

TECHNICAL MEMORANDUM

To: Nevada Environmental Response Trust

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

From: Dana Grady

Date: July 21, 2023

Subject: Las Vegas Wash ZVI-Enhanced Bioremediation Treatability Study Monthly Progress Report

At the direction of the Nevada Environmental Response Trust (NERT or Trust), Tetra Tech, Inc. (Tetra Tech) has prepared this memorandum to summarize Tetra Tech's progress during May 2023 toward successfully implementing the Las Vegas Wash Zero-Valent Iron (ZVI)-Enhanced Bioremediation Treatability Study.

Task Progress Update: May 2023

Task M18 – Las Vegas Wash ZVI-Enhanced Bioremediation Treatability Study

- Current Status
 - The general treatability study layout, including locations of the continuous and discontinuous ZVI walls and associated monitoring well network, is presented on Figures 1, 2a, and 2b. A diagram presenting the profile of the continuous ZVI wall is included on Figure 3. Well construction details are provided in Table 1.
 - As reported in the April 2023 progress report, a one-time injection event of the biological inoculum culture developed by SiREM, nutrients (i.e., Accelerite provided by JRW Bioremediation and potassium phosphate), oxygen scavenger (sodium sulfite), and extracted groundwater was performed from April 17 to April 24, 2023. A summary of the formation water volumes extracted for the injections is included in Table 2. Summaries of the injection quantities, rates and pressures for each injection well are provided in Tables 3 and 4.
 - Slug testing was performed in all newly installed wells from May 15 to May 19, 2023.
 - The Month 1 performance monitoring event was conducted from May 22 to May 30, 2023. Results from this sampling event will be summarized in future monthly progress reports once all laboratory data have been received and validated.
- Schedule and Progress Updates
 - Groundwater levels will be measured on a monthly basis for the duration of the treatability study. The next monthly synoptic event is scheduled for June 19, 2023.

- Groundwater samples will be collected on a quarterly basis to generate time-series data to evaluate the treatment effectiveness of the ZVI installations with respect to the design performance criteria. The next quarterly groundwater sampling event will be performed in August 2023.
- Health and Safety
 - There were no health and safety incidents related to Task M18 during May 2023.

CERTIFICATION

Las Vegas Wash ZVI-Enhanced Bioremediation Treatability Study Monthly Progress Report

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

Nevada Environmental Response Trust (NERT) Representative Certification

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

Office of the Nevada Environmental Response Trust

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

Not Individually, but Solely
as President of the Trustee

Signature: Jay A. Steinberg, President, 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: 7/21/23

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: Prepared Las Vegas Wash ZVI-Enhanced Bioremediation Treatability Study Monthly Progress Report.



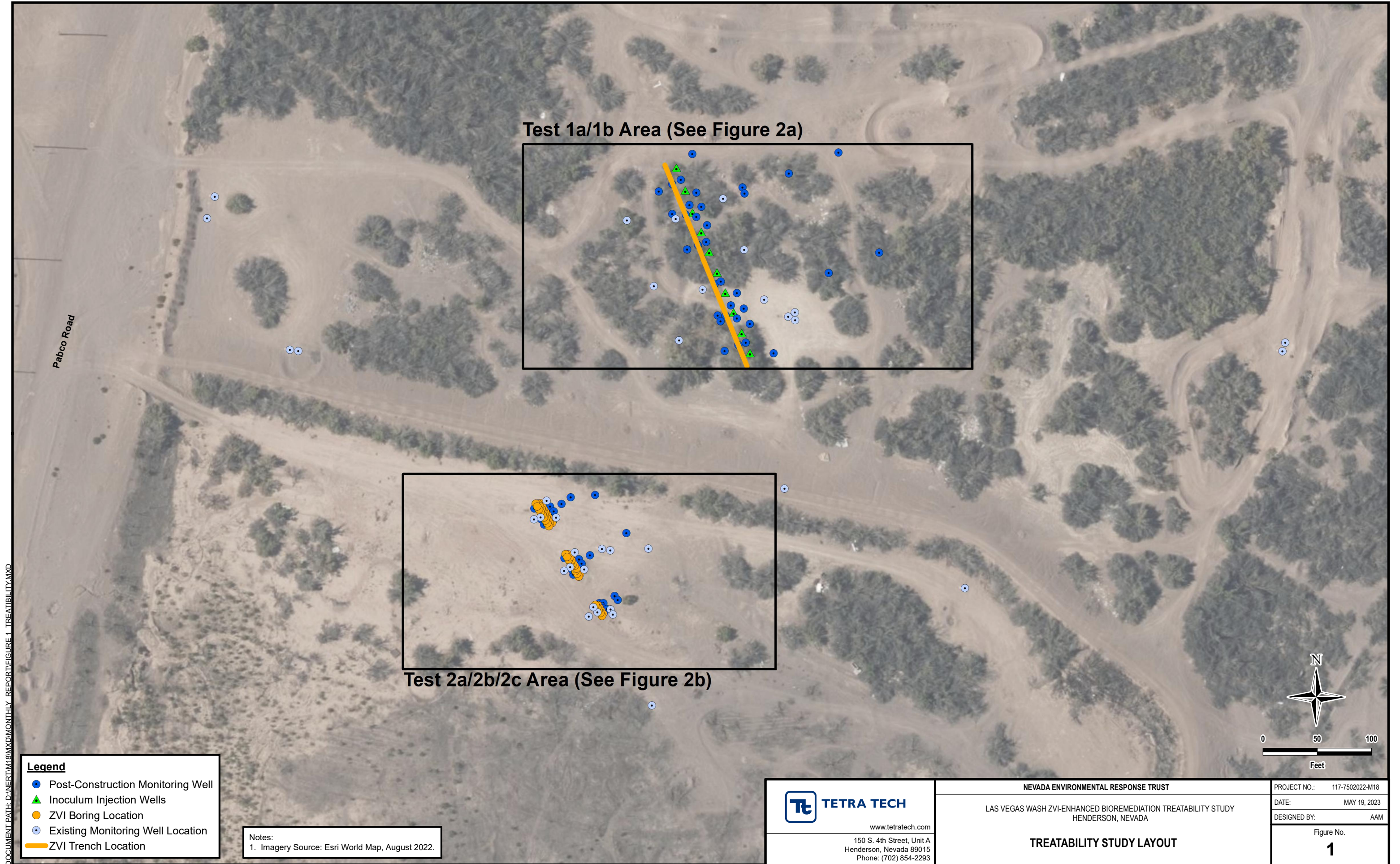
David S. Wilson, CEM
Principal Engineer
Tetra Tech, Inc.

July 21, 2023

Date

Nevada CEM Certificate Number: 2385
Nevada CEM Expiration Date: September 19, 2024

Figures



Test 1a/1b Area (See Figure 2a)

Test 2a/2b/2c Area (See Figure 2b)

- Legend**
- Post-Construction Monitoring Well
 - ▲ Inoculum Injection Wells
 - ZVI Boring Location
 - Existing Monitoring Well Location
 - ZVI Trench Location

Notes:
 1. Imagery Source: Esri World Map, August 2022.

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NEVADA ENVIRONMENTAL RESPONSE TRUST
 LAS VEGAS WASH ZVI-ENHANCED BIOREMEDIATION TREATABILITY STUDY
 HENDERSON, NEVADA

TREATABILITY STUDY LAYOUT

PROJECT NO.: 117-7502022-M18
 DATE: MAY 19, 2023
 DESIGNED BY: AAM

Figure No.
1

DOCUMENT PATH: D:\NERT\18\18\MONTHLY REPORT\FIGURE 1 - TREATABILITY.MXD

DOCUMENT PATH: D:\NERT\M18\MXD\MONTHLY REPORT\FIGURE 2A TEST AREA 1A 1B.MXD



Legend

- Post-Construction Monitoring Well
- ▲ Inoculum Injection Wells
- Existing Monitoring Well Location
- ZVI Trench Location

Notes:
1. Imagery Source: Esri World Map, August 2022.

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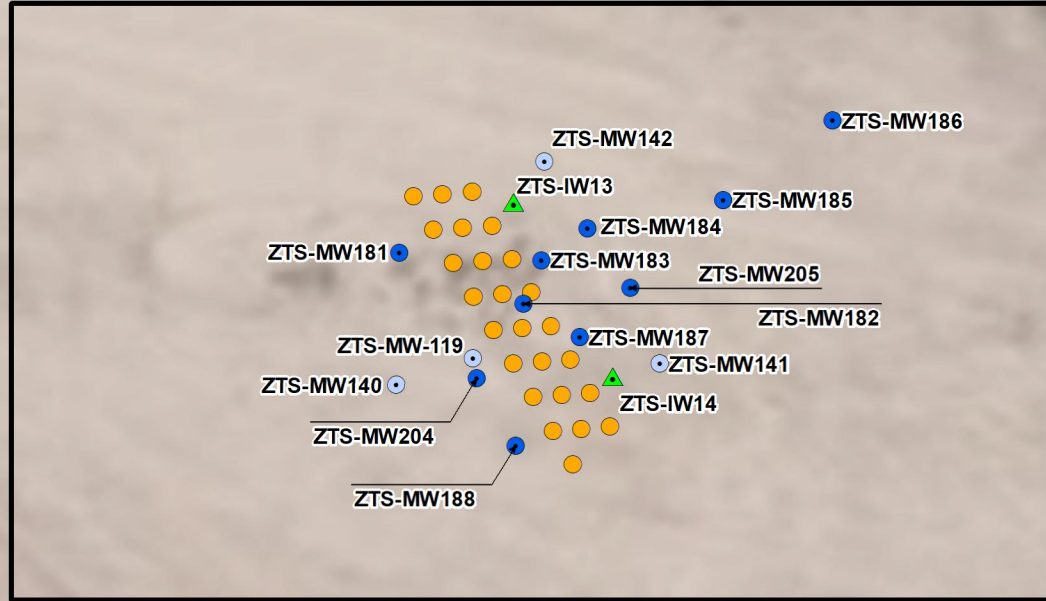
NEVADA ENVIRONMENTAL RESPONSE TRUST
LAS VEGAS WASH ZVI-ENHANCED BIOREMEDIATION TREATABILITY STUDY
HENDERSON, NEVADA

TEST AREA 1a/1b LAYOUT

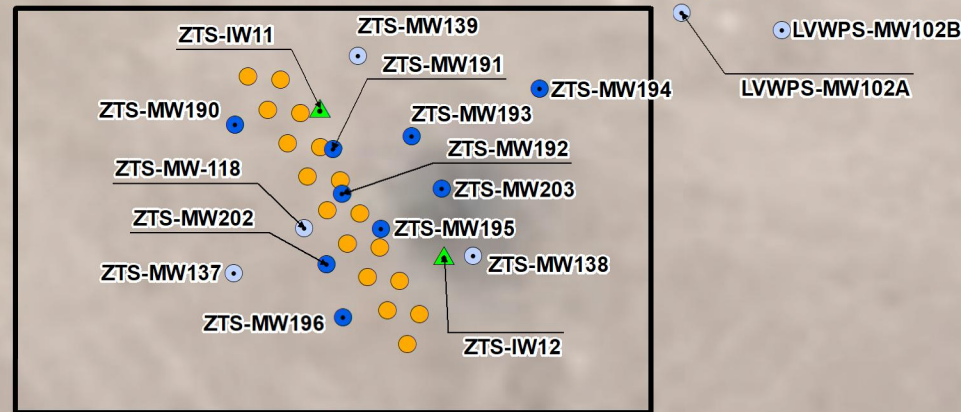
PROJECT NO.: 117-7502022-M18
DATE: MAY 19, 2023
DESIGNED BY: AAM

Figure No.
2a

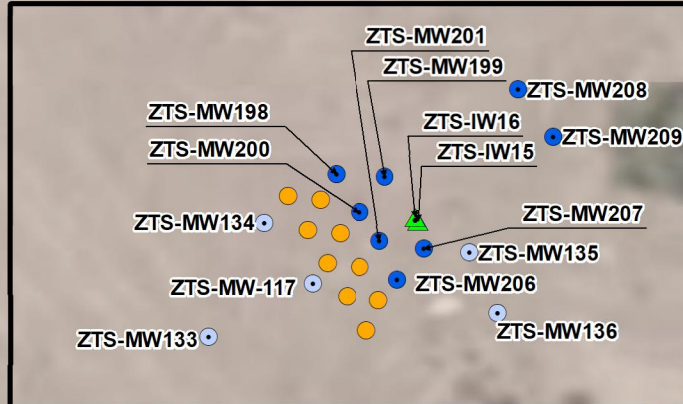
Test 2c Area (Borings ZTS-BH01 through ZTS-BH25)



Test 2a Area (Borings ZTS-BH26 through ZTS-BH42)



Test 2b Area (Borings ZTS-BH43 through ZTS-BH51)



Legend

- Post-Construction Monitoring Well
- ▲ Inoculum Injection Wells
- ZVI Boring Location
- Existing Monitoring Well Location

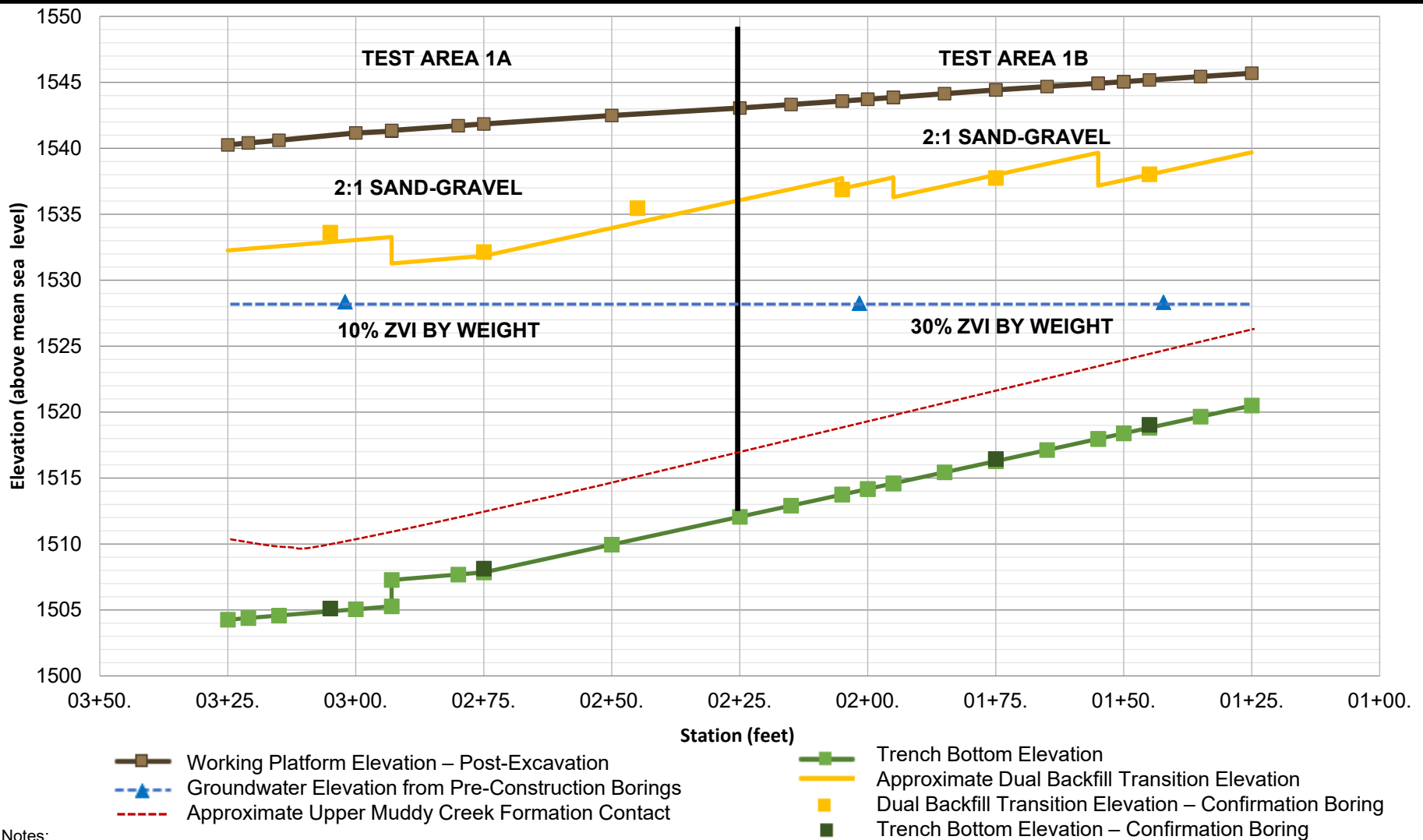
Notes:
 1. Imagery Source: Esri World Map, August 2022.

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NEVADA ENVIRONMENTAL RESPONSE TRUST
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 HENDERSON, NEVADA
TEST AREA 2a/2b/2c LAYOUT

PROJECT NO.:	117-7502022-M18
DATE:	MAY 19, 2023
DESIGNED BY:	AAM
Figure No.	2b

DOCUMENT PATH: D:\NERT\18\18\MONTHLY REPORT\FIGURE 2B TEST AREA 2A 2B 2C.MXD



Notes:

ZVI – Zero Valent Iron

1. A total of six confirmation borings were installed along the trench to verify the installation depth relative to the top of the Upper Muddy Creek formation. At two locations, the confirmation borings depths suggested that the trench bottom was shallower than the recorded as-built bottom elevation. This is likely due to a combination of the boring location not being exactly centered within the trench, the deviation from vertical of the trencher boom, and the narrower width of the trench in the more competent caliche-cemented material in the deepest alluvium. As a result, the soil cores retrieved from the bottom of the borings included some native materials rather than exclusively the ZVI backfill material. Therefore, these data have been excluded from the trench profile.

P:\BLD\152025-NERTZVI Treatability Study\Phase 2 Implementation\Trench Installation



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NEVADA ENVIRONMENTAL RESPONSE TRUST SITE
LAS VEGAS WASH ZVI-ENHANCED BIOREMEDIATION TREATABILITY STUDY MONTHLY PROGRESS REPORT
HENDERSON, NEVADA

ZVI TRENCH PROFILE – TEST AREAS 1A AND 1B

Project No.: 117-7502022-M18
Date: JUNE 12, 2023
Designed By: JD

Figure No.
3

Tables

Table 1
Phase 2 Post-Construction Well Construction Details
 Las Vegas Wash ZVI-Enhanced Bioremediation Treatability Study

Well ID	Screened Lithology	Northing	Easting	Ground Surface Elevation	Top of Casing Elevation	Depth to Water ¹	Groundwater Elevation	Casing Material	Slot Size	Filter Pack Gradation	Nominal Borehole Diameter	Borehole Total Depth	Well Diameter	Nominal Screen Length	Well Total Depth	Bottom of Screen	Top of Screen
				feet amsl	feet amsl	ft bTOC	amsl		inches		inches	feet bgs	inches	feet	feet bgs	feet bgs	feet bgs
ZTS-MW124R	Alluvium	26732932.91	833021.97	1545.35	1545.24	16.94	1528.30	Schedule 40 PVC	0.020	#3	8	35.0	4	10.0	34.5	34.0	24.5
ZTS-MW127R	Alluvium	26732786.41	833082.92	1548.26	1548.18	19.80	1528.38	Schedule 40 PVC	0.020	#3	8	24.0	4	5.0	23.5	23.0	18.5
ZTS-MW149	Alluvium	26732967.42	833052.83	1544.31	1544.20	16.38	1527.82	Schedule 40 PVC	0.020	#3	6	35.0	2	10.0	33.5	33.0	23.3
ZTS-MW150	Alluvium	26732939.76	833034.23	1546.83	1546.74	18.70	1528.04	Schedule 40 PVC	0.020	#3	6	45.0	2	10.0	34.5	34.0	24.3
ZTS-MW151	Alluvium	26732943.59	833042.18	1545.72	1545.62	17.75	1527.87	Schedule 40 PVC	0.020	#3	6	37.5	2	10.0	34.5	34.0	24.3
ZTS-MW152	Alluvium	26732931.70	833056.48	1545.63	1545.50	17.81	1527.69	Schedule 40 PVC	0.020	#3	6	35.0	2	10.0	33.5	33.0	23.3
ZTS-MW153	Alluvium	26732912.34	833034.31	1545.73	1545.61	17.38	1528.23	Schedule 40 PVC	0.020	#3	6	40.0	2	10.0	34.5	34.0	24.3
ZTS-MW154	Alluvium	26732911.74	833046.57	1546.73	1546.62	18.72	1527.90	Schedule 40 PVC	0.020	#3	6	42.5	2	10.0	32.5	32.0	22.3
ZTS-MW155	Alluvium	26732920.46	833050.08	1545.97	1545.89	18.18	1527.71	Schedule 40 PVC	0.020	#3	6	40.0	2	15.0	35.5	35.0	20.3
ZTS-MW156	UMCf	26732909.63	833056.38	1546.34	1546.30	18.52	1527.78	Schedule 40 PVC	0.010	#2/16	6	55.0	2	10.0	54.0	53.5	43.8
ZTS-MW157	Alluvium	26732918.81	833061.15	1545.95	1545.87	18.21	1527.66	Schedule 40 PVC	0.020	#3	6	35.0	2	10.0	33.5	33.0	23.3
ZTS-MW158	Alluvium	26732936.67	833099.40	1544.15	1544.09	16.70	1527.39	Schedule 40 PVC	0.020	#3	6	35.0	2	10.0	33.5	33.0	23.3
ZTS-MW159	UMCf	26732930.97	833101.22	1544.36	1544.08	16.83	1527.25	Schedule 40 PVC	0.010	#2/16	6	50.0	48	10.0	49.0	48.5	38.8
ZTS-MW160	Alluvium	26732949.66	833141.96	1544.42	1544.11	16.86	1527.25	Schedule 40 PVC	0.020	#3	6	40.0	2	10.0	33.5	33.0	23.3
ZTS-MW161	Alluvium	26732968.87	833187.88	1544.23	1543.99	17.03	1526.96	Schedule 40 PVC	0.020	#3	6	45.0	2	10.0	34.5	34.0	24.3
ZTS-MW162	Alluvium	26732901.90	833066.48	1545.76	1545.61	17.94	1527.67	Schedule 40 PVC	0.020	#3	6	40.0	2	10.0	33.5	33.0	23.3
ZTS-MW163	Alluvium	26732879.80	833048.04	1546.23	1546.18	19.05	1527.13	Schedule 40 PVC	0.020	#3	6	40.0	2	10.0	34.5	34.0	24.3
ZTS-MW164	Alluvium	26732883.65	833057.93	1547.06	1546.96	17.90	1529.06	Schedule 40 PVC	0.020	#3	6	40.0	2	10.0	32.5	32.0	22.3
ZTS-MW165	Alluvium	26732886.70	833065.74	1545.63	1545.50	17.83	1527.67	Schedule 40 PVC	0.020	#3	6	38.0	2	10	32.5	32.0	22.3
ZTS-MW166	Alluvium	26732847.93	833073.86	1548.22	1548.25	20.30	1527.95	Schedule 40 PVC	0.020	#3	6	38.0	2	10	30.0	29.5	19.8
ZTS-MW167	Alluvium	26732850.05	833079.50	1547.37	1547.33	19.43	1527.90	Schedule 40 PVC	0.020	#3	6	40.0	2	10.0	33.5	33.0	23.3
ZTS-MW168	Alluvium	26732839.48	833094.36	1547.52	1547.63	19.78	1527.85	Schedule 40 PVC	0.020	#3	6	32.0	2	10.0	30.5	30.0	20.3
ZTS-MW169	Alluvium	26732819.11	833076.48	1547.70	1547.57	19.44	1528.13	Schedule 40 PVC	0.020	#3	6	27.5	2	10.0	27.5	27.0	17.1
ZTS-MW170	UMCf	26732813.68	833079.28	1547.58	1547.45	19.32	1528.13	Schedule 40 PVC	0.010	#2/16	6	46.5	2	10.0	41.5	41.0	31.1
ZTS-MW171	Alluvium	26732819.11	833083.89	1548.61	1548.53	20.33	1528.20	Schedule 40 PVC	0.020	#3	6	35.0	2	10.0	29.5	29.0	19.3
ZTS-MW172	Alluvium	26732828.15	833088.77	1547.91	1547.74	19.77	1527.97	Schedule 40 PVC	0.020	#3	6	30.0	2	10.0	27.5	27.0	17.3
ZTS-MW173	UMCf	26732816.29	833094.22	1547.95	1547.78	19.77	1528.01	Schedule 40 PVC	0.010	#2/16	6	46.0	2	10.0	43.5	43.0	33.3
ZTS-MW174	Alluvium	26732825.33	833100.64	1548.30	1548.11	20.20	1527.91	Schedule 40 PVC	0.020	#3	6	31.5	2	10.0	30.0	29.5	19.8
ZTS-MW175	Alluvium	26732857.97	833178.91	1546.18	1546.25	19.24	1527.01	Schedule 40 PVC	0.020	#3	6	61.5	2	10.0	30.0	29.5	19.8
ZTS-MW176	Alluvium	26732876.92	833225.42	1543.90	1543.74	17.04	1526.70	Schedule 40 PVC	0.020	#3	6	32.0	2	10.0	30.0	29.5	19.8
ZTS-MW177	Alluvium	26732811.29	833106.07	1548.22	1548.12	20.17	1527.95	Schedule 40 PVC	0.020	#3	6	31.0	2	10.0	30.5	30.0	20.3
ZTS-MW178	Alluvium	26732791.95	833095.60	1549.21	1549.14	20.91	1528.23	Schedule 40 PVC	0.020	#3	6	34.0	2	10.0	28.0	27.5	17.8
ZTS-MW179	Alluvium	26732794.26	833102.47	1548.62	1548.45	20.23	1528.22	Schedule 40 PVC	0.020	#3	6	27.5	2	5.0	23.5	23.0	18.3
ZTS-MW180	Alluvium	26732784.25	833128.08	1548.42	1548.12	20.21	1527.91	Schedule 40 PVC	0.020	#3	6	25.0	2	5.0	23.0	22.5	17.8
ZTS-MW181	Alluvium	26732641.70	832907.27	1547.62	1547.25	16.67	1530.58	Schedule 40 PVC	0.020	#3	6	27.5	2	10.0	27.5	27.0	17.3
ZTS-MW182	Alluvium	26732637.76	832916.80	1548.07	1547.79	17.17	1530.62	Schedule 40 PVC	0.020	#3	6	35.0	2	10.0	27.8	27.3	17.6
ZTS-MW183	Alluvium	26732641.13	832918.19	1547.72	1547.58	17.00	1530.58	Schedule 40 PVC	0.020	#3	6	28.0	2	10.0	27.5	27.0	17.3
ZTS-MW184	Alluvium	26732643.60	832921.80	1547.60	1547.53	17.02	1530.51	Schedule 40 PVC	0.020	#3	6	27.5	2	10.0	26.5	26.0	16.3
ZTS-MW185	Alluvium	26732645.77	832932.26	1547.59	1547.60	17.11	1530.49	Schedule 40 PVC	0.020	#3	6	27.5	2	10.0	25.5	25.0	15.3
ZTS-MW186	Alluvium	26732651.85	832940.71	1547.27	1547.26	16.87	1530.39	Schedule 40 PVC	0.020	#3	6	27.0	2	10.0	25.5	25.0	15.3
ZTS-MW187	Alluvium	26732635.16	832921.20	1547.70	1547.25	16.70	1530.55	Schedule 40 PVC	0.020	#3	6	28.0	2	10.0	25.5	25.0	15.3
ZTS-MW188	Alluvium	26732626.83	832916.22	1547.30	1546.93	16.25	1530.68	Schedule 40 PVC	0.020	#3	6	27.5	2	10.0	27.5	27.0	17.3
ZTS-MW189	Alluvium	26732654.00	832963.19	1547.16	1547.14	16.98	1530.16	Schedule 40 PVC	0.020	#3	6	27.5	2	10.0	23.5	23.0	12.8
ZTS-MW190	Alluvium	26732595.87	832934.90	1547.59	1547.32	16.32	1531.00	Schedule 40 PVC	0.020	#3	6	25.0	2	10.0	25.5	24.0	14.3
ZTS-MW191	Alluvium	26732593.97	832942.42	1548.18	1547.93	17.00	1530.93	Schedule 40 PVC	0.020	#3	6	30.0	2	10.0	25.0	24.5	14.8
ZTS-MW192	Alluvium	26732590.54	832943.15	1548.28	1548.11	17.16	1530.95	Schedule 40 PVC	0.020	#3	6	25.0	2	10.0	24.5	24.0	14.3
ZTS-MW193	Alluvium	26732594.97	832948.47	1547.64	1547.48	16.62	1530.86	Schedule 40 PVC	0.020	#3	6	25.0	2	10.0	23.8	23.3	13.6
ZTS-MW194	Alluvium	26732598.62	832958.35	1547.33	1547.38	16.65	1530.73	Schedule 40 PVC	0.020	#3	6	25.0	2	5.0	23.0	22.5	17.8
ZTS-MW195	Alluvium	26732587.81	832946.10	1548.38	1548.14	17.20	1530.94	Schedule 40 PVC	0.020	#3	6	25.0	2	10.0	24.5	25.0	15.3
ZTS-MW196	Alluvium	26732581.00	832943.16	1547.81	1547.34	16.29	1531.05	Schedule 40 PVC	0.020	#3	6	25.0	2	10.0	24.0	23.5	13.8
ZTS-MW197	Alluvium	26732619.07	832992.11	1547.27	1546.99	16.97	1530.02	Schedule 40 PVC	0.020	#3	6	25.0	2	10.0	23.0	22.5	12.8
ZTS-MW198	UMCf	26732554.83	832967.16	1547.78	1547.69	16.64	1531.05	Schedule 40 PVC	0.010	#2/16	6	47.5	2	20.0	46.5	46.0	26.1
ZTS-MW199	UMCf	26732554.62	832970.93	1547.18	1546.84	10.53	1536.31	Schedule 40 PVC	0.010	#2/16	6	68.0	2	15.0	65.5	65.0	50.1
ZTS-MW200	UMCf	26732551.89	832968.94	1547.67	1547.57	11.41	1536.16	Schedule 40 PVC	0.010	#2/16	6	68.0	2	15.0	65.5	65.0	50.1
ZTS-MW201	UMCf	26732549.70	832970.52	1547.59	1547.29	16.03	1531.26	Schedule 40 PVC	0.010	#2/16	6	50.0	2	20.0	47.5	47.0	27.1

Table 1
Phase 2 Post-Construction Well Construction Details
 Las Vegas Wash ZVI-Enhanced Bioremediation Treatability Study

Well ID	Screened Lithology	Northing	Easting	Ground Surface Elevation	Top of Casing Elevation	Depth to Water ¹	Groundwater Elevation	Casing Material	Slot Size	Filter Pack Gradation	Nominal Borehole Diameter	Borehole Total Depth	Well Diameter	Nominal Screen Length	Well Total Depth	Bottom of Screen	Top of Screen
				feet amsl	feet amsl	ft bTOC	amsl		inches		inches	feet bgs	inches	feet	feet bgs	feet bgs	feet bgs
ZTS-MW202	UMCf	26732585.08	832941.97	1547.83	1547.46	16.48	1530.98	Schedule 40 PVC	0.010	#2/16	6	40.0	2	10.0	39.0	38.5	28.8
ZTS-MW203	UMCf	26732590.95	832950.78	1547.77	1547.71	16.90	1530.81	Schedule 40 PVC	0.010	#2/16	6	45.0	2	10.0	38.5	38.0	28.3
ZTS-MW204	UMCf	26732632.00	832913.21	1547.40	1546.87	16.35	1530.52	Schedule 40 PVC	0.010	#2/16	6	42.5	2	10.0	40.5	40.0	30.3
ZTS-MW205	UMCf	26732638.98	832925.09	1547.61	1547.30	17.00	1530.30	Schedule 40 PVC	0.010	#2/16	6	42.5	2	10.0	40.5	40.0	30.3
ZTS-MW206	UMCf	26732546.67	832971.91	1547.58	1547.61	11.34	1536.27	Schedule 40 PVC	0.010	#2/16	6	70.0	2	15.0	65.5	65.0	50.1
ZTS-MW207	UMCf	26732549.09	832973.98	1547.48	1547.43	16.33	1531.10	Schedule 40 PVC	0.010	#2/16	6	48.0	2	20.0	46.5	46.0	26.1
ZTS-MW208	UMCf	26732561.34	832981.27	1547.35	1547.21	16.41	1530.80	Schedule 40 PVC	0.010	#2/16	6	48.0	2	20.0	46.5	46.0	26.1
ZTS-MW209	UMCf	26732557.71	832983.97	1547.62	1547.30	11.00	1536.30	Schedule 40 PVC	0.010	#2/16	6	69.0	2	15.0	66.0	65.5	50.6
ZTS-IW01	Alluvium	26732954.69	833038.19	1545.73	1545.62	NM	NM	Schedule 40 PVC	0.020	#3	6	40.0	2	15.0	36.0	35.5	20.8
ZTS-IW02	Alluvium	26732933.88	833046.37	1545.63	1545.70	NM	NM	Schedule 40 PVC	0.020	#3	6	37.5	2	15.0	35.5	35.0	20.3
ZTS-IW03	Alluvium	26732913.63	833053.06	1546.39	1546.35	NM	NM	Schedule 40 PVC	0.020	#3	6	40.0	2	15.0	36.0	35.5	20.8
ZTS-IW04	Alluvium	26732895.95	833061.35	1545.81	1545.64	NM	NM	Schedule 40 PVC	0.020	#3	6	38.0	2	15.0	36.0	35.5	20.8
ZTS-IW05	Alluvium	26732877.62	833068.66	1546.34	1546.32	NM	NM	Schedule 40 PVC	0.020	#3	6	37.5	2	15.0	36.0	35.5	20.8
ZTS-IW06	Alluvium	26732858.63	833075.96	1547.14	1546.96	NM	NM	Schedule 40 PVC	0.020	#3	6	35.0	2	15.0	35.0	34.5	19.8
ZTS-IW07	Alluvium	26732840.03	833083.70	1547.73	1547.48	NM	NM	Schedule 40 PVC	0.020	#3	6	30.0	2	5.0	27.5	27.0	22.3
ZTS-IW08	Alluvium	26732822.00	833091.44	1547.88	1547.75	NM	NM	Schedule 40 PVC	0.020	#3	6	31.0	2	5.0	27.5	27.0	22.3
ZTS-IW09	Alluvium	26732803.17	833098.78	1548.14	1548.30	NM	NM	Schedule 40 PVC	0.020	#3	6	27.0	2	5.0	26.5	26.0	21.3
ZTS-IW10	Alluvium	26732784.72	833106.32	1548.63	1548.48	NM	NM	Schedule 40 PVC	0.020	#3	6	25.0	2	5.0	25.0	24.5	19.8
ZTS-IW11	Alluvium	26732597.13	832941.47	1547.80	1547.86	NM	NM	Schedule 40 PVC	0.020	#3	6	25.0	2	5.0	23.5	23.0	18.3
ZTS-IW12	Alluvium	26732585.78	832951.00	1547.51	1547.54	NM	NM	Schedule 40 PVC	0.020	#3	6	26.0	2	5.0	25.0	24.5	19.8
ZTS-IW13	Alluvium	26732645.58	832916.08	1547.54	1547.64	NM	NM	Schedule 40 PVC	0.020	#3	6	30.0	2	10.0	29.5	29.0	19.3
ZTS-IW14	Alluvium	26732632.18	832923.75	1547.50	1547.55	NM	NM	Schedule 40 PVC	0.020	#3	6	30.0	2	10.0	27.3	26.8	17.1
ZTS-IW15	UMCf	26732551.24	832973.58	1547.33	1547.34	NM	NM	Schedule 40 PVC	0.010	#2/16	10	68.0	2	15.0	46.5	46.0	26.3
ZTS-IW16	UMCf	26732551.53	832973.34	1547.37	1547.44	NM	NM	Schedule 40 PVC	0.010	#2/16			2	20.0	67.5	67.0	52.3

Notes
 amsl - above mean sea level
 bgs - below ground surface
 bTOC - below top of casing
 PVC - polyvinyl chloride
 NM - not measured
 UMCf - Upper Muddy Creek formation
 1. Depth to water collected on May 16-17, 2023.

Table 2
Summary of Groundwater Extraction Activities - April 2023
 Las Vegas Wash ZVI-Enhanced Bioremediation Treatability Study

Date	Extraction Well	Start Time	Stop Time	Duration	Average Flow Rate	Volume Extracted	Cumulative Volume Extracted
				min	gpm	gal	gal
4/17/2023	ZTS-MW143	13:25	17:07	222	11.0	2445.9	2,445.9
4/17/2023	ZTS-MW160	15:44	17:07	83	8.1	674.3	674.3
4/17/2023	ZTS-MW161	16:43	16:48	5	3.4	17.0	17.0
4/18/2023	ZTS-MW143	8:00	16:33	513	12.1	6,186.2	8,632.1
4/18/2023	ZTS-MW147	14:11	14:25	14	5.7	79.6	79.6
4/18/2023	ZTS-MW160	7:42	16:21	519	2.3	1,175.0	1,849.3
4/18/2023	ZTS-MW161	8:58	11:05	127	3.0	381.0	398.0
4/18/2023	LVWPS-MW107A	11:38	16:32	294	13.1	3,836.8	3,836.8
4/19/2023	ZTS-MW143	6:45	12:45	360	13.1	4,704.7	13,336.8
4/19/2023	ZTS-MW147	--	--	--	--	--	79.6
4/19/2023	ZTS-MW160	--	--	--	--	--	1,849.3
4/19/2023	ZTS-MW161	--	--	--	--	--	398.0
4/19/2023	LVWPS-MW107A	6:55	12:45	350	16.8	5,891.3	9,728.2
4/20/2023	ZTS-MW143	10:52	16:21	329	10.9	3,580.4	16,917.2
4/20/2023	ZTS-MW147	12:15	16:21	246	12.4	3,049.9	3,129.5
4/20/2023	ZTS-MW160	--	--	--	--	--	1,849.3
4/20/2023	ZTS-MW161	--	--	--	--	--	398.0
4/20/2023	LVWPS-MW107A	10:52	16:21	329	16.8	5,529.0	15,257.1
4/21/2023	ZTS-MW143	15:42	16:47	65	13.1	852.9	17,770.0
4/21/2023	ZTS-MW147	15:50	16:52	62	8.8	543.8	3,673.3
4/21/2023	ZTS-MW160	--	--	--	--	--	1,849.3
4/21/2023	ZTS-MW161	--	--	--	--	--	398.0
4/21/2023	LVWPS-MW107A	15:42	16:47	65	19.8	1,287.7	16,544.9
4/22/2023	ZTS-MW143	6:15	16:25	610	14.5	8,842.8	26,612.8
4/22/2023	ZTS-MW147	6:15	16:25	610	8.5	5,190.7	8,864.0
4/22/2023	ZTS-MW160	--	--	--	--	--	1,849.3
4/22/2023	ZTS-MW161	--	--	--	--	--	398.0
4/22/2023	LVWPS-MW107A	6:15	16:25	610	16.4	10,031.2	26,576.1
4/23/2023	ZTS-MW143	7:15	11:38	263	16.9	4,448.2	31,061.0
4/23/2023	ZTS-MW147	7:19	11:38	259	8.4	2,178.1	11,042.1
4/23/2023	ZTS-MW160	--	--	--	--	21:21	1,849.3
4/23/2023	ZTS-MW161	--	--	--	--	--	398.0
4/23/2023	LVWPS-MW107A	7:20	11:38	258	16.8	4344.89	30,920.9
EVENT TOTAL							75,271.4

Notes:

gal - gallons

gpm - gallons per minute

min - minutes

Table 3
Summary of Injection Activities - April 2023
 Las Vegas Wash ZVI-Enhanced Bioremediation Treatability Study

Injection Date	Injection Well ID	Injection Start Time	Injection Stop Time	Injection Duration ⁽¹⁾	Average Flow Rate	Maximum Pressure	Sustained Pressure	Volume of Anaerobic Chase Water Injected	Volume of Inoculum Injected	Volume of Nutrient Solution Injected	Cumulative Volume of Nutrient Solution Injected
				min	gpm	psi	psi	gal	L	gal	gal
4/19/2023	ZTS-IW11	2:02 PM	4:25 PM	143	7.4	0	0	200.8	3.0	853.6	853.6
	ZTS-IW12	2:02 PM	4:25 PM	143	7.6	14	14	200.3	3.0	885.1	885.1
	ZTS-IW13	2:02 PM	4:25 PM	143	7.5	10	8	200.3	3.0	865.6	865.6
	ZTS-IW14	2:02 PM	4:25 PM	143	6.7	0	0	200.3	3.0	751.2	751.2
	ZTS-IW15	2:02 PM	4:25 PM	143	8.9	30	13	200.6	3.0	1,066.7	1,066.7
ZTS-IW16	2:02 PM	4:25 PM	143	7.1	15	15	202.0	3.0	806.5	806.5	
Daily Summary								1,204.2	18.0	5,228.7	
4/20/2023	ZTS-IW11	7:45 AM	8:56 AM	71	21.1	7	7	--	--	1,496.0	2,349.7
	ZTS-IW12	7:45 AM	8:56 AM	71	20.6	15	15	--	--	1,464.2	2,349.3
	ZTS-IW13	7:45 AM	8:56 AM	71	20.9	24	24	--	--	1,483.8	2,349.4
	ZTS-IW14	7:45 AM	9:20 AM	95	14.7	2	1	--	--	1,398.3	2,149.5
		10:20 AM	10:30 AM	10	20.0	0	0	--	--	199.7	2,349.1
	ZTS-IW15	7:45 AM	4:20 PM	515	5.0	0	0	--	--	2,578.4	3,645.1
ZTS-IW16	7:45 AM	4:20 PM	515	4.8	3	3	--	--	2,494.0	3,300.4	
Daily Summary								0.0	0.0	11,114.3	
4/21/2023	ZTS-IW01	12:17 PM	4:40 PM	263	3.0	13	9	202.9	3.0	573.6	573.6
	ZTS-IW02	12:17 PM	4:40 PM	263	5.9	0	0	200.9	3.0	1,360.8	1,360.8
	ZTS-IW03	12:17 PM	4:40 PM	263	5.6	0	0	200.7	3.0	1,264.7	1,264.7
	ZTS-IW04	12:17 PM	4:40 PM	263	7.1	0	0	200.3	3.0	1,679.7	1,679.7
	ZTS-IW05	12:17 PM	4:40 PM	263	7.0	4	0	201.4	3.0	1,644.3	1,644.3
	ZTS-IW06	12:17 PM	4:40 PM	263	7.6	0	0	204.1	3.0	1,805.6	1,805.6
	ZTS-IW07	12:17 PM	4:40 PM	263	3.6	5	2	200.3	3.0	738.0	738.0
	ZTS-IW08	12:17 PM	4:40 PM	263	7.1	0	0	207.9	3.0	1,663.9	1,663.9
	ZTS-IW09	12:17 PM	4:40 PM	263	6.8	0	0	200.1	3.0	1,589.2	1,589.2
	ZTS-IW10	12:17 PM	4:40 PM	263	6.5	0	0	203.1	3.0	1,510.1	1,510.1
	ZTS-IW15	2:30 PM	3:43 PM	73	5.7	5	5	--	--	415.7	4,060.8
ZTS-IW16	2:30 PM	4:40 PM	130	1.7	0	0	--	--	227.1	3,527.5	
Daily Summary								2,021.7	30.0	14,472.6	
4/22/2023	ZTS-IW01	11:42 AM	1:36 PM	114	9.2	18	11	--	--	1,054.4	1,628.0
	ZTS-IW02	11:42 AM	1:36 PM	114	11.6	0	0	--	--	1,324.9	2,685.7
	ZTS-IW03	11:42 AM	1:36 PM	114	12.5	0	0	--	--	1,430.0	2,694.6
	ZTS-IW04	11:42 AM	1:36 PM	114	13.4	4	0	--	--	1,526.0	3,205.7
	ZTS-IW05	11:42 AM	1:36 PM	114	13.7	0	0	--	--	1,566.3	3,210.6
	ZTS-IW06	11:42 AM	1:36 PM	114	12.7	0	0	--	--	1,443.9	3,249.5
	ZTS-IW07	11:42 AM	1:36 PM	114	14.6	10	10	--	--	1,662.7	1,900.6
	ZTS-IW08	11:42 AM	12:40 PM	58	11.8	5	5	--	--	685.1	2,349.1
	ZTS-IW09	11:42 AM	12:47 PM	65	11.7	5	5	--	--	759.9	2,349.1
	ZTS-IW10	11:42 AM	12:55 PM	73	11.5	3	3	--	--	839.4	2,349.4
ZTS-IW15	11:42 AM	1:36 PM	114	3.2	5	5	--	--	368.8	4,429.6	
Daily Summary								0.0	0.0	12,661.3	
4/23/2023	ZTS-IW01	8:15 AM	10:25 AM	130	9.9	14	14	--	--	1,282.3	2,910.3
	ZTS-IW02	8:15 AM	10:25 AM	130	13.1	0	0	--	--	1,699.8	4,385.5
	ZTS-IW03	8:15 AM	10:25 AM	130	16.5	0	0	--	--	2,143.2	4,837.8
	ZTS-IW04	8:15 AM	10:25 AM	130	17.1	6	4	--	--	2,225.7	5,431.5
	ZTS-IW05	8:15 AM	10:25 AM	130	16.9	0	0	--	--	2,191.2	5,396.9
	ZTS-IW06	8:15 AM	10:25 AM	130	17.5	0	0	--	--	2,275.4	5,486.0
	ZTS-IW07	8:15 AM	9:17 AM	62	7.2	29	18	--	--	448.1	2,348.7
ZTS-IW15	8:15 AM	9:36 AM	81	3.3	5	5	--	--	268.8	4,698.3	
Daily Summary								0.0	0.0	12,534.5	
4/23/2023	ZTS-IW01	1:23 PM	5:30 PM	247	16.1	21	16	--	--	3,972.5	6,882.8
	ZTS-IW02	1:10 PM	3:39 PM	149	17.9	0	0	--	--	2,660.9	7,046.3
	ZTS-IW03	1:10 PM	3:10 PM	120	18.4	0	0	--	--	2,212.1	7,049.9
	ZTS-IW04	1:10 PM	2:40 PM	90	18.7	13	13	--	--	1,681.6	7,113.0
	ZTS-IW05	1:10 PM	3:01 PM	111	14.9	2	0	--	--	1,652.4	7,049.4
	ZTS-IW06	1:27 PM	2:40 PM	73	24.3	4	2	--	--	1,773.6	7,259.6
Daily Summary								0.0	0.0	13,953.1	
4/24/2023	ZTS-IW01	9:15 AM	9:25 AM	10	16.7	14	14	--	--	166.8	7,049.6
Daily Summary								0.0	0.0	166.8	
Injection Event Summary								3,225.9	48.0	70,131.2	

Notes:

gal - gallons min - minutes
 gpm - gallons per minute psi - pounds per square inch

1. Injection duration indicates the total minutes of active injection per day, accounting for any downtime in injections that may have occurred throughout the day. Therefore, injection duration may be less than the difference in daily injection start and stop times indicated.

Table 4
Batch Mixing Summary - April 2023
Las Vegas Wash ZVI-Enhanced Bioremediation Treatability Study

Solution	Batch ID	Accelerite (gallons)	Monopotassium Phosphate (lbs)	Sodium Sulfite (lbs)	ZVI (lbs)	Extracted Groundwater (gallons)	Total Injectate Solution (gallons)
Anaerobic Water	1A-A	--	--	1.1	0.3	1,350	1,350
Nutrient Solution	1A-N	3.2	14.1	7.9	2.3	9,471	9,474
Nutrient Solution	2B-N	5.0	21.3	12.2	3.5	14,570	14,575
Anaerobic Water	3B-A	--	--	2.1	0.6	2,545	2,545
Nutrient Solution	3B-N	3.3	14.6	8.0	2.2	9,582	9,585
Nutrient Solution	4A-N	4.4	19.6	10.8	3.0	12,895	12,900
Nutrient Solution	5B-N	4.4	19.5	10.7	3.0	12,808	12,812
Nutrient Solution	6A-N	4.7	20.9	11.4	3.2	13,729	13,733
Injectate Total		25	110	64	18	76,950	76,976