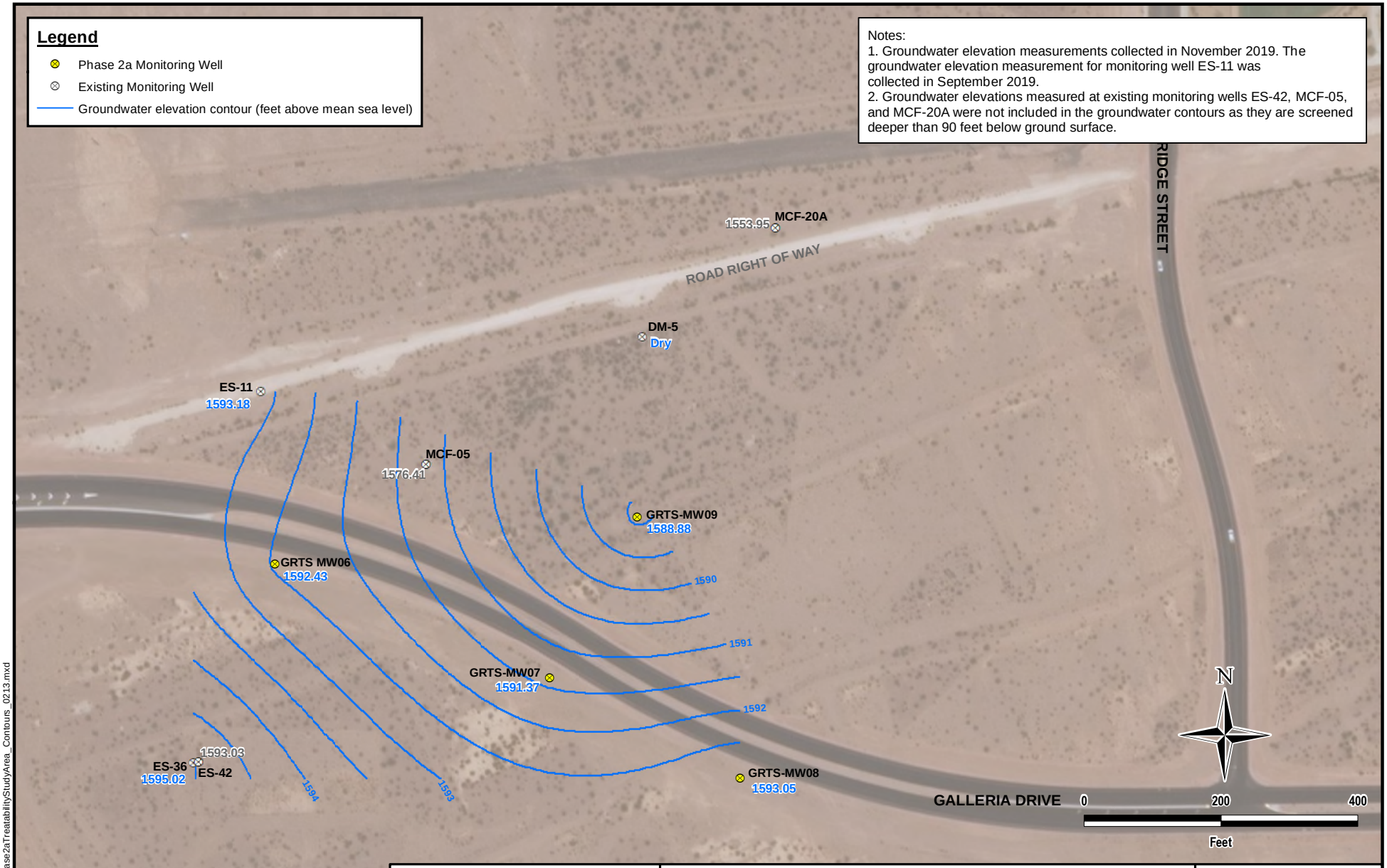
| Project No.: | 117-7502019 |
| Date: | FEBRUARY 13, 2020 |
| Designed By: | ES |

Figure No.

**2**

T:\NERT\GIS\M17_ProposedPhase2aTreatabilityStudyArea_0213.mxd




Imagery Source: Esri World Map, May 2017.

T:\NERT\GIS\M17_ProposedPhase2aTreatabilityStudyArea_Contours_0213.mxd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NEVADA ENVIRONMENTAL RESPONSE TRUST

PHASE 2A RESULTS AND FINAL CLOSEOUT
GALLERIA DRIVE BIOREMEDIATION TREATABILITY STUDY

# GROUNDWATER POTENTIOMETRIC SURFACE MAP

| | |
|---|---|
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Figure No.
**3**