Data Validation Summary Report, Revision 1
2019 Las Vegas Wash Zero-Valent Iron Treatability Study
Nevada Environmental Response Trust (NERT)
Henderson, Nevada

Prepared for

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July 16, 2020

DVSR and EDD for the 2019 Las Vegas Wash Zero-Valent Iron Treatability Study, Revision 1

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

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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

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Date: 7/20/2020

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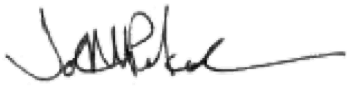
DVSR and EDD for the 2019 Las Vegas Wash Zero-Valent Iron Treatability Study, Revision 1

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.



7/20/2020

John M. Pekala, PG
Principal

Date

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

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ATTACHMENTS

LIST OF ACRONYMS AND ABBREVIATIONS

CCB	Continuing Calibration Blank
CLPNFG	Contract Laboratory Program National Functional Guidelines
DL	Detection Limit
DNR	Do Not Report
DOC	Dissolved Organic Carbon
DQO	Data Quality Objectives
DUP	Laboratory Duplicate
DVR	Data Validation Report
DVSR	Data Validation Summary Report
EPA	Environmental Protection Agency
FD	Field Duplicate
ICB	Initial Calibration Blank
ICV	Initial Calibration Verification
LCS/LCSD	Laboratory Control Sample / Laboratory Control Sample Duplicate
LDC	Laboratory Data Consultants, Inc.
MDL	Method Detection Limit
MS/MSD	Matrix Spike / Matrix Spike Duplicate
NDEP	Nevada Department of Environmental Protection
NERT	Nevada Environmental Response Trust
PARCCS	Precision, Accuracy, Representativeness, Comparability, Completeness, Sensitivity
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance / Quality Control
QAPP	Quality Assurance Project Plan
RPD	Relative Percent Difference
SDG	Sample Delivery Group
SQL	Sample Quantitation Limit
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
USEPA	United States Environmental Protection Agency
ZVI	Zero-Valent Iron
ug/Kg	Micrograms per Kilogram
ug/L	Micrograms per Liter
mg/Kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
nM	Nanomolar
%	Percent
%RSD	Percent Relative Standard Deviation
%D	Percent Difference
%R	Percent Recovery

1.0 INTRODUCTION

This data validation summary report (DVSR) has been prepared by Laboratory Data Consultants, Inc. (LDC) to assess the validity and usability of laboratory analytical data associated with the 2019 Las Vegas Wash Zero-Valent Iron (ZVI) Treatability Study conducted at the Nevada Environmental Response Trust (NERT) site in Henderson, Nevada. The assessment was performed by Ramboll as a part of the *Quality Assurance Project Plan, Revision 4, Nevada Environmental Response Trust Site, Henderson, Nevada* dated December 2019 and included the collection and analyses of 48 environmental and quality control (QC) samples. The analyses were performed by the following methods:

Hydrogen by AM20GAX
Metals by Environmental Protection Agency (EPA) 200.7 and EPA SW 846 Method 6010B

Wet Chemistry:
Alkalinity by Standard Method 2320B
Chlorate by EPA Method 300.1B
Chloride, Nitrate as Nitrogen, Nitrate as NO3, and Sulfate by EPA Method 300.0
Dissolved Organic Carbon by Standard Method 5310B
Ferric Iron by Standard Method 3500
Ferrous Iron by Standard Method 3500-FE D
Moisture by Standard Method 2540 G-2011
Perchlorate by EPA Method 314.0
Total Dissolved Solids by Standard Method 2540C
Total Organic Carbon by Standard Method 5310B and Lloyd Kahn

Laboratory analytical services were provided by Eurofins and Pace Analytical Services, LLC. The samples were grouped into sample delivery groups (SDGs). The water and soil samples are associated with quality assurance and quality control (QA/QC) samples designed to document the data quality of the entire SDG or a sub-group of samples within an SDG. Table I is a cross-reference table listing each sample, analysis, SDG, collection date, laboratory sample number, matrix, and validation level. An individual sample may be on multiple rows if it is reported on more than one SDG or if its analytes were validated at different validation levels. Table II is a reference table that identifies the QC elements reviewed for each validation level per method, as applicable.

The laboratory analytical data were validated in accordance with procedures described in the Nevada Division of Environmental Protection (NDEP) *Data Validation Guidance* established for the BMI Plant Sites and Common Areas Projects, Henderson, Nevada, July 13, 2018. Consistent with the NDEP requirements, one hundred percent of the water analytical data were validated according to Stage 2A and approximately ninety percent of the soil analytical data were validated according to Stage 2B data validation procedures and approximately ten percent of the soil samples were validated according to Stage 4 data validation procedures. The number of samples and percentage of samples validated to Stage 2A, Stage 2B, and Stage 4 for each method is presented in Table III.

The analytical data were evaluated for QA/QC based on the following documents: *Quality Assurance Project Plan, Revision 4, NERT Site, Henderson, Nevada,* December 2019; a modified outline of the *USEPA National Functional Guidelines* (NFGs) *for Organic Superfund Methods Data Review* (January 2017) and *for Inorganic Superfund Data Review* (January 2017); *Standard Method for the Examination of Water and Wastewater 22nd edition (2012);* and the *EPA SW 846 Third Edition, Test Methods for Evaluating Solid Waste,* update I, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IV, February 2007; update V, July 2014.

This report summarizes the QA/QC evaluation of the data according to precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) relative to the project data quality objectives (DQOs). This report provides a quantitative and qualitative assessment of the data and identifies potential sources of error, uncertainty, and bias that may affect the overall usability.

The PARCCS summary report evaluates and summarizes the results of QA/QC data validation for the entire sampling program. Each analytical fraction has a separate section for each of the PARCCS criteria. These sections interpret specific QC deviations and their effects on both individual data points and the analyses as a whole. Section 6 presents a summary of the PARCCS criteria by comparing quantitative parameters with acceptability criteria defined in the project DQO's. Qualitative PARCCS criteria are also summarized in this section.

Precision and Accuracy of Environmental Data

Environmental data quality depends on sample collection procedures, analytical methods and instrumentation, documentation, and sample matrix properties. Both sampling procedures and laboratory analyses contain potential sources of uncertainty, error, and/or bias, which affect the overall quality of a measurement. Errors for sample data may result from incomplete equipment decontamination, inappropriate sampling techniques, sample heterogeneity, improper filtering, and improper preservation. The accuracy of analytical results is dependent on selecting appropriate analytical methods, maintaining equipment properly, and complying with QC requirements. The sample matrix also is an important factor in the ability to obtain precise and accurate results within a given media.

Environmental and laboratory QA/QC samples assess the effects of sampling procedures and evaluate laboratory contamination, laboratory performance, and matrix effects. QA/QC samples include: method blanks, calibration blanks, matrix spike/matrix spike duplicates (MS/MSD), laboratory duplicates (DUP), laboratory control samples (LCS), field duplicates (FD), and equipment blanks (EB).

Before conducting the PARCCS evaluation, the analytical data were validated according to the NDEP Data Validation Guidance (July 2018), QAPP (December 2019), NFGs (USEPA 2017), and EPA Methods. Samples not meeting the acceptance criteria were qualified with a flag, an abbreviation indicating a deficiency with the data. The following are flags used in data validation.

J- Estimated The associated numerical value is an estimated quantity with a negative bias. The analyte was detected but the reported value may not be accurate or precise.

J+ Estimated The associated numerical value is an estimated quantity with a positive bias. The analyte was detected but the reported value may not be accurate or precise.

J Estimated The associated numerical value is an estimated quantity. It is not possible to assess the direction of the potential bias. The analyte was detected but the reported value may not be accurate or precise. The "J" qualification indicates the data fell outside the QC limits but the exceedance was not sufficient to cause rejection of the data.

R Rejected The data is unusable (the analyte may or may not be present). Use of the "R" qualifier indicates a significant variance from functional guideline acceptance criteria. Either resampling or reanalysis is necessary to determine the presence or absence of the rejected analyte.

U Nondetected Analyses were performed for the compound or analyte, but it was not detected.

UJ Estimated/Nondetected Analyses were performed for the analyte, but it was not detected and the sample quantitation or detection limit is an estimated quantity due to poor accuracy or precision.

DNR Do Not Report A more appropriate result is reported from another analysis or dilution.

A Indicates the finding is based upon technical validation criteria.

P Indicates the finding is related to a protocol/contractual deviation.

The hierarchy of flags is listed below:

R > J	The R flag will always take precedence over the J qualifier.
J+	The high bias (J+) flag is applied only to detected results.
J > J+ or J-	A non-biased (J) flag will always supersede biased (J+ or J-) flags since it is not possible to assess the direction of the potential bias.
J = J+ plus J-	Adding biased (J+, J-) flags with opposite signs will result in a non-biased flag (J).
UJ = U plus J	The UJ flag is used when a non-detected (U) flag is added to a non-biased flag (J).

Table IV lists the reason codes used. Reason codes explain why flags have been applied and allow data users to assess if a result is usable with qualification due to QA/QC outliers or not usable when rejected due to QA/QC outliers. Reason codes are cumulative except when one of the flags is R then only the reason code associated to the R flag will be used.

Table V presents the overall qualified results after all the flags or validation qualifiers and associated reason codes have been applied.

Once the data are reviewed and qualified according to the QAPP, NFG, EPA and Standard Methods, the data set is then evaluated using PARCCS criteria. PARCCS criteria provide an evaluation of overall data usability. The following is a discussion of PARCCS criteria as related to the project DQOs.

Precision is a measure of the agreement or reproducibility of analytical results under a given set of conditions. It is a quantity that cannot be measured directly but is calculated from reported concentrations.

Precision is expressed as the relative percent difference (RPD):

$RPD = (D1-D2)/\{1/2(D1+D2)\} \times 100$
where:
D1 = reported concentration for the sample
D2 = reported concentration for the duplicate

Precision is primarily assessed by calculating an RPD from the reported concentrations of the spiked compounds for each sample in the MS/MSD pair. In the absence of an MS/MSD pair, a laboratory duplicate or LCS/LCSD pair can be analyzed as an alternative means of assessing precision. An additional measure of sampling precision was obtained by collecting and analyzing field duplicate samples, which were compared using the RPD result as the evaluation criteria.

MS and MSD samples are field samples spiked by the laboratory with target analytes prior to preparation and analysis. These samples measure the overall efficiency of the analytical method in recovering target analytes from an environmental matrix. A LCS is similar to an MS/MSD sample in that the LCS is spiked with the same target analytes prior to preparation and analysis. However, the LCS is prepared using a

controlled interference-free matrix instead of a field sample aliquot. Laboratory reagent water or solid matrix is used to prepare an LCS. The LCS measures laboratory efficiency in recovering target analytes from either matrix in the absence of matrix interferences.

DUPs measure laboratory precision. DUPs are replicate samples and are prepared by taking two aliquots from one sample container. The analytical results for DUPs are reported as the RPD between the results of the two aliquots.

Laboratory and field sampling precision are evaluated by calculating RPDs for field sample duplicate pairs. The sampler collects two field samples at the same location and under identically controlled conditions. The laboratory then analyzes the samples under identical conditions.

An RPD outside the numerical QC limit in the LCS/LCSD, MS/MSD, DUPs, or field duplicates indicates imprecision. Imprecision is the variance in the consistency with which the laboratory arrives at a particular reported result. Thus, the actual analyte concentration may be higher or lower than the reported result.

Possible causes of poor precision include sample heterogeneity, improper sample collection or handling, inconsistent sample preparation, and poor instrument stability. In some duplicate pairs, results may be reported in either the primary or duplicate samples at levels below the practical quantitation limit (PQL) or non-detected. Since these values are considered to be estimates, RPD exceedances from these duplicate pairs do not suggest a significant impact on the data quality.

Accuracy is a measure of the agreement of an experimental determination and the true value of the parameter being measured. It is used to identify bias in a given measurement system. Recoveries outside acceptable QC limits may be caused by factors such as instrumentation, analyst error, or matrix interference. Accuracy is assessed through the analysis of MS, MSD, and LCS. In some cases, samples from multiple SDGs were within one QC batch and therefore are associated with the same laboratory QC samples. Accuracy is determined using the percent recoveries of MS and LCS analyses.

Percent recovery (%R) is calculated using the following equation:

$$\%R = (A-B)/C \times 100$$

where:
A = measured concentration in the spiked sample
B = measured concentration of the spike compound in the unspiked sample
C = concentration of the spike

The percent recovery of each analyte spiked in MS/MSD samples, and LCS/LCSD is evaluated with the acceptance criteria specified by the previously noted documents. Spike recoveries outside the acceptable QC accuracy limits provide an indication of bias, where the reported data may overestimate or underestimate the actual concentration of compounds detected or quantitation limits reported for environmental samples.

Representativeness is a qualitative parameter that expresses the degree to which the sample data are characteristic of a population. It is evaluated by reviewing the QC results of blanks, samples and holding times. Positive detects of compounds in the blank samples identify compounds that may have been introduced into the samples during sample collection, transport, preparation, or analysis. The QA/QC blanks collected and analyzed are method blanks, initial calibration blanks (ICB), and continuing calibration blanks (CCB) and EBs.

A method blank is a laboratory grade water or solid matrix that contains the method reagents and has undergone the same preparation and analysis as the environmental samples. The method blank provides a

measure of the combined contamination derived from the laboratory source water, glassware, instruments, reagents, and sample preparation steps. Method blanks are prepared for each sample of a similar matrix extracted by the same method at a similar concentration level.

Calibration blanks consist of acidified laboratory grade water, which are injected at the beginning and at a regular frequency during each 12 - hour sample analysis run. These blanks estimate residual contaminants from the previous sample or standards analysis and measure baseline shifts that commonly occur in emission and absorption spectroscopy.

Equipment blanks consist of analyte-free water poured over or through the sample collection equipment. The water is collected in a sample container for laboratory analysis. These blanks are collected after the sampling equipment is decontaminated and measure effectiveness of the decontamination procedure.

Holding times are evaluated to assure that the sample integrity is intact for accurate sample preparation and analysis. Holding times will be specific for each method and matrix analyzed. Holding time exceedance can cause loss of sample constituents due to biodegradation, precipitation, volatilization, and chemical degradation.

Comparability is a qualitative expression of the confidence with which one data set may be compared to another. It provides an assessment of the equivalence of the analytical results to data obtained from other analyses. It is important that data sets be comparable if they are used in conjunction with other data sets. The factors affecting comparability include the following: sample collection and handling techniques, matrix type, and analytical method. If these aspects of sampling and analysis are carried out according to standard analytical procedures, the data are considered comparable. Comparability is also dependent upon other PARCCS criteria, because only when precision, accuracy, and representativeness are known can data sets be compared with confidence.

Completeness is defined as the percentage of acceptable sample results compared to the total number of sample results. Completeness is evaluated to determine if an acceptable amount of usable data were obtained so that a valid scientific site assessment can be completed. Completeness equals the total number of sample results for each fraction minus the total number of rejected sample results divided by the total number of sample results multiplied by 100. As specified in the project DQOs, the goal for completeness for target analytes in each analytical fraction is 90 percent.

Percent completeness is calculated using the following equation:

$$\%C = (T - R)/T \times 100$$

where:
%C = percent completeness
T = total number of sample results
R = total number of rejected sample results

Completeness is also determined by comparing the planned number of samples per method and matrix as specified in the QAPP, with the number determined above.

Sensitivity is the ability of an analytical method or instrument to discriminate between measurement responses representing different concentrations. This capability is established during the planning phase to meet the DQOs. It is important that calibration requirements, detection limits (DLs), and PQLs presented in the QAPP are achieved and that target analytes can be detected at concentrations necessary to support the DQOs. The method detection limits (MDLs) represent the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. Sample quantitation limits (SQLs) are adjusted MDL values that reflect sample specific actions, such as

dilutions or varying aliquot sizes. PQLs are the lowest level at which the entire analytical system gives a recognizable signal and acceptable calibration point for the analyte. The laboratory is required to report detected analytes down to the SQL for this project. In addition, sample results are compared to method blank and field blank results to identify potential effects of laboratory background and field procedures on sensitivity.

The QA/QC criteria were met with the exceptions noted in the following sections for each analytical method.

2.0 HYDROGEN

A total of 11 water samples were analyzed for hydrogen by AM20GAX. All hydrogen data were assessed to be valid since none of the 11 total results were rejected due to holding time or QC exceedances. This section discusses the QA/QC supporting documentation as defined by the PARCCS criteria and evaluated based on the DQOs.

2.1 Precision and Accuracy

2.1.1 MS/MSD Samples

MS/MSD was not performed for this analysis.

2.1.2 LCS/LCSD Samples

All LCS/LCSD %Rs and RPDs met the laboratory acceptance criteria.

2.1.3 FD Samples

The field duplicate RPDs met the QAPP acceptance criteria for field duplicate samples LVWPS-MW108B-20191205 and LVWPS-MW108B-20191205-FD. The details regarding the RPD calculation of results are provided in Attachment A.

2.2 Representativeness

2.2.1 Sample Preservation and Holding Times

The evaluation of holding times to verify compliance with the method was conducted. All samples met the 14-day analysis holding time criteria for hydrogen.

2.2.2 Blanks

Method blanks were analyzed to evaluate representativeness. The concentration for an individual target compound in any of the types of QA/QC blanks was used for data qualification.

If contaminants were detected in a blank, corrective actions were made for the chemical analytical data during data validation. The corrective action consisted of amending the laboratory reported results based on the following criteria.

> Results Below the PQL - Using professional judgment, if a sample result for the blank contaminant was less than the PQL and the sample result was less than or equal to 2 times the blank value, the sample result was qualified as detected estimated (J) at the reported concentration.
>
> Results Above the PQL - Using professional judgment, if a sample result for the blank contaminant was greater than the PQL and the sample result was less than or equal to 2 times the blank

contaminant value, the sample result was qualified as detected estimated (J+) at the reported concentration.

No Action - Using professional judgment, if a sample result for the blank contaminant was greater than 2 times the blank value, the result was not qualified.

2.2.2.1 Method Blanks

No contaminants were detected in the method blanks.

2.3 Comparability

The laboratory used standard analytical methods for all of the analyses. In all cases, the SQLs attained were at or below the PQLs. The comparability of the hydrogen data is regarded as acceptable.

2.4 Completeness

The completeness level attained for hydrogen field samples was 100 percent. This percentage was calculated as the total number of accepted sample results divided by the total number of sample results multiplied by 100.

2.5 Sensitivity

The calibration was evaluated for instrument sensitivity and was determined to be technically acceptable. All laboratory PQLs met the specified requirements described in the QAPP.

3.0 METALS

A total of 28 water samples were analyzed for metals by EPA Method 200.7. A total of one (1) water sample and eight (8) soil samples were analyzed for metals by EPA SW-846 Method 6010B. All metals data were assessed to be valid since none of the 177 total results were rejected due to holding time or QC exceedances. This section discusses the QA/QC supporting documentation as defined by the PARCCS criteria and evaluated based on the DQOs.

3.1 Precision and Accuracy

3.1.1 Instrument Calibration

Initial and continuing calibration verification results provide a means of evaluating accuracy within a particular SDG. Correlation coefficient (r) and percent recovery (%R) are the two major parameters used to measure the effectiveness of instrument calibration. The correlation coefficient indicates the linearity of the calibration curve. %R is used to verify the ongoing calibration acceptability of the analytical system. The most critical of the two calibration parameters, r, has the potential to affect data accuracy across an SDG when it is outside the acceptable QC limits. %R exceedances suggest more routine instrumental anomalies, which typically impact all sample results for the affected analytes.

The correlation coefficients in the initial calibrations were within the acceptance criteria of ≥ 0.995. The continuing calibration verifications %Rs were within the acceptance criteria of 90-110%.

3.1.2 MS/MSD Samples

All MS/MSD %Rs and RPDs met the laboratory acceptance criteria.

3.1.3 LCS Samples

All LCS %Rs met the laboratory acceptance criteria.

3.1.4 ICP Interference Check Sample

All ICP interference check %Rs met the method acceptance criteria.

3.1.5 FD Samples

Two (2) results for field duplicate samples LVWPS-MW108C-20191205 and LVWPS-MW108C-20191205-FD and four (4) results for field duplicate samples LVWPS-MW111A-20191205 and LVWPS-MW111A-20191205-FD were qualified as detected estimated (J) due to RPDs above the QAPP acceptance criteria. The details regarding the qualification of results are provided in Attachment B.

3.1.6 Sample Result Verification

Raw data were evaluated for one (1) soil sample for metals by EPA SW-846 Methods 6010B. All reported sample results, detects and non-detects, were correctly calculated for these Stage 4 samples.

3.2 Representativeness

3.2.1 Sample Preservation and Holding Times

The evaluation of holding times to verify compliance with the method was conducted. All samples met the 180-day analysis holding time criteria for metals.

3.2.2 Blanks

Method blanks, ICB/CCBs, EB, and FB were collected and analyzed to evaluate representativeness. The concentration for an individual target compound in any of the types of QA/QC blanks was used for data qualification.

If contaminants were detected in a blank, corrective actions were made for the chemical analytical data during data validation. The corrective action consisted of amending the laboratory reported results based on the following criteria.

> Results Below the PQL - If a sample result and blank contaminant value were less than the PQL, the sample result was amended as estimated (J) at the reported concentration.
>
> Results Above the PQL - If a sample result and blank contaminant value were greater than the PQL and the sample result was less than 10 times the blank contaminant value, the sample result was qualified as detected estimated (J+) at the reported concentration.
>
> No Action - If blank contaminant values were less than the PQL and associated sample results were greater than the PQL, or if blank contaminant values were greater than the PQL and associated sample results were greater than 10 times the blank contaminant value, the result was not qualified.

3.2.2.1 Method and Calibration Blanks

No data were qualified due to the contaminants detected in the method blanks.

No contaminants were detected in the ICB/CCBs.

3.2.2.2 EB and FB

No data were qualified due to the contaminants detected in the equipment blank.

No contaminants were detected in the field blank.

3.3 Comparability

The laboratory used standard analytical methods for all of the analyses. In all cases, the SQLs attained were at or below the PQLs. Target compounds detected below the PQLs flagged (J) by the laboratory should be considered estimated. The comparability of the metals data is regarded as acceptable.

3.4 Completeness

The completeness level attained for metal field samples was 100 percent. This percentage was calculated as the total number of accepted sample results divided by the total number of sample results multiplied by 100.

3.5 Sensitivity

The calibration was evaluated for instrument sensitivity and was determined to be technically acceptable. All laboratory PQLs met the specified requirements described in the QAPP.

4.0 WET CHEMISTRY

A total of 29 water samples were analyzed for nitrate as nitrate by EPA Method 300.0, chlorate by EPA Method 300.1B, perchlorate by EPA Method 314.0, and TOC by Standard Method 5310B; 28 water samples were analyzed for chloride and sulfate by EPA Method 300.0, alkalinity by Standard Method 2320B, ferrous iron by Standard Method 3500-FE D, and DOC by Standard Method 5310B; 23 water samples for nitrate as nitrogen by EPA Method 300.0; and 22 water samples for ferric iron by Calculation Method, and TDS by Standard Method 2540C. A total of eight (8) soil samples were analyzed for nitrate as nitrate by EPA Method 300.0, chlorate by EPA Method 300.1B, perchlorate by EPA Method 314.0, TOC by Lloyd Kahn, and moisture content by Standard Method 2540 G-2011. All wet chemistry data were assessed to be valid since none of the 457 total results which were rejected due to holding time or QC exceedances. This section discusses the QA/QC supporting documentation as defined by the PARCCS criteria and evaluated based on the DQOs.

4.1 Precision and Accuracy

4.1.1 Instrument Calibration

The correlation coefficients in the initial calibrations were within the acceptance criteria of ≥ 0.995. The continuing calibration verifications %Rs were within the acceptance criteria of 90-110%.

4.1.2 Surrogate

All surrogate %Rs associated to the chlorate analysis met the laboratory acceptance criteria.

4.1.3 MS/MSD Samples

All MS/MSD %Rs and RPDs met the laboratory acceptance criteria.

4.1.4 DUP Samples

All DUP RPDs met the laboratory acceptance criteria.

4.1.5 LCS/LCSD Samples

All LCS/LCSD %Rs and RPDs met the laboratory acceptance criteria.

4.1.6 FD Samples

Two (2) results for field duplicate samples LVWPS-MW111A-20191205 and LVWPS-MW111A-20191205-FD were qualified as detected estimated (J) due to RPDs above the QAPP acceptance criteria. The details regarding the qualification of results are provided in Attachment C.

4.1.7 Sample Result Verification

Raw data were evaluated for one (1) soil sample for nitrate as nitrate, chlorate, perchlorate, TOC, and moisture content. All reported sample results, detects and non-detects, were correctly calculated for these Stage 4 samples.

4.2 Representativeness

4.2.1 Sample Preservation and Holding Times

The evaluation of holding times to verify compliance with all wet chemistry methods was conducted. All samples met the 7-day analysis holding time criteria for water samples analyzed for TDS, the 14-day analysis holding time criteria for water samples analyzed for alkalinity, the 28-day analysis holding time criteria for water samples analyzed for chlorate, chloride, DOC, perchlorate, sulfate, and TOC, the 28-day analysis holding time criteria for soil samples analyzed for chlorate, moisture content, perchlorate, and TOC.

Eight (8) nitrate as nitrate results were qualified as detected estimated (J-) or non-detected estimated (UJ) due to an exceedance of holding time criteria. The analysis holding time criteria is 28 days for soil samples.

For water samples, one nitrate as nitrate result, one nitrate as nitrogen result, 22 ferric iron results, and 28 ferrous iron results were qualified as detected estimated (J-) or non-detected estimated (UJ) due to an exceedance of holding time criteria. The analysis holding time criteria is 48 hours for water samples.

4.2.2 Blanks

Method blanks, ICB/CCBs, EB, and FB were collected and analyzed to evaluate representativeness.

If contaminants were detected in a blank, corrective actions were made for the chemical analytical data during data validation based on the criteria presented in Section 3.2.2.

4.2.2.1 Method and Calibration Blanks

No contaminants were detected in the method blanks and ICB/CCBs.

4.2.2.2 EB and FB

No contaminants were detected in the equipment blanks and field blank.

4.3 Comparability

The laboratory used standard analytical methods for all of the analyses. In all cases, the SQLs attained were at or below the PQLs. Target compounds detected below the PQLs flagged (J) by the laboratory should be considered estimated. The comparability of the data is regarded as acceptable.

4.4 Completeness

The completeness level attained for wet chemistry was 100 percent. This percentage was calculated as the total number of accepted sample results divided by the total number of sample results multiplied by 100.

4.5 Sensitivity

The calibration was evaluated for instrument sensitivity and was determined to be technically acceptable. All laboratory PQLs met the specified requirements described in the QAPP.

5.0 VARIANCES IN ANALYTICAL PERFORMANCE

The laboratory used standard analytical methods for all of the analyses throughout the project. No systematic variances in analytical performance were noted in the laboratory case narratives.

6.0 SUMMARY OF PARCCS CRITERIA

The validation reports present the PARCCS results for all SDGs. Each PARCCS criterion is discussed in detail in the following sections.

6.1 Precision and Accuracy

Precision and accuracy were evaluated using data quality indicators such as calibration, MS/MSD, DUP, LCS/LCSD, and field duplicates. The precision and accuracy of the data set were considered acceptable after integration of result qualification.

All calibrations were performed as required and met the acceptance criteria. All MS/MSD and LCS percent recoveries and RPDs, and DUP and field duplicate RPDs met acceptance criteria with the exceptions noted in Sections 3.1.5 and 4.1.6.

6.2 Representativeness

All samples for each method and matrix were evaluated for holding time compliance. All holding times were met with the exceptions noted in Section 4.2.1. All samples were associated with a method blank and in each individual SDG. The representativeness of the project data is considered acceptable.

6.3 Comparability

Sampling frequency requirements were met in obtaining necessary field duplicates and blanks. The laboratory used standard analytical methods for the analyses. The analytical results were reported in correct standard units. Sample integrity criteria were met. Sample preservation and holding times were within QC criteria with the exceptions noted in Section 4.2.1. The overall comparability is considered acceptable.

6.4 Completeness

Of the 635 total analytes reported, none of the results were rejected. The completeness for the SDGs is as follows:

Parameter	Total Analytes	No. of Rejects	% Completeness
Hydrogen	11	0	100
Metals	177	0	100
Wet Chemistry:			
Alkalinity	112	0	100
Anions	116	0	100
Chlorate	37	0	100
DOC	28	0	100
FeII	22	0	100
FeIII	28	0	100
Perchlorate	37	0	100
TDS	22	0	100
TOC	37	0	100
Moisture Content	8	0	100
Total	**635**	**0**	**100**

The completeness percentage based on rejected data met the 90 percent DQO goal.

6.5 Sensitivity

Sensitivity was achieved by the laboratory to support the DQOs. Calibration concentrations and PQLs met the project requirements and low-level contamination in the method and equipment blanks did not affect sensitivity.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The analytical data quality assessment for the soil and groundwater sample laboratory analytical results generated during the 2019 Las Vegas Wash Zero-Valent Iron Treatability Study at the NERT site in Henderson, Nevada established that the overall project requirements and completeness levels were met. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the Stage 2A, Stage 2B and Stage 4 data validation, all other results are considered valid and usable for all purposes.

8.0 REFERENCES

American Public Health Association 2012. Standard Method for the Examination of Water and Wastewater (22nd ed.). Washington, DC: American Public Health Association; Rice, Baird, Eaton, and Clesceri.

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USEPA 1996. EPA SW 846 Third Edition, Test Methods for Evaluating Solid Waste, update I, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IV, February 2007; update V, July 2014.

USEPA 2017. USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review. January.

USEPA 2017. USEPA National Functional Guidelines for Superfund Organic Methods Data Review. January.

TABLES

Table I. Sample Cross-Reference

LDC	SDG	Client Sample ID	Lab ID	Sample Date	Validation Level	Matrix	QC Type	Hydrogen (AM20GAX)	Metals (200.7)	Chromium (6010B)	Anions (300.0)	Chlorate (300.1B)	Perchlorate (314.0)	Alkalinity (2320B)	Moisture Content (2540 G-2011)	TDS (2540C)	Ferric Iron (3500)	Ferrous Iron (3500 Fe-D)	DOC (5310B)	TOC (5310B)	TOC (Lloyd Kahn)
47091A	4402556291	ZTS-MW115-35.0-20191122	440-255629-1	11/22/19	Stage 4	Soil				X	X	X	X		X						X
47091A	4402556291	ZTS-MW115-40.0-20191122	440-255629-2	11/22/19	Stage 2B	Soil				X	X	X	X		X						X
47091A	4402556291	ZTS-MW114-45.0-20191120	440-255629-3	11/20/19	Stage 2B	Soil				X	X	X	X		X						X
47091A	4402556291	ZTS-MW113-10.0-20191122	440-255629-4	11/22/19	Stage 2B	Soil				X	X	X	X		X						X
47091A	4402556291	ZTS-MW113-15.0-20191122	440-255629-5	11/22/19	Stage 2B	Soil				X	X	X	X		X						X
47091A	4402556291	ZTS-MW113-20.0-20191123	440-255629-6	11/23/19	Stage 2B	Soil	FD1			X	X	X	X		X						X
47091A	4402556291	ZTS-MW113-20.0-20191123-FD	440-255629-7	11/23/19	Stage 2B	Soil	FD1			X	X	X	X		X						X
47091A	4402556291	ZTS-MW113-25.0-20191123	440-255629-8	11/23/19	Stage 2B	Soil				X	X	X	X		X						X
47091A	4402556291	ZTS-MW113-25.0-20191123-EB	440-255629-9	11/23/19	Stage 2A	Water	EB			X	X	X	X							X	
47091B	4402562151	ZTS-MW113-20191203	440-256215-1	12/03/19	Stage 2A	Water			X		X	X	X	X				X	X	X	
47091B	4402562151	LVWPS-MW102A-20191203	440-256215-2	12/03/19	Stage 2A	Water			X		X	X	X	X				X	X	X	
47091B	4402562151	LVWPS-MW102B-20191203	440-256215-3	12/03/19	Stage 2A	Water			X		X	X	X	X				X	X	X	
47091B	4402562151	LVWPS-MW105-20191203	440-256215-4	12/03/19	Stage 2A	Water			X		X	X	X	X				X	X	X	
47091B	4402562151	LVWPS-MW103A-20191203	440-256215-5	12/03/19	Stage 2A	Water			X		X	X	X	X				X	X	X	
47091B	4402562151	LVWPS-MW103B-20191203	440-256215-6	12/03/19	Stage 2A	Water			X		X	X	X	X				X	X	X	
47091C	4402565961	LVWPS-MW108C-20191205	440-256596-1	12/05/19	Stage 2A	Water	FD2		X		X	X	X	X		X	X	X	X	X	
47091C	4402565961	LVWPS-MW108C-20191205-FD	440-256596-2	12/05/19	Stage 2A	Water	FD2		X		X	X	X	X		X	X	X	X	X	
47091C	4402565961	LVWPS-MW108B-20191205	440-256596-3	12/05/19	Stage 2A	Water			X		X	X	X	X		X	X	X	X	X	
47091C	4402565961	LVWPS-MW108A-20191205	440-256596-4	12/05/19	Stage 2A	Water			X		X	X	X	X		X	X	X	X	X	
47091C	4402565961	LVWPS-MW111A-20191205	440-256596-5	12/05/19	Stage 2A	Water	FD3		X		X	X	X	X		X	X	X	X	X	
47091C	4402565961	LVWPS-MW111A-20191205-FD	440-256596-6	12/05/19	Stage 2A	Water	FD3		X		X	X	X	X		X	X	X	X	X	
47091C	4402565961	LVWPS-MW111B-20191205	440-256596-7	12/05/19	Stage 2A	Water			X		X	X	X	X		X	X	X	X	X	
47091C	4402565961	LVWPS-MW112A-20191205	440-256596-8	12/05/19	Stage 2A	Water			X		X	X	X	X		X	X	X	X	X	
47091C	4402565961	LVWPS-MW112B-20191205	440-256596-9	12/05/19	Stage 2A	Water			X		X	X	X	X		X	X	X	X	X	
47091D	4402567551	ZTS-MW114-20191206	440-256755-1	12/06/19	Stage 2A	Water			X		X	X	X	X		X	X	X	X	X	
47091D	4402567551	LVWPS-MW104-20191206	440-256755-2	12/06/19	Stage 2A	Water			X		X	X	X	X		X	X	X	X	X	
47091D	4402567551	LVWPS-MW101B-20191206	440-256755-3	12/06/19	Stage 2A	Water			X		X	X	X	X		X	X	X	X	X	
47091D	4402567551	LVWPS-MW101A-20191206	440-256755-4	12/06/19	Stage 2A	Water			X		X	X	X	X		X	X	X	X	X	
47091D	4402567551	LVWPS-MW110-20191206	440-256755-5	12/06/19	Stage 2A	Water			X		X	X	X	X		X	X	X	X	X	
47091D	4402567551	ZTS-MW115-20191206	440-256755-6	12/06/19	Stage 2A	Water			X		X	X	X	X		X	X	X	X	X	
47091E	4402569191	LVWPS-MW107A-20191209	440-256919-1	12/09/19	Stage 2A	Water			X		X	X	X	X		X	X	X	X	X	
47091E	4402569191	LVWPS-MW107B-20191209	440-256919-2	12/09/19	Stage 2A	Water			X		X	X	X	X		X	X	X	X	X	
47091E	4402569191	LVWPS-MW107C-20191209	440-256919-3	12/09/19	Stage 2A	Water			X		X	X	X	X		X	X	X	X	X	
47091E	4402569191	20191209-FB	440-256919-4	12/09/19	Stage 2A	Water	FB		X		X	X	X	X		X	X	X	X	X	
47091E	4402569191	20191209-EB	440-256919-5	12/09/19	Stage 2A	Water	EB		X		X	X	X	X		X	X	X	X	X	
47091E	4402569191	LVWPS-MW109-20191209	440-256919-6	12/09/19	Stage 2A	Water			X		X	X	X	X		X	X	X	X	X	
47091E	4402569191	LVWPS-MW106-20191209	440-256919-7	12/09/19	Stage 2A	Water			X		X	X	X	X		X	X	X	X	X	

Table I. Sample Cross-Reference

LDC	SDG	Client Sample ID	Lab ID	Sample Date	Validation Level	Matrix	QC Type	Hydrogen (AM20GAX)	Metals (200.7)	Chromium (6010B)	Anions (300.0)	Chlorate (300.1B)	Perchlorate (314.0)	Alkalinity (2320B)	Moisture Content (2540 G-2011)	TDS (2540C)	Ferric Iron (3500)	Ferrous Iron (3500 Fe-D)	DOC (5310B)	TOC (5310B)	TOC (Lloyd Kahn)
47091F	32345	LVWPS-MW108B-20191205	323450001	12/05/19	Stage 2A	Water	FD4	X													
47091F	32345	LVWPS-MW108B-20191205-FD	323450002	12/05/19	Stage 2A	Water	FD4	X													
47091F	32345	LVWPS-MW108A-20191205	323450003	12/05/19	Stage 2A	Water		X													
47091G	32347	ZTS-MW114-20191206	323470001	12/06/19	Stage 2A	Water		X													
47091G	32347	LVWPS-MW101B-20191206	323470002	12/06/19	Stage 2A	Water		X													
47091G	32347	ZTS-MW113-20191206	323470003	12/06/19	Stage 2A	Water		X													
47091G	32347	LVWPS-MW103A-20191206	323470004	12/06/19	Stage 2A	Water		X													
47091G	32347	ZTS-MW115-20191206	323470005	12/06/19	Stage 2A	Water		X													
47091H	32391	LVWPS-MW106-20191209	323910001	12/09/19	Stage 2A	Water		X													
47091H	32391	LVWPS-MW107A-20191209	323910002	12/09/19	Stage 2A	Water		X													
47091H	32391	LVWPS-MW109-20191209	323910003	12/09/19	Stage 2A	Water		X													

Table II. Stage 2A, Stage 2B, and Stage 4 Validation Elements

Quality Control Elements	Stage 2A		
	Hydrogen	**Metals**	**Wet Chemistry**
Sample Receipt & Technical Holding Time	√	√	√
Instrument Performance Check	-	-	-
Initial Calibration (ICAL)	-	-	-
Initial Calibration Verification (ICV)	-	-	-
Continuing Calibration Verification (CCV)	-	-	-
Laboratory Blanks	√	√	√
Initial Calibration Blank and Continuing Calibration Blank (ICB/CCB)	**N/A**	-	-
Field Blanks	**N/A**	√	√
Inductively Coupled Plasma (ICP) Interference Check Sample	**N/A**	-	**N/A**
Surrogate Spikes/ Carrier Recovery	**N/A**	**N/A**	√
Matrix Spike (MS)/ Matrix Spike Duplicate (MSD)	**N/A**	√	√
Laboratory Duplicate (DUP)	**N/A**	**N/A**	√
Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD)	√	√	√
Serial Dilution	**N/A**	-	**N/A**
Internal Standards	**N/A**	-	**N/A**
Field Duplicate	√	√	√
RPD Between Two Columns	**N/A**	**N/A**	**N/A**
Project Quantitation Limits (PQL)[1]	√	√	√
Multiple Results for One Sample	√	√	√
Target Compound Identification	-	-	-
Compound Quantitation/ Sample Result Verification	-	-	-
System Performance[2]	-	-	-
Overall Data Usability Assessment	√	√	√

√ = Reviewed for Stage 2A review
N/A = Not applicable to method or not performed during this sampling event
- = Not applicable for Stage 2A review
[1]PQLs verified for Hydrogen, Metals, and Wet Chemistry methods.
[2]System performance is a thorough review of the data acquisition that can yield indicators of degrading instrument performance affecting quality of data.

Table II. Stage 2A, Stage 2B, and Stage 4 Validation Elements

Quality Control Elements	Stage 2B	
	Metals	**Wet Chemistry**
Sample Receipt & Technical Holding Time	√	√
Instrument Performance Check	√	√
Initial Calibration (ICAL)	√	√
Initial Calibration Verification (ICV)	√	√
Continuing Calibration Verification (CCV)	√	√
Laboratory Blanks	√	√
Initial Calibration Blank and Continuing Calibration Blank (ICB/CCB)	√	√
Field Blanks	√	√
Inductively Coupled Plasma (ICP) Interference Check Sample	√	**N/A**
Surrogate Spikes/ Carrier Recovery	**N/A**	√
Matrix Spike (MS)/ Matrix Spike Duplicate (MSD)	√	√
Laboratory Duplicate (DUP)	**N/A**	√
Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD)	√	√
Serial Dilution	√	**N/A**
Internal Standards	√	**N/A**
Field Duplicate	√	√
RPD Between Two Columns	**N/A**	**N/A**
Project Quantitation Limits (PQL)[1]	√	√
Multiple Results for One Sample	√	√
Target Compound Identification	-	-
Compound Quantitation/ Sample Result Verification	-	-
System Performance[2]	-	-
Overall Data Usability Assessment	√	√

√ = Reviewed for Stage 2B review
N/A = Not applicable to method or not performed during this sampling event
- = Not applicable for Stage 2B review
[1]PQLs verified for Metals and Wet Chemistry methods.
[2]System performance is a thorough review of the data acquisition that can yield indicators of degrading instrument performance affecting quality of data.

Table II. Stage 2A, Stage 2B, and Stage 4 Validation Elements

Quality Control Elements	Stage 4	
	Metals	**Wet Chemistry**
Sample Receipt & Technical Holding Time	√	√
Instrument Performance Check	√	√
Initial Calibration (ICAL)	√	√
Initial Calibration Verification (ICV)	√	√
Continuing Calibration Verification (CCV)	√	√
Laboratory Blanks	√	√
Initial Calibration Blank and Continuing Calibration Blank (ICB/CCB)	√	√
Field Blanks	√	√
Inductively Coupled Plasma (ICP) Interference Check Sample	√	**N/A**
Surrogate Spikes/ Carrier Recovery	**N/A**	√
Matrix Spike (MS)/ Matrix Spike Duplicate (MSD)	√	√
Laboratory Duplicate (DUP)	**N/A**	√
Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD)	√	√
Serial Dilution	√	**N/A**
Internal Standards	√	**N/A**
Field Duplicate	√	√
RPD Between Two Columns	**N/A**	**N/A**
Project Quantitation Limits (PQL)[1]	√	√
Multiple Results for One Sample	√	√
Target Compound Identification	**N/A**	**N/A**
Compound Quantitation/ Sample Result Verification	√	√
System Performance[2]	**N/A**	**N/A**
Overall Data Usability Assessment	√	√

√ = Reviewed for Stage 4 review
N/A = Not applicable to method or not performed during this sampling event
- = Not applicable for Stage 4 review
[1]PQLs verified for Metals and Wet Chemistry methods.
[2]System performance is a thorough review of the data acquisition that can yield indicators of degrading instrument performance affecting quality of data.

Table III. Stage 2A, Stage 2B & Stage 4 Validation Percentages

Parameter	Number of Samples				Validation Percentage		
	(Water) Stage 2A	(Soil) Stage 2B	(Soil) Stage 4	(Soil) Total	(Water [1]) Stage 2A (%)	(Soil) Stage 2B (%)	(Soil) Stage 4 (%)
Hydrogen (AM20-GAX)	11	-	-	-	100	-	-
Metals (200.7)	28	-	-	-	100	-	-
Metals (6010B)	1	7	1	8	100	87.5	12.5
Chloride and Sulfate (300.0)	28	-	-	-	100	-	-
Nitrate as N (300.0)	23	-	-	-	100	-	-
Nitrate as NO3 (300.0)	29	7	1	8	100	87.5	12.5
Chlorate (300.1B)	29	7	1	8	100	87.5	12.5
Perchlorate (314.0)	29	7	1	8	100	87.5	12.5
Alkalinity (2320B)	28	-	-	-	100	-	-
TDS (2540C)	22	-	-	-	100	-	-
Ferrous Iron (3500-Fe D)	28	-	-	-	100	-	-
Ferric Iron (Calculation)	22	-	-	-	100	-	-
DOC (5310B)	28	-	-	-	100	-	-
TOC (5310B/Lloyd Kahn)	29	7	1	8	100	87.5	12.5
% Moisture (2540 G-2011)	-	7	1	8	-	87.5	12.5

Notes:

1. Consistent with NDEP guidance emailed on March 7, 2017, all water results have been validated to Stage 2A.

Table IV. Reason Codes and Definitions

Reason Code	Explanation
a	qualified due to low abundance (radiochemical activity)
be	qualified due to equipment blank contamination
bf	qualified due to field blank contamination
bl	qualified due to lab blank contamination
bt	qualified due to trip blank contamination
bp	qualified due to pump blank contamination (wells w/o dedicated pumps, when contamination is detected in the Pump Blk)
br	qualified due to filter blank contamination (aqueous Hexavalent Chromium and Dissolved sample fractions)
c	qualified due to calibration problems
cp	qualified due to insufficient ingrowth (radiochemical only)
dc	dual column confirmation RPD exceeded
e	concentration exceeded the calibration range
fd	qualified due to field duplicate imprecision
h	qualified due to holding time exceedance
i	qualified due to internal standard areas
k	qualified as Estimated Maximum Possible Concentrations (dioxins and PCB congeners)
l	qualified due to LCS recoveries
ld	qualified due to lab duplicate imprecision (matrix duplicate, MSD, LCSD)
m	qualified due to matrix spike recoveries
nb	qualified due to negative lab blank contamination (nondetect results only)
nd	qualified due to non-detected target analyte
o	other
orr	other result reported
p	qualified as a false positive due to contamination during shipping
pH	sample preservation not within acceptance range
q	qualified due to quantitation problem
s	qualified due to surrogate recoveries
sd	serial dilution did not meet control criteria
sp	detected value reported >SQL <PQL
st	sample receipt temperature exceeded
t	qualified due to elevated helium tracer concentrations
vh	volatile headspace detected in aqueous sample containers submitted for VOC analysis
x	qualified due to low % solids
z	qualified due to ICS results

Table V. Overall Qualified Results

SDG	Client Sample ID	Sample Date	Method	Client Analyte ID	Analyte	Lab Result	Lab Qualifier	SQL	PQL	Units	Validator Qualifier	Reason Code	Data Quality Indicator	Qualification Finding	Acceptance Criteria	
4402556291	ZTS-MW113-10.0-20191122	11/22/19	E300	14797-55-8_NO3	Nitrate as NO3		UH	3.7	5.3	mg/kg	UJ	h	Holding time	34	28	days
4402556291	ZTS-MW113-15.0-20191122	11/22/19	E300	14797-55-8_NO3	Nitrate as NO3	4.2	JH	3.8	5.4	mg/kg	J-	h,sp	Holding time; <PQL	34	28	days
4402556291	ZTS-MW113-15.0-20191122	11/22/19	E300.1	14866-68-3	Chlorate	110	J	22	220	ug/kg	J	sp	<PQL			
4402556291	ZTS-MW113-20.0-20191123	11/23/19	E300	14797-55-8_NO3	Nitrate as NO3	16	H	4.5	6.4	mg/kg	J-	h	Holding time	34	28	days
4402556291	ZTS-MW113-20.0-20191123-FD	11/23/19	E300	14797-55-8_NO3	Nitrate as NO3	19	H	4.4	6.2	mg/kg	J-	h	Holding time	34	28	days
4402556291	ZTS-MW113-25.0-20191123	11/23/19	E300	14797-55-8_NO3	Nitrate as NO3	28	H	4.7	6.7	mg/kg	J-	h	Holding time	34	28	days
4402556291	ZTS-MW113-25.0-20191123-EB	11/23/19	E300	14797-55-8_N	Nitrate as N		UHH3	0.055	0.11	mg/l	UJ	h	Holding time	83.95	48	hours
4402556291	ZTS-MW113-25.0-20191123-EB	11/23/19	E300	14797-55-8_NO3	Nitrate as NO3		UHH3	0.25	0.50	mg/l	UJ	h	Holding time	83.95	48	hours
4402556291	ZTS-MW114-45.0-20191120	11/20/19	E300	14797-55-8_NO3	Nitrate as NO3		UH	5.6	8.0	mg/kg	UJ	h	Holding time	36	28	days
4402556291	ZTS-MW115-35.0-20191122	11/22/19	E300	14797-55-8_NO3	Nitrate as NO3	10	H	7.2	10	mg/kg	J-	h	Holding time	34	28	days
4402556291	ZTS-MW115-35.0-20191122	11/22/19	LLOYD_KAHN	7440-44-0	CARBON	604	J	204	612	mg/kg	J	sp	<PQL			
4402556291	ZTS-MW115-40.0-20191122	11/22/19	E300	14797-55-8_NO3	Nitrate as NO3	18	H	6.3	9.0	mg/kg	J-	h	Holding time	34	28	days
4402556291	ZTS-MW115-40.0-20191122	11/22/19	LLOYD_KAHN	7440-44-0	CARBON	416	J	198	593	mg/kg	J	sp	<PQL			
4402562151	LVWPS-MW102A-20191203	12/03/19	E300	14797-55-8_N	Nitrate as N	2.9	J	2.8	5.5	mg/l	J	sp	<PQL			
4402562151	LVWPS-MW102A-20191203	12/03/19	E300	14797-55-8_NO3	Nitrate as NO3	13	J	13	25	mg/l	J	sp	<PQL			
4402569191	20191209-EB	12/09/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	102.28	48	hours
4402562151	LVWPS-MW102A-20191203	12/03/19	SM5310_DOC_B	7440-44-0	CARBON	780	J	650	1000	ug/l	J	sp	<PQL			
4402569191	20191209-EB	12/09/19	SM3500	7439-89-6-FE3	Iron, Ferric		U	0.10	0.10	mg/l	UJ	h,nd	Holding time	102.28	48	hours
4402562151	LVWPS-MW103A-20191203	12/03/19	E200.7	7439-89-6	Iron	0.064	J	0.050	0.10	mg/l	J	sp	<PQL			
4402569191	20191209-FB	12/09/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	102.75	48	hours
4402562151	LVWPS-MW103A-20191203	12/03/19	SM5310_DOC_B	7440-44-0	CARBON	770	J	650	1000	ug/l	J	sp	<PQL			
4402562151	LVWPS-MW103A-20191203	12/03/19	SM5310B	7440-44-0	CARBON	0.82	J	0.65	1.0	mg/l	J	sp	<PQL			
4402569191	20191209-FB	12/09/19	SM3500	7439-89-6-FE3	Iron, Ferric		U	0.10	0.10	mg/l	UJ	h,nd	Holding time	102.75	48	hours
4402567551	LVWPS-MW101A-20191206	12/06/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	174.75	48	hours
4402567551	LVWPS-MW101A-20191206	12/06/19	SM3500	7439-89-6-FE3	Iron, Ferric	8.1		0.10	0.10	mg/l	J-	h	Holding time	174.75	48	hours
4402567551	LVWPS-MW101B-20191206	12/06/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	175.67	48	hours
4402567551	LVWPS-MW101B-20191206	12/06/19	SM3500	7439-89-6-FE3	Iron, Ferric	4.4		0.10	0.10	mg/l	J-	h	Holding time	175.67	48	hours
4402562151	LVWPS-MW102A-20191203	12/03/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	105.25	48	hours
4402562151	LVWPS-MW102B-20191203	12/03/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	105.67	48	hours
4402565961	LVWPS-MW108B-20191205	12/05/19	SM5310_DOC_B	7440-44-0	CARBON	750	J	650	1000	ug/l	J	sp	<PQL			
4402565961	LVWPS-MW108B-20191205	12/05/19	SM5310B	7440-44-0	CARBON	0.81	J	0.65	1.0	mg/l	J	sp	<PQL			
4402565961	LVWPS-MW108C-20191205	12/05/19	E200.7	7440-70-2	Calcium	350		2.5	5.0	mg/l	J	fd	FD RPD	33	30	%
4402562151	LVWPS-MW103A-20191203	12/03/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	103.42	48	hours
4402562151	LVWPS-MW103B-20191203	12/03/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	102.17	48	hours
4402565961	LVWPS-MW108C-20191205-FD	12/05/19	E200.7	7440-70-2	Calcium	250		5.0	10	mg/l	J	fd	FD RPD	33	30	%
4402567551	LVWPS-MW104-20191206	12/06/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	176.33	48	hours
4402567551	LVWPS-MW104-20191206	12/06/19	SM3500	7439-89-6-FE3	Iron, Ferric	3.7		0.10	0.10	mg/l	J-	h	Holding time	176.33	48	hours
4402565961	LVWPS-MW111A-20191205	12/05/19	E200.7	7439-89-6	Iron	22		0.050	0.10	mg/l	J	fd	FD RPD	60	30	%
4402565961	LVWPS-MW111A-20191205	12/05/19	E200.7	7440-47-3	Chromium (total)	0.053		0.0025	0.0050	mg/l	J	fd	FD RPD	43	30	%
4402562151	LVWPS-MW105-20191203	12/03/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	104.42	48	hours
4402569191	LVWPS-MW106-20191209	12/09/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	100.33	48	hours
4402565961	LVWPS-MW111A-20191205-FD	12/05/19	E200.7	7440-47-3	Chromium (total)	0.082		0.0025	0.0050	mg/l	J	fd	FD RPD	43.0	30	%
4402565961	LVWPS-MW111A-20191205-FD	12/05/19	E200.7	7439-89-6	Iron	41		0.050	0.10	mg/l	J	fd	FD RPD	60.0	30	%
4402569191	LVWPS-MW106-20191209	12/09/19	SM3500	7439-89-6-FE3	Iron, Ferric	0.24		0.10	0.10	mg/l	J-	h	Holding time	100.33	48	hours
4402569191	LVWPS-MW107A-20191209	12/09/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	104.58	48	hours
4402569191	LVWPS-MW107A-20191209	12/09/19	SM3500	7439-89-6-FE3	Iron, Ferric	0.18		0.10	0.10	mg/l	J-	h	Holding time	104.58	48	hours
4402569191	LVWPS-MW107B-20191209	12/09/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	103.5	48	hours
4402565961	LVWPS-MW111B-20191205	12/05/19	SM5310B	7440-44-0	CARBON	0.80	J	0.65	1.0	mg/l	J	sp	<PQL			
4402569191	LVWPS-MW107B-20191209	12/09/19	SM3500	7439-89-6-FE3	Iron, Ferric	0.23		0.10	0.10	mg/l	J-	h	Holding time	103.5	48	hours
4402569191	LVWPS-MW107C-20191209	12/09/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	102.67	48	hours
4402569191	LVWPS-MW107C-20191209	12/09/19	SM3500	7439-89-6-FE3	Iron, Ferric	1.1		0.10	0.10	mg/l	J-	h	Holding time	102.67	48	hours
4402565961	LVWPS-MW108A-20191205	12/05/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	57.17	48	hours
4402565961	LVWPS-MW108A-20191205	12/05/19	SM3500	7439-89-6-FE3	Iron, Ferric	0.11		0.10	0.10	mg/l	J-	h	Holding time	57.17	48	hours
4402565961	LVWPS-MW108B-20191205	12/05/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	58.83	48	hours
4402567551	LVWPS-MW101A-20191206	12/06/19	SM5310B	7440-44-0	CARBON	940	J	650	1000	ug/l	J	sp	<PQL			
4402565961	LVWPS-MW108B-20191205	12/05/19	SM3500	7439-89-6-FE3	Iron, Ferric	4.7		0.10	0.10	mg/l	J-	h	Holding time	58.83	48	hours
4402565961	LVWPS-MW108C-20191205	12/05/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	59.5	48	hours
4402565961	LVWPS-MW108C-20191205	12/05/19	SM3500	7439-89-6-FE3	Iron, Ferric		U	0.10	0.10	mg/l	UJ	h,nd	Holding time	59.5	48	hours
4402565961	LVWPS-MW108C-20191205-FD	12/05/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	59.42	48	hours
4402565961	LVWPS-MW108C-20191205-FD	12/05/19	SM3500	7439-89-6-FE3	Iron, Ferric		U	0.10	0.10	mg/l	UJ	h,nd	Holding time	59.42	48	hours
4402569191	LVWPS-MW109-20191209	12/09/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	101.67	48	hours
4402567551	LVWPS-MW110-20191206	12/06/19	SM5310_DOC_B	7440-44-0	CARBON	860	J	650	1000	ug/l	J	sp	<PQL			
4402567551	LVWPS-MW110-20191206	12/06/19	SM5310B	7440-44-0	CARBON	710	J	650	1000	ug/l	J	sp	<PQL			
4402569191	LVWPS-MW109-20191209	12/09/19	SM3500	7439-89-6-FE3	Iron, Ferric	21		0.10	0.10	mg/l	J-	h	Holding time	101.67	48	hours
4402567551	LVWPS-MW110-20191206	12/06/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	172.08	48	hours
4402567551	ZTS-MW114-20191206	12/06/19	SM5310_DOC_B	7440-44-0	CARBON	690	J	650	1000	ug/l	J	sp	<PQL			
4402567551	LVWPS-MW110-20191206	12/06/19	SM3500	7439-89-6-FE3	Iron, Ferric	1.8		0.10	0.10	mg/l	J-	h	Holding time	172.08	48	hours
4402565961	LVWPS-MW111A-20191205	12/05/19	SM3500	7439-89-6-FE3	Iron, Ferric	22		0.10	0.10	mg/l	J	fd,h	FD RPD	60; 56.67	30; 48	%; hours
4402569191	20191209-EB	12/09/19	E200.7	7439-95-4	Magnesium	0.010	J	0.010	0.020	mg/l	J	sp	<PQL			
4402565961	LVWPS-MW111A-20191205	12/05/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	56.67	48	hours
4402565961	LVWPS-MW111A-20191205-FD	12/05/19	SM3500	7439-89-6-FE3	Iron, Ferric	41		0.10	0.10	mg/l	J	fd,h	FD RPD	60; 56.58	30; 48	%; hours
4402565961	LVWPS-MW111A-20191205-FD	12/05/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	56.58	48	hours

Table V. Overall Qualified Results

SDG	Client Sample ID	Sample Date	Method	Client Analyte ID	Analyte	Lab Result	Lab Qualifier	SQL	PQL	Units	Validator Qualifier	Reason Code	Data Quality Indicator	Qualification Finding	Acceptance Criteria	
4402565961	LVWPS-MW111B-20191205	12/05/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	56.08	48	hours
4402565961	LVWPS-MW111B-20191205	12/05/19	SM3500	7439-89-6-FE3	Iron, Ferric	2.8		0.10	0.10	mg/l	J-	h	Holding time	56.08	48	hours
4402565961	LVWPS-MW112A-20191205	12/05/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	55.25	48	hours
4402565961	LVWPS-MW112A-20191205	12/05/19	SM3500	7439-89-6-FE3	Iron, Ferric	0.98		0.10	0.10	mg/l	J-	h	Holding time	55.25	48	hours
4402565961	LVWPS-MW112B-20191205	12/05/19	SM3500	7439-89-6-FE2	Iron, Ferrous	0.60	HF	0.10	0.10	mg/l	J-	h	Holding time	54.42	48	hours
4402569191	LVWPS-MW107A-20191209	12/09/19	SM5310B	7440-44-0	CARBON	0.98	J	0.65	1.0	mg/l	J	sp	<PQL			
4402565961	LVWPS-MW112B-20191205	12/05/19	SM3500	7439-89-6-FE3	Iron, Ferric	4.5		0.10	0.10	mg/l	J-	h	Holding time	54.42	48	hours
4402562151	ZTS-MW113-20191203	12/03/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	107.17	48	hours
4402567551	ZTS-MW114-20191206	12/06/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	177.33	48	hours
4402567551	ZTS-MW114-20191206	12/06/19	SM3500	7439-89-6-FE3	Iron, Ferric	0.33		0.10	0.10	mg/l	J-	h	Holding time	177.33	48	hours
4402567551	ZTS-MW115-20191206	12/06/19	SM3500	7439-89-6-FE2	Iron, Ferrous		UHF	0.10	0.10	mg/l	UJ	h	Holding time	171.58	48	hours
4402567551	ZTS-MW115-20191206	12/06/19	SM3500	7439-89-6-FE3	Iron, Ferric	1.1		0.10	0.10	mg/l	J-	h	Holding time	171.58	48	hours

ATTACHMENT A

Hydrogen Data Validation Report

Hydrogen by Method AM20GAX

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

Initial calibration data were not reviewed for Stage 2A validation.

III. Continuing Calibration

Continuing calibration data were not reviewed for Stage 2A validation.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in these SDGs.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in these SDGs, and therefore matrix spike and matrix spike duplicate analyses were not performed for these SDGs.

VII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Field Duplicates

Samples LVWPS-MW108B-20191205 and LVWPS-MW108B-20191205-FD (both from SDG 32345) were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

SDG	Compound	Concentration (nM)		RPD (Limits)	Flag	A or P
		LVWPS-MW108B-20191205	LVWPS-MW108B-20191205-FD			
32345	Hydrogen	1.7	2.0	16 (≤30)	-	-

IX. Compound Quantitation

Raw data were not reviewed for Stage 2A validation.

X. Target Compound Identification

Raw data were not reviewed for Stage 2A validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in these SDGs.

NERT, 2019 Las Vegas Wash Zero-Valent Iron Treatability Study
Hydrogen - Data Qualification Summary - SDGs 32345, 32347, 32391

No Sample Data Qualified in these SDGs

NERT, 2019 Las Vegas Wash Zero-Valent Iron Treatability Study
Hydrogen - Laboratory Blank Data Qualification Summary - SDGs 32345, 32347, 32391

No Sample Data Qualified in these SDGs

NERT, 2019 Las Vegas Wash Zero-Valent Iron Treatability Study
Hydrogen - Field Blank Data Qualification Summary - SDGs 32345, 32347, 32391

No Sample Data Qualified in these SDGs

ATTACHMENT B

Metals Data Validation Report

Calcium, Chromium, Iron, Magnesium, Potassium, and Sodium by Environmental Protection Agency (EPA) Method 200.7
Chromium by EPA SW 846 Method 6010B

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

Instrument calibration data were not reviewed for Stage 2A validation.

III. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

ICP Interference check sample (ICS) analysis data were not reviewed for Stage 2A validation.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

SDG	Blank ID	Analyte	Maximum Concentration	Associated Samples
440-256215-1	PB (prep blank)	Magnesium Potassium	0.0123 mg/L 0.323 mg/L	ZTS-MW113-20191203*
440-256215-1	PB (prep blank)	Calcium Sodium	0.0590 mg/L 0.470 mg/L	LVWPS-MW102A-20191203*

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

*Samples underwent Stage 2A validation
**Samples underwent Stage 4 validation

V. Field Blanks

Samples ZTS-MW113-25.0-20191123-EB* (from SDG 440-255629-1) and 20191209-EB* (from SDG 440-256919-1) were identified as equipment blanks. No contaminants were found with the following exceptions:

SDG	Blank ID	Collection Date	Analyte	Concentration	Associated Samples
440-256919-1	20191209-EB*	12/09/19	Magnesium	0.010 mg/L	LVWPS-MW107A-20191209* LVWPS-MW107B-20191209* LVWPS-MW107C-20191209* LVWPS-MW109-20191209* LVWPS-MW106-20191209*

Sample 20191209-FB* (from SDG 440-256919-1) was identified as a field blank. No contaminants were found.

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated field blanks.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample.

For LVWPS-MW102B-20191203MS/MSD* (from SDG 440-256215-1), LVWPS-MW104-20191206MS/MSD* (from SDG 440-256755-1), no data were qualified for calcium, iron, magnesium, potassium, and sodium percent recoveries (%R) outside the QC limits since the parent sample results were greater than 4X the spike concentration.

For LVWPS-MW108C-20191205MS/MSD* (from SDG 440-256596-1) and LVWPS-MW107A-20191209MS/MSD* (from SDG 440-256919-1), no data were qualified for calcium, magnesium, potassium, and sodium percent recoveries (%R) outside the QC limits since the parent sample results were greater than 4X the spike concentration.

Relative percent differences (RPD) were within QC limits.

VII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in these SDGs, and therefore duplicate analyses were not performed for these SDGs.

VIII. Serial Dilution

Serial dilution was not performed for these SDGs.

*Samples underwent Stage 2A validation
**Samples underwent Stage 4 validation

IX. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ZTS-MW113-20.0-20191123 and ZTS-MW113-20.0-20191123-FD (both from SDG 440-255629-1), samples LVWPS-MW108C-20191205* and LVWPS-MW108C-20191205-FD* (both from SDG 440-256596-1), and samples LVWPS-MW111A-20191205* and LVWPS-MW111A-20191205-FD* (both from SDG 440-256596-1) were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

SDG	Analyte	Concentration (mg/Kg)		RPD (Limits)	Flag	A or P
		ZTS-MW113-20.0-20191123	ZTS-MW113-20.0-20191123-FD			
440-255629-1	Chromium	24	20	18 (≤50)	-	-

SDG	Analyte	Concentration (mg/L)		RPD (Limits)	Flag	A or P
		LVWPS-MW108C-20191205*	LVWPS-MW108C-20191205-FD*			
440-256596-1	Calcium	350	250	33 (≤30)	J (all detects)	A
	Magnesium	5400	6000	11 (≤30)	-	-
	Potassium	2400	2700	12 (≤30)	-	-
	Sodium	7600	8400	10 (≤30)	-	-

SDG	Analyte	Concentration (mg/L)		RPD (Limits)	Flag	A or P
		LVWPS-MW111A-20191205*	LVWPS-MW111A-20191205-FD*			
440-256596-1	Calcium	630	600	5 (≤30)	-	-
	Chromium	0.053	0.082	43 (≤30)	J (all detects)	A
	Iron	22	41	60 (≤30)	J (all detects)	A
	Magnesium	220	230	4 (≤30)	-	-
	Potassium	54	57	5 (≤30)	-	-
	Sodium	700	650	7 (≤30)	-	-

*Samples underwent Stage 2A validation
**Samples underwent Stage 4 validation

XI. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2A and Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the methods.

Due to field duplicate RPD, data were qualified as estimated in four samples.

No results were rejected in these SDGs.

*Samples underwent Stage 2A validation
**Samples underwent Stage 4 validation

NERT, 2019 Las Vegas Wash Zero-Valent Iron Treatability Study
Metals - Data Qualification Summary - SDGs 440-255629-1, 440-256215-1, 440-256596-1, 440-256755-1, 440-256919-1

SDG	Sample	Analyte	Flag	A or P	Reason (Code)
440-256596-1	LVWPS-MW108C-20191205* LVWPS-MW108C-20191205-FD*	Calcium	J (all detects)	A	Field duplicates (RPD) (fd)
440-256596-1	LVWPS-MW111A-20191205* LVWPS-MW111A-20191205-FD*	Chromium Iron	J (all detects) J (all detects)	A	Field duplicates (RPD) (fd)

NERT, 2019 Las Vegas Wash Zero-Valent Iron Treatability Study
Metals - Laboratory Blank Data Qualification Summary - SDGs 440-255629-1, 440-256215-1, 440-256596-1, 440-256755-1, 440-256919-1

No Sample Data Qualified in these SDGs

NERT, 2019 Las Vegas Wash Zero-Valent Iron Treatability Study
Metals - Field Blank Data Qualification Summary - SDGs 440-255629-1, 440-256215-1, 440-256596-1, 440-256755-1, 440-256919-1

No Sample Data Qualified in these SDGs

*Samples underwent Stage 2A validation
**Samples underwent Stage 4 validation

ATTACHMENT C

Wet Chemistry Data Validation Report

Alkalinity by Standard Method 2320B
Chlorate by Environmental Protection Agency (EPA) Method 300.1B
Chloride, Nitrate as Nitrogen, Nitrate as NO3, and Sulfate by EPA Method 300.0
Dissolved Organic Carbon by Standard Method 5310B
Ferric Iron by Standard Method 3500
Ferrous Iron by Standard Method 3500-FE D
Moisture by Standard Method 2540 G-2011
Perchlorate by EPA Method 314.0
Total Dissolved Solids by Standard Method 2540C
Total Organic Carbon by Standard Method 5310B and Lloyd Kahn

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met with the following exceptions:

SDG	Sample	Analyte	Total Time From Sample Collection Until Analysis	Required Holding Time From Sample Collection Until Analysis	Affected Analyte	Flag	A or P
440-255629-1/ 2077611	ZTS-MW115-35.0-20191122** ZTS-MW115-40.0-20191122 ZTS-MW113-10.0-20191122 ZTS-MW113-15.0-20191122 ZTS-MW113-20.0-20191123 ZTS-MW113-20.0-20191123-FD ZTS-MW113-25.0-20191123	Nitrate as NO3	34 days	28 days	Nitrate as NO3	J- (all detects) UJ (all non-detects)	P
440-255629-1/ 2077611	ZTS-MW114-45.0-20191120	Nitrate as NO3	36 days	28 days	Nitrate as NO3	UJ (all non-detects)	P
440-255629-1/ 2077611	ZTS-MW113-25.0-20191123-EB*	Nitrate as N Nitrate as NO3	83.95 hours	48 hours	Nitrate as N Nitrate as NO3	UJ (all non-detects) UJ (all non-detects)	P
440-256215-1	ZTS-MW113-20191203*	Ferrous iron	107.17 hours	48 hours	Ferrous iron	UJ (all non-detects)	P
440-256215-1	LVWPS-MW102A-20191203*	Ferrous iron	105.25 hours	48 hours	Ferrous iron	UJ (all non-detects)	P
440-256215-1	LVWPS-MW102B-20191203*	Ferrous iron	105.67 hours	48 hours	Ferrous iron	UJ (all non-detects)	P
440-256215-1	LVWPS-MW105-20191203*	Ferrous iron	104.42 hours	48 hours	Ferrous iron	UJ (all non-detects)	P
440-256215-1	LVWPS-MW103A-20191203*	Ferrous iron	103.42 hours	48 hours	Ferrous iron	UJ (all non-detects)	P
440-256215-1	LVWPS-MW103B-20191203*	Ferrous iron	102.17 hours	48 hours	Ferrous iron	UJ (all non-detects)	P
440-256596-1	LVWPS-MW108C-20191205*	Ferrous iron	59.50 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P

*Samples underwent Stage 2A validation
**Samples underwent Stage 4 validation

SDG	Sample	Analyte	Total Time From Sample Collection Until Analysis	Required Holding Time From Sample Collection Until Analysis	Affected Analyte	Flag	A or P
440-256596-1	LVWPS-MW108C-20191205-FD*	Ferrous iron	59.42 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P
440-256596-1	LVWPS-MW108B-20191205*	Ferrous iron	58.83 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P
440-256596-1	LVWPS-MW108A-20191205*	Ferrous iron	57.17 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P
440-256596-1	LVWPS-MW111A-20191205*	Ferrous iron	56.67 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P
440-256596-1	LVWPS-MW111A-20191205-FD*	Ferrous iron	56.58 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P
440-256596-1	LVWPS-MW111B-20191205*	Ferrous iron	56.08 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P
440-256596-1	LVWPS-MW112A-20191205*	Ferrous iron	55.25 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P
440-256596-1	LVWPS-MW112B-20191205*	Ferrous iron	54.42 hours	48 hours	Ferrous iron Ferric iron	J- (all detects) J- (all detects)	P
440-256755-1	ZTS-MW114-20191206*	Ferrous iron	177.33 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P
440-256755-1	LVWPS-MW104-20191206*	Ferrous iron	176.33 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P
440-256755-1	LVWPS-MW101B-20191206*	Ferrous iron	175.67 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P
440-256755-1	LVWPS-MW101A-20191206*	Ferrous iron	174.75 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P
440-256755-1	LVWPS-MW110-20191206*	Ferrous iron	172.08 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P
440-256755-1	ZTS-MW115-20191206*	Ferrous iron	171.58 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P
440-256919-1	LVWPS-MW107A-20191209*	Ferrous iron	104.58 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P
440-256919-1	LVWPS-MW107B-20191209*	Ferrous iron	103.50 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P

*Samples underwent Stage 2A validation
**Samples underwent Stage 4 validation

SDG	Sample	Analyte	Total Time From Sample Collection Until Analysis	Required Holding Time From Sample Collection Until Analysis	Affected Analyte	Flag	A or P
440-256919-1	LVWPS-MW107C-20191209*	Ferrous iron	102.67 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P
440-256919-1	20191209-FB*	Ferrous iron	102.75 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P
440-256919-1	20191209-EB*	Ferrous iron	102.28 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P
440-256919-1	LVWPS-MW109-20191209*	Ferrous iron	101.67 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P
440-256919-1	LVWPS-MW106-20191209*	Ferrous iron	100.33 hours	48 hours	Ferrous iron Ferric iron	UJ (all non-detects) UJ (all non-detects)	P

II. Initial Calibration

All criteria for the initial calibration of each method were met.

Initial calibration data were not reviewed for Stage 2A validation.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

Continuing calibration data were not reviewed for Stage 2A validation.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

Samples ZTS-MW113-25.0-20191123-EB* (from SDG 440-255629-1) and 20191209-EB* (from SDG 440-256919-1) were identified as equipment blanks. No contaminants were found.

Sample 20191209-FB* (from SDG 440-256919-1) was identified as a field blank. No contaminants were found.

*Samples underwent Stage 2A validation
**Samples underwent Stage 4 validation

VI. Surrogates

Surrogates were added to all samples as required by EPA Method 300.1B. Surrogate recoveries (%R) were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample.

For LVWPS-MW108C-20191205MS/MSD* (from SDG 440-256596-1), LVWPS-MW110-20191206MS/MSD* (from SDG 440-256755-1), and LVWPS-MW109-20191209MS/MSD* (from SDG 440-256919-1), no data were qualified for chloride and sulfate percent recoveries (%R) outside the QC limits since the parent sample results were greater than 4X the spike concentration.

For LVWPS-MW111B-20191205MS/MSD* (from SDG 440-256596-1) and LVWPS-MW107A-20191209MS/MSD* (from SDG 440-256919-1), no data were qualified for chlorate, chloride, and sulfate percent recoveries (%R) outside the QC limits since the parent sample results were greater than 4X the spike concentration.

Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples ZTS-MW113-20.0-20191123 and ZTS-MW113-20.0-20191123-FD (both from SDG 440-255629-1/2077611), samples LVWPS-MW108C-20191205* and LVWPS-MW108C-20191205-FD* (both from SDG 440-256596-1), and samples LVWPS-MW111A-20191205* and LVWPS-MW111A-20191205-FD* (both from SDG 440-256596-1) were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

*Samples underwent Stage 2A validation
**Samples underwent Stage 4 validation

SDG	Analyte	Concentration		RPD (Limits)	Flag	A or P
		ZTS-MW113-20.0-20191123	ZTS-MW113-20.0-20191123-FD			
440-255629-1/ 2077611	Nitrate as NO3	16 mg/Kg	19 mg/Kg	17 (≤50)	-	-
	Chlorate	13000 ug/Kg	12000 ug/Kg	8 (≤50)	-	-
	Perchlorate	1.2 mg/Kg	2.0 mg/Kg	50 (≤50)	-	-
	Total organic carbon	1730 mg/Kg	2450 mg/Kg	34 (≤50)	-	-
	Moisture	21.8 %	21.6 %	1 (≤50)	-	-

SDG	Analyte	Concentration		RPD (Limits)	Flag	A or P
		LVWPS-MW108C-20191205*	LVWPS-MW108C-20191205-FD*			
440-256596-1	Chloride	11000 mg/L	11000 mg/L	0 (≤30)	-	-
	Sulfate	28000000 ug/L	27000000 ug/L	4 (≤30)	-	-
	Alkalinity as CaCO3	110000 ug/L	110000 ug/L	0 (≤30)	-	-
	Bicarbonate ion as HCO3	130000 ug/L	130000 ug/L	0 (≤30)	-	-
	Total dissolved solids	61000000 ug/L	60000000 ug/L	2 (≤30)	-	-
	Total organic carbon	5.1 mg/L	5.1 mg/L	0 (≤30)	-	-
	Dissolved organic carbon	4900 ug/L	4900 ug/L	0 (≤30)	-	-

SDG	Analyte	Concentration		RPD (Limits)	Flag	A or P
		LVWPS-MW111A-20191205*	LVWPS-MW111A-20191205-FD*			
440-256596-1	Chloride	1000 mg/L	980 mg/L	2 (≤30)	-	-
	Nitrate as N	7.8 mg/L	8.0 mg/L	3 (≤30)	-	-
	Nitrate as NO3	35 mg/L	35 mg/L	0 (≤30)	-	-
	Sulfate	1600000 ug/L	1600000 ug/L	0 (≤30)	-	-
	Chlorate	21000 ug/L	21000 ug/L	0 (≤30)	-	-

*Samples underwent Stage 2A validation
**Samples underwent Stage 4 validation

SDG	Analyte	Concentration		RPD (Limits)	Flag	A or P
		LVWPS-MW111A-20191205*	LVWPS-MW111A-20191205-FD*			
	Perchlorate	7900 ug/L	7400 ug/L	7 (≤30)	-	-
	Alkalinity as CaCO3	190000 ug/L	190000 ug/L	0 (≤30)	-	-
	Bicarbonate ion as HCO3	240000 ug/L	230000 ug/L	4 (≤30)	-	-
	Total dissolved solids	5000000 ug/L	5000000 ug/L	0 (≤30)	-	-
	Ferric iron	22 mg/L	41 mg/L	60 (≤30)	J (all detects)	A
	Total organic carbon	2.2 mg/L	2.4 mg/L	9 (≤30)	-	-
	Dissolved organic carbon	1700 ug/L	1700 ug/L	0 (≤30)	-	-

XI. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2A and Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the methods.

Due to technical holding time and field duplicate RPD, data were qualified as estimated in thirty-five samples.

No results were rejected in this SDG.

*Samples underwent Stage 2A validation
**Samples underwent Stage 4 validation

NERT, 2019 Las Vegas Wash Zero-Valent Iron Treatability Study
Wet Chemistry - Data Qualification Summary - SDGs 440-255629-1/2077611, 440-256215-1, 440-256596-1, 440-256755-1, 440-256919-1

SDG	Sample	Analyte	Flag	A or P	Reason (Code)
440-255629-1/ 2077611	ZTS-MW115-35.0-20191122** ZTS-MW115-40.0-20191122 ZTS-MW113-10.0-20191122 ZTS-MW113-15.0-20191122 ZTS-MW113-20.0-20191123 ZTS-MW113-20.0-20191123-FD ZTS-MW113-25.0-20191123 ZTS-MW114-45.0-20191120	Nitrate as NO3	J- (all detects) UJ (all non-detects)	P	Technical holding times (h)
440-255629-1/ 2077611	ZTS-MW113-25.0-20191123-EB*	Nitrate as N Nitrate as NO3	UJ (all non-detects) UJ (all non-detects)	P	Technical holding times (h)
440-256215-1	ZTS-MW113-20191203* LVWPS-MW102A-20191203* LVWPS-MW102B-20191203* LVWPS-MW105-20191203* LVWPS-MW103A-20191203* LVWPS-MW103B-20191203*	Ferrous iron	UJ (all non-detects)	P	Technical holding times (h)
440-256596-1	LVWPS-MW108C-20191205* LVWPS-MW108C-20191205-FD* LVWPS-MW108B-20191205* LVWPS-MW108A-20191205* LVWPS-MW111A-20191205* LVWPS-MW111A-20191205-FD* LVWPS-MW111B-20191205* LVWPS-MW112A-20191205* LVWPS-MW112B-20191205*	Ferrous iron Ferric Iron	J- (all detects) UJ (all non-detects)	P	Technical holding times (h)
440-256755-1	ZTS-MW114-20191206* LVWPS-MW104-20191206* LVWPS-MW101B-20191206* LVWPS-MW101A-20191206* LVWPS-MW110-20191206* ZTS-MW115-20191206*	Ferrous iron Ferric Iron	UJ (all non-detects)	P	Technical holding times (h)
440-256919-1	LVWPS-MW107A-20191209* LVWPS-MW107B-20191209* LVWPS-MW107C-20191209* 20191209-FB* 20191209-EB* LVWPS-MW109-20191209* LVWPS-MW106-20191209*	Ferrous iron Ferric Iron	UJ (all non-detects)	P	Technical holding times (h)
440-256596-1	LVWPS-MW111A-20191205* LVWPS-MW111A-20191205-FD*	Ferric iron	J (all detects)	A	Field duplicates (RPD) (fd)

*Samples underwent Stage 2A validation
**Samples underwent Stage 4 validation

NERT, 2019 Las Vegas Wash Zero-Valent Iron Treatability Study
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDGs 440-255629-1/2077611, 440-256215-1, 440-256596-1, 440-256755-1, 440-256919-1

No Sample Data Qualified in these SDGs

NERT, 2019 Las Vegas Wash Zero-Valent Iron Treatability Study
Wet Chemistry - Field Blank Data Qualification Summary - SDGs 440-255629-1/2077611, 440-256215-1, 440-256596-1, 440-256755-1, 440-256919-1

No Sample Data Qualified in these SDGs

*Samples underwent Stage 2A validation
**Samples underwent Stage 4 validation