TEC-Weston Joint Venture

December 10, 2018

Dave Connolly
Army National Guard
Installations & Environment – Cleanup Branch
111 South George Mason Drive
Arlington, VA 22204

Subject: **Facility-Wide Groundwater Monitoring Program, RVAAP-66 Facility-Wide Groundwater Technical Memorandum for First 2018 Semi-Annual Sampling Event (June 2018, Revised)**
RVAAP-66, Portage and Trumbull Counties, Ohio
Contract Number: W9133L-14-D-0008
Delivery Order: 0003

ATTN: Dave Connolly

TEC-WESTON Joint Venture (JV) is pleased to submit this revised technical memorandum summarizing work conducted during the Facility-Wide Groundwater Monitoring Program (FWGWMP) first semi-annual groundwater sampling event for June 2018. This memorandum was prepared in accordance with the Performance Work Statement (PWS), Contract Number W9133L-14-D-0008 Delivery Order 0003, and satisfies the Semi-Annual Groundwater Sampling requirement outlined in Task 9.11, Semi-annual Groundwater Sampling #5, of the Performance Metric and Measurement Plan (PMMP). Revisions to the previous version of the technical memorandum were made to address comments received from the Army National Guard (ARNG) in email correspondence dated October 29, 2018.

The June 2018 sampling event was conducted from 20 June through 28 June 2018 and was a continuation of monitoring activities conducted at Camp Ravenna since 2005 under the FWGWMP Plan. The following tasks were performed in accordance with specifications contained in the Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) updates provided with the *Final Facility-Wide Groundwater RI Work Plan* (RIWP; dated December 2016):

- Performed groundwater sampling of selected wells during the June 2018 sampling event, including wells sampled as part of the FWGWMP. The FWGWMP sampling included the collection of groundwater samples from 79 monitoring wells, including 4 Resource Conservation and Recovery Act (RCRA) wells, in accordance with the *Final Facility-Wide Groundwater Monitoring Addendum for 2018*, dated June 2018 (*2018 Addendum*). One RCRA well (DET-4) was observed to be dry during the June 2018 sampling event and was not sampled. The sampled wells and analyses performed are identified in **Table 1**.

- Although listed in the *2018 Addendum* for testing at FBQmw-171, sulfates, nitrite, and nitrate were not included due to a chain-of-custody error.
- Gauged depth to water levels at the 79 monitoring wells at Camp Ravenna prior to sampling. The depth to water levels are identified in **Table 2**.
- Several wells were sampled prior to meeting field water quality parameter stabilization criteria during purging as specified in the approved SAP. Turbidity was the primary parameter failing to stabilize prior to sampling; however, dissolved oxygen and conductivity also did not properly stabilize for certain monitoring wells. Additionally, some wells were purged for less than the SAP prescribed minimum of 30 minutes. A summary of wells and field water quality parameters not meeting the SAP stabilization criteria is provided on **Table 3**.
- Two monitoring wells, FWGmw-007 and NTAmw-119, were sampled through the water quality meter flow through cells used during purging. Based on a review of detected concentrations, the June 2018 results fit within the historically observed range of concentrations for constituents previously detected above current screening levels. No cross-contamination effects are indicated to have resulted from sampling methodology error. The data are acceptable for utilization in the current annual monitoring program and for the facility-wide RI.
- Performed laboratory analyses and data validation for the collected samples.

Validated Electronic Data Deliverables (EDDs) from the June 2018 sampling event are included as **Attachment A**. Data validation reports (DVRs) are included as **Attachment B**. Rejected data were limited to semi-volatile organic compound results for hexachlorocyclopentadiene under SDG Nos. 111344-1 and 111421-1, nitrocellulose under SDG No. 111468-1, and nitroguanidine under SDG No. 111468-1. Details regarding rejected results for each of these compounds are provided in their respective DVRs. Field notes, including purge forms presenting water quality parameters, are included in **Attachment C**. The water quality parameters will be provided in electronic format in a pending Ravenna Environmental Information Management System submittal for the June 2018 sampling event. Documentation pertaining to Investigation Derived Waste (IDW) disposal is included as **Attachment D**. The data collected during the June 2018 sampling event will be presented in a Facility-Wide Groundwater Monitoring Program Annual Report for 2018 following the second semi-annual groundwater sampling event for 2018, which will be conducted under separate contract.

TEC-Weston Joint Venture

We appreciate the opportunity to work with you. If you have any questions or comments regarding this deliverable, please feel free to contact me by telephone (512) 651-7108 or email at Brent.Ferry@westonsolutions.com.

Sincerely,



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Gail Harris, AR Manager – Camp Ravenna	2 Hardcopies, 2 CDs

Attachments (Provided on CD):
Attachment A: Validated EDDs – June 2018 Sampling Event
Attachment B: Data Validation Reports – June 2018 Sampling Event
Attachment C: Field Notes – June 2018 Sampling Event
Attachment D: IDW Documentation – June 2018 Sampling Event

TABLES

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Table 1 Monitoring Wells with Analytical Testing Suite, June 2018

Well ID	VOCs	SVOCs	PCBs	Explosives	Pesticides	Cyanide	Other	Metals
CBLmw-001		X	X	X		X	Sulfate, Sulfide, Nitrate/Nitrite, pH	X + Cr[VI]
CBLmw-002		X	X	X		X	Sulfate, Sulfide, Nitrate/Nitrite, pH	X + Cr[VI]
CBLmw-003		X	X	X		X	Sulfate, Sulfide, Nitrate/Nitrite, pH	X + Cr[VI]
CBLmw-004		X	X	X		X	Sulfate, Sulfide, Nitrate/Nitrite, pH	X + Cr[VI]
CBPmw-008						X		
CBPmw-009						X		
DA2mw-115		X[2]		X		X		X
DET-003	X	X[2,3,4,5]	X	X	X	X		X
DET-004	Well dry during June 2018 event – not sampled							
EBGmw-125						X		
EBGmw-131						X		
FBQmw-171[1]						X	Sulfide, Alkalinity	As, Cr[VI]
FBQmw-172						X		
FBQmw-174		X[2]		X	X		Nitrate/Nitrite, Sulfate/Sulfide, Chloride, Alkalinity	Cr[VI]
FBQmw-175							Nitrate/Nitrite, Sulfate/Sulfide, Chloride, Alkalinity	Cr[VI]
FBQmw-176						X		
FWGmw-004		X[2]		X				X
FWGmw-007		X[2]		X				X
FWGmw-010						X		
FWGmw-011		X[2]		X				X
FWGmw-012		X[2]		X				X
FWGmw-013						X		

Table 1 Monitoring Wells with Analytical Testing Suite, June 2018

Well ID	VOCs	SVOCs	PCBs	Explosives	Pesticides	Cyanide	Other	Metals
FWGmw-015		X[2]		X				X
FWGmw-016		X[2]		X				X
FWGmw-017	X	X		X			X (Perchlorate, Nitroguanidine, Nitrocellulose)	X + Cr(VI)
FWGmw-018	X	X	X	X		X	X (Perchlorate, Nitroguanidine, Nitrocellulose)	X + Cr(VI)
FWGmw-019	X	X	X			X	X (Perchlorate, Nitroguanidine, Nitrocellulose)	Cr(VI)
FWGmw-020	X	X	X	X		X	X (Perchlorate, Nitroguanidine, Nitrocellulose, Nitrate)	X + Cr(VI)
FWGmw-021	X	X[2]	X	X	X	X	X (Perchlorate, Nitroguanidine, Nitrocellulose)	X + Cr(VI)
FWGmw-022	X	X	X			X	X (Perchlorate, Nitroguanidine, Nitrocellulose)	Cr(VI)
FWGmw-023	X	X				X	X (Perchlorate, Nitroguanidine, Nitrocellulose)	Cr(VI)
FWGmw-024	X	X		X			X (Perchlorate, Nitroguanidine, Nitrocellulose)	X + Cr(VI)
LL1mw-064				X				X
LL1mw-065		X[2]		X				X
LL1mw-080				X				
LL1mw-081				X		X		
LL1mw-083		X[2]		X	X		Nitrate/Nitrite, Sulfate/Sulfide, Chloride, Alkalinity	Cr[VI]
LL1mw-084		X[2]		X	X	X	Nitrate/Nitrite, Sulfate/Sulfide, Chloride, Alkalinity	X + Cr[VI]
LL1mw-086		X[2]		X		X	Alkalinity	X
LL1mw-087		X[2]		X				X

Table 1 Monitoring Wells with Analytical Testing Suite, June 2018

Well ID	VOCs	SVOCs	PCBs	Explosives	Pesticides	Cyanide	Other	Metals
LL1mw-088		X[2]		X	X		Alkalinity	X
LL1mw-089		X		X		X	X (Perchlorate, Nitroguanidine, Nitrocellulose)	Cr(VI)
LL2mw-059		X[2]		X				X
LL2mw-264						X		
LL2mw-267		X[2]		X				X
LL2mw-272		X		X		X	X (Perchlorate, Nitroguanidine, Nitrocellulose)	Cr(VI)
LL3mw-234						X		
LL3mw-237				X				
LL3mw-244		X[2]		X	X			X + Cr(VI)
LL3mw-246		X[2]		X			Perchlorate	X
LL4mw-193						X		
LL4mw-200						X		
LL7mw-001	X	X[2]		X		X		X
LL7mw-006				X				
LL10mw-003	X	X[2,3]						X
LL10mw-005	X	X						X
LL11mw-005						X		
LL12mw-183		X[4]				X		
LL12mw-185						X	Nitrate	Arsenic
LL12mw-187		X[2]					Nitrate	X
LL12mw-242		X[2]		X			Nitrate	X
LL12mw-245		X[2]		X			Nitrate	X
LL12mw-247		X[2]		X		X	Nitrate	X + Cr(VI)

Table 1 Monitoring Wells with Analytical Testing Suite, June 2018

Well ID	VOCs	SVOCs	PCBs	Explosives	Pesticides	Cyanide	Other	Metals
NTAmw-117						X		
NTAmw-118						X		
NTAmw-119	X	X[2,3,4]		X				X
NTAmw-120		X		X			X (Perchlorate, Nitroguanidine, Nitrocellulose)	Cr(VI)
RQLmw-007	X	X	X	X	X	X	Phosphorus	X
RQLmw-008	X	X	X	X	X	X		X
RQLmw-009	X	X	X	X	X	X		X
RQLmw-011		X					Nitrate/Nitrate, Sulfate/Sulfide, Chloride, Alkalinity	Cr[VI]
RQLmw-012						X	Nitrate/Nitrate, Sulfate/Sulfide, Chloride, Alkalinity	Cr[VI]
RQLmw-013							Nitrate/Nitrate, Sulfate/Sulfide, Chloride, Alkalinity	Cr[VI]
RQLmw-014				X			Nitrate/Nitrate, Sulfate/Sulfide, Chloride, Alkalinity	Cr[VI]
RQLmw-016						X		
SCFmw-004		X[2]		X	X			X
WBGmw-006		X[2]		X				X
WBGmw-009		X[2]		X				X
WBGmw-020		X[2]		X				X
WBGmw-021		X[2]		X				X

Notes:

X - Indicates well or constituent sampled in June 2018 as part of the 2018 FWGWMP.

[1] Although indicated for sampling in the *2018 Addendum*, FBQmw-017 was not tested for sulfate, nitrate and nitrite due to a chain-of-custody error.

[2] SVOCs: phthalates

[3] SVOCs: nitroaromatics

[4] SVOCs: polycyclic aromatic hydrocarbons

[5] SVOCs: phenols

Table 2
Well Construction and Groundwater Elevations - June 2018

RVAAP Area	Well ID	Ohio State Plane Easting	Ohio State Plane Northing	Ground Elevation (ft, AMSL)	Total Drilled Depth (ft, BGS)	TOC Elevation (ft, AMSL)	Well Head Type[1]	Monitored Zone	Top of Screen (ft, BGS)	Bottom of Screen (ft, BGS)	Bottom of Inner Casing Plug or End Cap (ft, BGS)	Stickup height (ft, AGS)	Reported Bottom of Inner Casing (ft, BTOC)	Depth to Water - June 2018 (ft, BTOC)	Groundwater Elevation - June 2018 (ft, AMSL)
C-Block Quarry	CBLmw-001	2343657.08	559403.12	1,178.50	50.0	1,181.08	A	Homewood	39.0	49.0	49.0	2.58	NM[2]	42.99	1138.09
	CBLmw-002	2343845.22	559044.48	1,172.50	45.3	1,175.24	A	Homewood	34.5	44.5	44.5	2.74	NM[2]	37.60	1137.64
	CBLmw-003	2343970.00	559695.52	1,172.22	44.0	1,175.06	A	Homewood	33.0	43.0	43.0	2.84	NM[2]	35.33	1139.73
	CBLmw-004	2343688.76	559951.58	1,172.08	45.0	1,174.84	A	Homewood	34.0	44.0	44.0	2.76	NM[2]	35.63	1139.21
Central Burn Pits	CBPmw-008	2366757.21	562668.84	970.57	25.5	973.19	A	Unconsolidated	15.0	25.0	25.0	2.62	NM[2]	17.63	955.56
	CBPmw-009	2367174.00	561797.00	969.90	65	972.48	A	Sharon	54.0	64.0	64.3	2.58	NM[2]	12.15	960.33
Open Demolition Area #2	DA2mw-115	2355269.00	560459.00	1,035.40	44.0	1,038.08	A	Sharon	33.75	43.75	44.05	2.68	NM[2]	7.00	1031.08
	DETmw-003	2355204.94	560456.10	1,035.81	15.0	1,036.81	A	Unconsolidated	7.0	12.0	12.0	1.00	NM[2]	9.70	1027.11
	DETmw-004	2355072.36	560454.22	1,037.68	11.0	1,038.68	A	Unconsolidated	6.0	11.0	11.0	1.00	NM[2]	NM[3]	NM[3]
Erie Burning Grounds	EBGmw-125	2379679.20	571655.63	947.55	25.0	949.89	A	Unconsolidated	14.0	24.0	24.5	2.34	NM[2]	12.68	937.21
	EBGmw-131	2379666.00	571655.00	947.50	71.0	950.08	A	Sharon	60.5	70.5	70.8	2.58	NM[2]	10.34	939.74
Fuze and Booster	FBQmw-171	2350072.44	554230.93	1,140.49	30.0	1,143.55	A	Homewood	18.0	28.0	28.0	3.06	NM[2]	19.08	1124.47
Quarry Landfill/Ponds	FBQmw-172	2349907.37	554322.17	1,145.71	33.0	1,150.09	A	Homewood	20.0	30.0	30.0	4.38	NM[2]	26.59	1123.50
	FBQmw-174	2350289.81	554142.44	1,135.78	22.5	1,139.97	A	Homewood	12.0	22.0	22.0	4.19	NM[2]	17.76	1122.21
	FBQmw-175	2350297.98	553989.24	1,137.16	22.5	1,140.73	A	Homewood	12.0	22.0	22.0	3.57	NM[2]	18.23	1122.50
	FBQmw-176	2350219.45	553273.33	1,129.57	21.5	1,131.91	A	Unconsolidated	11.0	21.0	21.0	2.34	NM[2]	9.48	1122.43
Facility-Wide	FWGmw-004	2356970.00	549319.00	1,034.50	20.0	1,037.15	A	Unconsolidated	9.5	19.5	19.8	2.65	NM[2]	14.35	1022.80
Groundwater	FWGmw-007	2344785.00	548356.00	1,072.80	30.0	1,075.41	A	Unconsolidated	19.5	29.5	29.8	2.61	NM[2]	25.20	1050.21
	FWGmw-010	2379060.00	565077.00	959.50	17.3	962.15	A	Unconsolidated	6	16	16.3	2.65	NM[2]	12.65	949.50
	FWGmw-011	2380390.00	566801.00	939.00	17.5	941.61	A	Unconsolidated	6	16	16.3	2.61	17.64	2.90	938.71
	FWGmw-012	2380389.00	566790.00	938.90	40.0	941.39	A	Sharon Shale	29.5	39.5	39.8	2.49	NM[2]	2.95	938.44
	FWGmw-013	2357460.00	559483.00	1,057.10	34.5	1,059.51	A	Sharon	24	34	34.3	2.41	NM[2]	22.19	1037.32
	FWGmw-015	2358353.00	550179.00	1,012.10	26.0	1,014.51	A	Unconsolidated	13.5	23.5	23.8	2.41	NM[2]	6.96	1007.55
	FWGmw-016	2358364.00	550171.00	1,011.90	65.0	1,014.39	A	Sharon	54.5	64.5	64.8	2.49	NM[2]	17.35	997.04
	FWGmw-017	557518.22	2375792.88	958.53	148.00	961.26	A	Sharon Cong.	133.5	143.5	143.5	2.73	NM[2]	13.12	948.14
	FWGmw-018	554933.24	2369793.44	981.12	154.00	984.03	A	Sharon Cong.	136.2	146.2	146.2	2.91	NM[2]	22.43	961.60
	FWGmw-019	555486.89	2356265.25	1,129.58	240.00	1,132.23	A	Sharon Cong.	224.5	234.5	234.5	2.65	NM[2]	115.00	1017.23
	FWGmw-020	554944.12	2369769.12	981.73	45.70	984.58	A	Sharon	34.7	44.7	44.7	2.85	NM[2]	23.27	961.31
	FWGmw-021	555708.43	2371551.33	984.88	44.90	987.97	A	Sharon	34.4	44.4	44.4	3.09	NM[2]	21.88	966.09
	FWGmw-022	555466.61	2356276.69	1,129.61	165.00	1,132.31	A	Sharon	153.8	163.8	163.8	2.70	NM[2]	115.11	1017.20
	FWGmw-023	553999.50	2351494.36	1,149.66	215.00	1,152.37	A	Sharon	203.5	213.5	213.5	2.71	NM[2]	117.60	1034.77
	FWGmw-024	557546.23	2375717.99	960.30	35.00	963.16	A	Sharon	23.70	33.70	33.70	2.86	NM[2]	14.84	948.32
Load Line 1	LL1mw-064	2380286.97	563118.74	932.32	18.4	935.10	A	Unconsolidated	8.0	18.0	18.4	2.78	NM[2]	2.90	932.20
	LL1mw-065	2380452.00	560916.92	941.53	20.5	944.41	A	Unconsolidated	10.2	20.2	20.5	2.88	NM[2]	12.70	931.71
	LL1mw-080	2376845.07	562479.73	993.70	19.5	996.27	A	Sharon	9.5	19.0	19.5	2.57	NM[2]	14.21	982.06
	LL1mw-081	2376672.66	563462.73	996.40	39.4	998.92	A	Sharon	29.4	38.9	39.4	2.52	NM[2]	31.44	967.48
	LL1mw-083	2377074.80	563612.75	992.80	39.3	995.20	A	Sharon	29.1	38.6	39.3	2.40	NM[2]	35.39	959.81
	LL1mw-084	2377316.02	563160.44	996.40	37.0	998.73	A	Sharon	26.7	36.3	37.0	2.33	NM[2]	31.02	967.71
	LL1mw-086	2380437.00	561714.00	938.00	75.0	940.63	A	Unconsolidated	64.5	74.5	74.8	2.63	NM[2]	9.00	931.63
	LL1mw-087	2378732.00	560375.00	941.80	17.5	944.32	A	Unconsolidated	7	17	17.3	2.52	NM[2]	8.67	935.65
	LL1mw-088	2380525.00	561746.00	936.30	24	938.63	A	Unconsolidated	13.9	23.9	24.51	3.00	NM[2]	6.50	932.13
	LL1mw-089	2378139.92	563639.31	977.54	37	980.29	A	Unconsolidated	26.5	36.5	36.50	2.75	NM[2]	26.42	953.87
Load Line 2	LL2mw-059	2375453.00	558020.00	964.33	19.5	966.67	A	Unconsolidated	9.3	19.1	19.5	2.34	NM[2]	14.82	951.85
	LL2mw-264	2374532.00	561173.60	1,010.10	20.5	1,011.88	A	Sharon	9.8	19.8	20.0	1.78	NM[2]	9.45	1002.43
	LL2mw-267	2373715.04	561393.22	1,012.81	20.5	1,014.81	A	Sharon	9.8	19.8	20.0	2.00	NM[2]	11.12	1003.69
	LL2mw-272	560599.71	2373808.49	1015.00	30.00	1017.80	A	Sharon	19.2	29.2	29.2	3	NM[2]	14.52	1003.28
Load Line 3	LL3mw-234	2370297.47	560058.89	1,004.47	20.5	1,006.56	A	Sharon	9.8	19.8	20.0	2.09	NM[2]	10.82	995.74
	LL3mw-237	2371475.00	559328.09	1,003.57	23.9	1,005.57	A	Sharon	12.7	22.7	22.9	2.00	NM[2]	16.86	988.71
	LL3mw-244	2371456.00	556033.00	986.20	45	988.78	A	Sharon	34.5	44.5	44.8	2.58	NM[2]	13.46	975.32
	LL3mw-246	2371441.00	555969.00	986.50	43	988.84	A	Sharon	32.8	42.8	43.0	2.75	NM[2]	21.46	967.38
Load Line 4	LL4mw-193	2364237.44	554959.74	980.88	21.9	982.92	A	Unconsolidated	11.3	21.3	21.5	2.04	NM[2]	7.26	975.66
	LL4mw-200	2365904.12	554579.72	985.97	23.5	987.93	A	Unconsolidated	12.6	22.6	23.0	1.96	NM[2]	18.80	969.13
Load Line 7 Pink Waste Water	LL7mw-001	2352192.91	554925.77	1,126.90	30.0	1,129.64	A	Homewood	19.5	29.5	29.5	2.74	NM[2]	23.00	1106.64
Treatment	LL7mw-006	2351879.92	555990.59	1,120.70	28.0	1,123.56	A	Homewood	17.5	27.5	27.5	2.86	NM[2]	13.40	1110.16

Table 2
Well Construction and Groundwater Elevations - June 2018

RVAAP Area	Well ID	Ohio State Plane Easting	Ohio State Plane Northing	Ground Elevation (ft, AMSL)	Total Drilled Depth (ft, BGS)	TOC Elevation (ft, AMSL)	Well Head Type[1]	Monitored Zone	Top of Screen (ft, BGS)	Bottom of Screen (ft, BGS)	Bottom of Inner Casing Plug or End Cap (ft, BGS)	Stickup height (ft, AGS)	Reported Bottom of Inner Casing (ft, BTOC)	Depth to Water - June 2018 (ft, BTOC)	Groundwater Elevation - June 2018 (ft, AMSL)
Load Line 10	LL10mw-003	2355389.92	555494.71	1,127.40	26.4	1,130.28	A	Homewood	16.0	26.0	26.0	2.88	NM[2]	21.46	1108.82
	LL10mw-005	2355943.55	555380.53	1,122.90	27.0	1,125.67	A	Homewood	16.5	26.5	26.5	2.77	29.3	16.64	1109.03
Load Line 11	LL11mw-005	2352847.56	558501.02	1,079.60	17.0	1,079.40	F	Unconsolidated	6.2	16.2	16.2	-0.20	NM[2]	9.25	1070.15
Load Line 12	LL12mw-183	2369224.36	556068.15	980.59	36.0	982.98	A	Sharon Shale	23.3	33.3	33.6	2.39	NM[2]	14.00	968.98
	LL12mw-185	2368829.86	556946.75	979.09	24.0	981.31	A	Unconsolidated	10.8	20.8	21.0	2.22	NM[2]	7.84	973.47
	LL12mw-187	2368524.14	557633.10	977.90	29.0	979.94	A	Unconsolidated	17.2	27.2	27.4	2.04	NM[2]	11.36	968.58
	LL12mw-242	2368545.29	558020.51	978.40	26.3	981.20	A	Unconsolidated	15.5	25.5	25.5	2.80	NM[2]	11.00	970.20
	LL12mw-245	2368370.74	557044.55	977.50	29.0	980.04	A	Unconsolidated	18.0	28.0	28.0	2.54	NM[2]	10.40	969.64
	LL12mw-247	2368932.00	555141.00	981.30	20.5	984.25	A	Unconsolidated	10	20	20.3	2.95	NM[2]	6.07	978.18
NACA Test Area	NTAmw-117	2347994.83	551584.57	1,091.67	25.0	1,094.54	A	Unconsolidated	14.5	24.5	24.5	2.87	NM[2]	16.78	1077.76
	NTAmw-118	2347609.41	551335.04	1,078.86	22.5	1,081.44	A	Unconsolidated	12.0	22.0	22.0	2.58	NM[2]	9.95	1071.49
	NTAmw-119	2346013.00	551286.00	1,077.40	130	1,080.07	A	Unconsolidated	90.0	100.0	100.3	2.67	NM[2]	13.60	1066.47
	NTAmw-120	2347141.08	551376.89	1,072.67	120	1,075.20	A	Sharon	109.5	119.5	119.5	2.53	NM[2]	34.01	1041.19
Ramsdell Quarry Landfill	RQLmw-007	2375872.56	566544.36	963.86	18.7	965.91	A	Sharon	6.0	16.0	16.2	2.05	NM[2]	7.59	958.32
	RQLmw-008	2376011.08	566327.94	963.82	18.7	966.08	A	Sharon	6.0	16.0	16.2	2.26	NM[2]	7.77	958.31
	RQLmw-009	2376253.65	566351.20	962.60	18.8	964.58	A	Sharon	5.9	15.9	16.4	1.98	NM[2]	6.04	958.54
	RQLmw-011	2376398.19	566819.66	974.60	35.4	976.57	A	Sharon	12.4	32.4	32.6	1.97	NM[2]	23.06	953.51
	RQLmw-012	2376558.19	566551.95	975.12	30.5	977.65	A	Sharon	19.8	29.8	30.0	2.53	NM[2]	22.91	954.74
	RQLmw-013	2376204.93	566928.09	978.04	34.4	980.71	A	Sharon	23.7	33.7	33.9	2.67	NM[2]	26.39	954.32
	RQLmw-014	2376519.38	566941.29	970.83	29.4	973.49	A	Sharon	18.6	28.6	28.9	2.66	NM[2]	20.89	952.60
	RQLmw-016	2375649.55	566177.68	994.02	39.5	996.60	A	Sharon	28.5	38.5	39.0	2.58	NM[2]	37.44	959.16
Basal Sharon Conglomerate	SCFmw-004	2378730.23	560361.03	941.87	120	944.17	A	Sharon Cong.	100	110	NA	2.30	NM[2]	0.50	943.67
Winklepeck Burning Grounds	WBGmw-006	2359087.79	563008.87	1,012.16	19.0	1,014.66	A	Unconsolidated	7.6	17.6	17.9	2.50	NM[2]	8.82	1005.84
	WBGmw-009	2357159.20	561603.54	1,045.03	24.0	1,047.53	A	Unconsolidated	11.4	21.4	21.5	2.50	NM[2]	15.82	1031.71
	WBGmw-020	2357161.00	561623.00	1,043.40	43.3	1,044.31	A	Sharon	32.9	42.9	43.2	0.91	NM[2]	14.55	1029.76
	WBGmw-021	2359106.00	563009.00	1,010.00	42.5	1,010.92	A	Sharon	32	42	42.3	0.92	NM[2]	10.55	1000.37

Notes and Abbreviations:

[1] A = above grade completion; F = flush-mount completion

[2] Total depth could not be measured because a sampling pump is installed in the well.

[3] Well dry during June 2018 sampling event.

AGS = above ground surface
ASML - above mean sea level
BGS = below ground surface
BTOC - below top of casing
ft - feet
NA - not applicable
NM - not measured
TOC - top of casing

Table 3 Non-Stabilized Field Water Quality Parameter Wells - June 2018

No.	Well	Description
1	CBLmw-001	Turbidity > 10 in last 3 readings; purged < 2 hours; all other parameters stabilized.
2	CBLmw-002	Purged 22 minutes; all parameters stabilized.
3	FWGmw-024	Turbidity > 10 in last 3 readings; purged < 2 hours; all other parameters stabilized.
4	FWGmw-021	Turbidity > 10 at sample collection; purged < 2 hours; all other parameters stabilized.
5	FWGmw-020	Turbidity > 10 at sample collection; purged < 2 hours; all other parameters stabilized.
6	CBLmw-003	Purged 27 minutes; all parameters stabilized.
7	NTAmw-118	Turbidity > 10 at sample collection; purged < 2 hours; all other parameters stabilized.
8	LL10mw-003	Purged 22 min; all parameters stabilized.
9	CBLmw-002	Purged 22 min; all parameters stabilized.
10	CBLmw-001	Purged 24 min; all parameters stabilized.
11	WBGmw-021	Turbidity > 10 in last 3 readings; purged < 2 hours; all other parameters stabilized.
12	LL1mw-088	Turbidity > 10 in last 3 readings; purged < 2 hours; all other parameters stabilized.
13	FWGmw-017	Turbidity > 10 in last 3 readings; purged < 2 hours; all other parameters stabilized.
14	LL3mw-246	Turbidity > 10 in last 3 readings; purged < 2 hours; all other parameters stabilized.
15	FWGmw-007	Sampled through YSI; turbidity > 10; purged < 2 hours; all other parameters stabilized.
16	NTAmw-119	Sampled through YSI; turbidity > 10 in last 3 readings; purged < 2 hours; all other parameters stabilized.
17	WBGmw-009	Turbidity > 10 in last 3 readings; purged < 2 hours; all other parameters stabilized.
18	WBGmw-006	Turbidity > 10 in last 3 readings; purged < 2 hours; all other parameters stabilized.
19	LL2mw-272	Turbidity > 10 in last 3 readings; purged < 2 hours; all other parameters stabilized.
20	RQLmw-016	D.O. outside 0.2 mg/L; all other parameters stabilized.
21	FBQmw-175	Turbidity > 10 in last 3 readings; purged < 2 hours; all other parameters stabilized.
22	FBQmw-176	2 hour purge.
23	LL3mw-234	Turbidity > 10 in last 3 readings; purged < 2 hours; all other parameters stabilized.
24	RQLmw-011	Turbidity > 10 in last 3 readings; purged < 2 hours; Conductivity outside ± 3%; all other parameters stabilized.
25	LL7mw-001	Turbidity > 10 in last 3 readings; purged < 2 hours; all other parameters stabilized.
26	FWGmw-010	Turbidity > 10 in last 3 readings; purged < 2 hours; Conductivity outside ± 3%; all other parameters stabilized.
27	LL1mw-064	Turbidity > 10 in last 3 readings; purged < 2 hours; all other parameters stabilized.
28	FWGmw-012	Turbidity > 10 in last 3 readings; purged < 2 hours; D.O. outside ± 0.3 mg/L; all other parameters stabilized.
29	LL7mw-006	Turbidity > 10 in last 3 readings; purged < 2 hours; all other parameters stabilized.
30	FWGmw-004	Turbidity > 10 in last 3 readings; purged < 2 hours; all other parameters stabilized.
31	FWGmw-022	Turbidity > 10 in last 3 readings; purged < 2 hours; all other parameters stabilized.

Purging and Stabilization Criteria (from Revised Final RI Work Plan, Appendix A: Sampling and Analysis Plan, A.1 Field Sampling Plan, dated November 23, 2016).
Minimum purging duration of 30 minutes.
Turbidity: less than 10 nephelometric turbidity units (NTUs), if not met after 2 hours contact ARNG/OHARNG.
pH: +/- 0.1
Conductivity: +/- 3%
Temperature: +/- 5° C
Dissolved oxygen: +/- 0.3 mg/L
Oxidation Reduction Potential: +/- 10 millivolts or 10%

ATTACHMENT A
VALIDATED EDDS – JUNE 2018 SAMPLING EVENT

Provided as separate files.

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ATTACHMENT B
DATA VALIDATION REPORTS – JUNE 2018 SAMPLING EVENT

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Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual & Quarterly Sampling Event for June 2018

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 240-97364-1

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.

Travis Withers
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Travis Withers, Validation Chemist, TEC-WESTON JV Date

Peter Chapman, Senior Chemist, TEC-WESTON JV 7/10/18
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INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **240-97364-1**.

TestAmerica, Inc., Canton, Ohio performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Hexavalent Chromium	7196A	Canton, OH

TestAmerica Canton does not hold DoD accreditation for hexavalent chromium analysis; therefore, method EPA SW-846 Method 7196A is reported.

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*); and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*), the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	Hexavalent Chromium
CBLmw-001-062018-GW	240-97364-1	06/20/2018	Groundwater		✓
CBLmw-001-D-062018-GW	240-97364-2	06/20/2018	Groundwater	Field Duplicate	✓
CBLmw-002-062018-GW	240-97364-3	06/20/2018	Groundwater		✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 SAMPLE RECEIPT

The samples were received by the laboratory on June 21, 2018; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.3 TECHNICAL DATA VALIDATION

1.3.1 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- Method blank
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank
- Field duplicate

No analytical or quality parameters requiring further discussion were identified for Method 7196A.

No qualifications were made in this SDG.

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual & Quarterly Sampling Event for June 2018

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 240-97441-1

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TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.

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INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **240-97441-1**.

TestAmerica, Inc., Canton, Ohio performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Hexavalent Chromium	7196A	Canton, OH

TestAmerica Canton does not hold DoD accreditation for hexavalent chromium analysis; therefore, method EPA SW-846 Method 7196A is reported.

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*); and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*), the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	Hexavalent Chromium
FWGmw-024-062118-GW	240-97441-1	06/21/2018	Groundwater		✓
FWGmw-017-062118-GW	240-97441-2	06/21/2018	Groundwater		✓
FWGmw-021-062118-GW	240-97441-3	06/21/2018	Groundwater		✓
FWGmw-020-062118-GW	240-97441-4	06/21/2018	Groundwater		✓
FWGmw-018-062118-GW	240-97441-5	06/21/2018	Groundwater		✓
CBLmw-003-062118-GW	240-97441-6	06/21/2018	Groundwater		✓
CBLmw-004-062118-GW	240-97441-7	06/21/2018	Groundwater		✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 SAMPLE RECEIPT

The samples were received by the laboratory on June 21, 2018; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.3 TECHNICAL DATA VALIDATION

1.3.1 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- Method blank
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank

No analytical or quality parameters requiring further discussion were identified for Method 7196A.

No qualifications were made in this SDG.

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual & Quarterly Sampling Event for June 2018

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 240-97629-1

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.

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INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **240-97629-1**.

TestAmerica, Inc., Canton, Ohio performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Hexavalent Chromium	7196A	Canton, OH

TestAmerica Canton does not hold DoD accreditation for hexavalent chromium analysis; therefore, method EPA SW-846 Method 7196A is reported.

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*); and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*), the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	Hexavalent Chromium
FBQmw-171-062518-GW	240-97629-1	06/25/2018	Groundwater		✓
FBQmw-171-D-062518-GW	240-97629-2	06/25/2018	Groundwater	Field Duplicate	✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 SAMPLE RECEIPT

The samples were received by the laboratory on June 25, 2018; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.3 TECHNICAL DATA VALIDATION

1.3.1 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPDs
- Method blank
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank
- Field duplicate

No analytical or quality parameters requiring further discussion were identified for Method 7196A.

No qualifications were made in this SDG.

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual & Quarterly Sampling Event for June 2018

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 240-97635-1

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TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.

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INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **240-97635-1**.

TestAmerica, Inc., Canton, Ohio performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Hexavalent Chromium	7196A	Canton, OH

TestAmerica Canton does not hold DoD accreditation for hexavalent chromium analysis; therefore, method EPA SW-846 Method 7196A is reported.

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*); and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*), the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	Hexavalent Chromium
FBQmw-174-062518-GW	240-97635-1	06/25/2018	Groundwater		✓
FBQmw-175-062518-GW	240-97635-2	06/25/2018	Groundwater		✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 SAMPLE RECEIPT

The samples were received by the laboratory on June 26, 2018; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.3 TECHNICAL DATA VALIDATION

1.3.1 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- Method blank
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank

No analytical or quality parameters requiring further discussion were identified for Method 7196A.

No qualifications were made in this SDG.

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual & Quarterly Sampling Event for June 2018

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 240-97682-1

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.

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INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **240-97682-1**.

TestAmerica, Inc., Canton, Ohio performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Hexavalent Chromium	7196A	Canton, OH

TestAmerica Canton does not hold DoD accreditation for hexavalent chromium analysis; therefore, method EPA SW-846 Method 7196A is reported.

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*); and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*), the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	Hexavalent Chromium
LL12mw-247-062618-GW	240-97682-1	06/26/2018	Groundwater		✓
LL12mw-247-D-062618-GW	240-97682-2	06/26/2018	Groundwater	Field Duplicate	✓
NTAmw-120-062618-GW	240-97682-3	06/26/2018	Groundwater		✓
NTAmw-120-D-062618-GW	240-97682-4	06/26/2018	Groundwater	Field Duplicate	✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 SAMPLE RECEIPT

The samples were received by the laboratory on June 26, 2018; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.3 TECHNICAL DATA VALIDATION

1.3.1 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPDs
- Method blank
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank
- Field Duplicates

No analytical or quality parameters requiring further discussion were identified for Method 7196A.

No qualifications were made in this SDG.

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual & Quarterly Sampling Event for June 2018

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 240-97687-1

Prepared For:

National Guard Bureau

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Prepared By:

TEC-WESTON Joint Venture

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.

Travis Withers
2018.07.10 22:32:38 -05'00'

Travis Withers, Validation Chemist, TEC-WESTON JV Date

Peter Chapman, Senior Chemist, TEC-WESTON JV 7/10/18
Date

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INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **240-97687-1**.

TestAmerica, Inc., Canton, Ohio performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Hexavalent Chromium	7196A	Canton, OH

TestAmerica Canton does not hold DoD accreditation for hexavalent chromium analysis; therefore, method EPA SW-846 Method 7196A is reported.

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*); and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*), the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	Hexavalent Chromium
LL3mw-244-062618-GW	240-97687-1	06/26/2018	Groundwater		✓
FWGmw-019-062618-GW	240-97687-2	06/26/2018	Groundwater		✓
FWGmw-022-062618-GW	240-97687-3	06/26/2018	Groundwater		✓
FWGmw-023-062618-GW	240-97687-4	06/26/2018	Groundwater		✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 SAMPLE RECEIPT

The samples were received by the laboratory on June 27, 2018; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.3 TECHNICAL DATA VALIDATION

1.3.1 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- Method blank
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank

No analytical or quality parameters requiring further discussion were identified for Method 7196A.

No qualifications were made in this SDG.

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual & Quarterly Sampling Event for June 2018

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 240-97744-1

Prepared For:

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.

Travis Withers
2018.07.10 22:31:23 -05'00'

Travis Withers, Validation Chemist, TEC-WESTON JV Date

Peter Chapman, Senior Chemist, TEC-WESTON JV 7/10/18
Date

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INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **240-97744-1**.

TestAmerica, Inc., Canton, Ohio performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Hexavalent Chromium	7196A	Canton, OH

TestAmerica Canton does not hold DoD accreditation for hexavalent chromium analysis; therefore, method EPA SW-846 Method 7196A is reported.

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*); and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*), the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	Hexavalent Chromium
LL1mw-089-062718-GW	240-97744-1	06/27/2018	Groundwater		✓
LL1mw-089-D-062718-GW	240-97744-2	06/27/2018	Groundwater	Field Duplicate	✓
LL1mw-084-062718-GW	240-97744-3	06/27/2018	Groundwater		✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 SAMPLE RECEIPT

The samples were received by the laboratory on June 27, 2018; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.3 TECHNICAL DATA VALIDATION

1.3.1 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPDs
- Method blank
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank
- Field duplicates

No analytical or quality parameters requiring further discussion were identified for Method 7196A.

No qualifications were made in this SDG.

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual & Quarterly Sampling Event for June 2018

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 240-97767-1

Prepared For:

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.

Travis Withers
2018.07.10 22:30:23 -05'00'

Travis Withers, Validation Chemist, TEC-WESTON JV Date

Peter Chapman, Senior Chemist, TEC-WESTON JV 7/10/18
Date

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INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **240-97767-1**.

TestAmerica, Inc., Canton, Ohio performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Hexavalent Chromium	7196A	Canton, OH

TestAmerica Canton does not hold DoD accreditation for hexavalent chromium analysis; therefore, method EPA SW-846 Method 7196A is reported.

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*); and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*), the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	Hexavalent Chromium
LL1mw-083-062718-GW	240-97767-1	06/27/2018	Groundwater		✓
LL2mw-272-062718-GW	240-97767-2	06/27/2018	Groundwater		✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 SAMPLE RECEIPT

The samples were received by the laboratory on June 27, 2018; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.3 TECHNICAL DATA VALIDATION

1.3.1 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- Method blank
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank

No analytical or quality parameters requiring further discussion were identified for Method 7196A.

No qualifications were made in this SDG.

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual & Quarterly Sampling Event for June 2018

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 240-97858-1

Prepared For:

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Prepared By:

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.

Travis Withers
2018.07.10 22:29:21 -05'00'

Travis Withers, Validation Chemist, TEC-WESTON JV Date

Peter Chapman, Senior Chemist, TEC-WESTON JV 7/10/18
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INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **240-97858-1**.

TestAmerica, Inc., Canton, Ohio performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Hexavalent Chromium	7196A	Canton, OH

TestAmerica Canton does not hold DoD accreditation for hexavalent chromium analysis; therefore, method EPA SW-846 Method 7196A is reported.

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*); and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*), the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	Hexavalent Chromium
RQLmw-011-062818-GW	240-97858-1	06/28/2018	Groundwater		✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 SAMPLE RECEIPT

The samples were received by the laboratory on June 28, 2018; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.3 TECHNICAL DATA VALIDATION

1.3.1 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPDs
- Method blank
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank

No analytical or quality parameters requiring further discussion were identified for Method 7196A.

No qualifications were made in this SDG.

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual & Quarterly Sampling Event for June 2018

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 240-97871-1

Prepared For:

National Guard Bureau

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Prepared By:

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.

Travis Withers
2018.07.10 22:28:04 -05'00'

Travis Withers, Validation Chemist, TEC-WESTON JV Date

Peter Chapman, Senior Chemist, TEC-WESTON JV 7/10/18
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INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **240-97871-1**.

TestAmerica, Inc., Canton, Ohio performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Hexavalent Chromium	7196A	Canton, OH

TestAmerica Canton does not hold DoD accreditation for hexavalent chromium analysis; therefore, method EPA SW-846 Method 7196A is reported.

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*); and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*), the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	Hexavalent Chromium
RQLmw-012-062818-GW	240-97871-1	06/28/2018	Groundwater		✓
RQLmw-013-062818-GW	240-97871-2	06/28/2018	Groundwater		✓
RQLmw-014-062818-GW	240-97871-3	06/28/2018	Groundwater		✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 SAMPLE RECEIPT

The samples were received by the laboratory on June 28, 2018; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.3 TECHNICAL DATA VALIDATION

1.3.1 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPDs
- Method blank
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank

No analytical or quality parameters requiring further discussion were identified for Method 7196A.

No qualifications were made in this SDG.

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual & Quarterly Sampling Event for June 2018

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-111344-1

Prepared For:

National Guard Bureau

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Prepared By:

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.

Travis Withers
2018.09.05 17:26:40 -05'00'

Travis Withers, Validator, TEC-WESTON JV — Date

Peter Chapman, Senior Chemist, TEC-WESTON JV — 9/12/18 Date

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INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-111344-1**.

TestAmerica, Inc., Denver, Colorado or TestAmerica, Inc., Sacramento, CA performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semi-Volatile Organic Compounds (SVOCs)	8270D	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Nitroguanidine	8330 (Modified)	Sacramento, CA
Perchlorate	6860	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Alkalinity	2320B	Denver, CO
Nitrocellulose	353.2	Sacramento, CA
Total Cyanide	9012B	Denver, CO
Sulfide	9034	Denver, CO
Corrosivity (pH)	9040C	Denver, CO
Nitrate	9056A	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*); and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*), the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R)

should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*) and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*). Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs	Pesticides	PCBs	Nitroguanidine	Perchlorate	Explosives	Metals	Alkalinity	Nitrocellulose	Total Cyanide	Sulfide	pH	Anions
FWGmw-020-062118-GW	280-111344-1	06/21/18	Groundwater		✓	✓		✓	✓	✓	✓	✓		✓	✓			✓
TB-062118-03	280-111344-2	06/21/18	Groundwater	Trip Blank	✓													
CBLmw-001-062018-GW	280-111344-3	06/20/18	Groundwater			✓		✓			✓	✓				✓	✓	
CBLmw-001-D-062018-GW	280-111344-4	06/20/18	Groundwater			✓		✓			✓	✓				✓	✓	
CBLmw-002-062018-GW	280-111344-5	06/20/18	Groundwater			✓		✓			✓	✓				✓	✓	
LL1mw-088-062118-GW	280-111344-6	06/21/18	Groundwater			✓	✓				✓	✓	✓					
FWGmw-021-062118-GW	280-111344-7	06/21/18	Groundwater		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓			
TB-062118-01	280-111344-8	06/21/18	Groundwater	Trip Blank	✓													
CBLmw-003-062118-GW	280-111344-9	06/21/18	Groundwater			✓		✓			✓	✓			✓	✓	✓	✓
CBLmw-004-062118-GW	280-111344-10	06/21/18	Groundwater			✓		✓			✓	✓			✓	✓	✓	✓
LL3mw-246-D-062118-GW	280-111344-11	06/21/18	Groundwater	Field Duplicate		✓			✓	✓	✓	✓						
FWGmw-018-062118-GW	280-111344-12	06/21/18	Groundwater		✓	✓		✓	✓	✓	✓	✓		✓	✓			
TB-062118-02	280-111344-13	06/21/18	Groundwater	Trip Blank	✓													
FWGmw-024-062118-GW	280-111344-14	06/21/18	Groundwater		✓	✓			✓	✓	✓	✓		✓				
FWGmw-017-062118-GW	280-111344-15	06/21/18	Groundwater			✓				✓	✓	✓		✓				
TB-062118-04	280-111344-16	06/21/18	Groundwater	Trip Blank	✓													
LL3mw-246-062118-GW	280-111344-17	06/21/18	Groundwater			✓				✓	✓	✓						

Some samples were analyzed for natural attenuation parameters. Natural attenuation parameters are reported, but not validated in accordance with the QAPP.

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 SAMPLE RECEIPT

The samples were received by the laboratory on June 23, 2018; the samples were received in good condition, under chain-of-custody, properly preserved and cooler temperatures were less than 6°C.

All 11 coolers were received without a custody seal present. It was noted that the shipping tape was intact and there was no evidence of tampering during transit.

Nitroguanidine and nitrocellulose analyses were performed by TestAmerica, Sacramento.

Per request, the laboratory cancelled 2320B Alkalinity analysis and added 9040C pH analysis for the following samples: CBLmw-001-062018-GW, CBLmw-001-D-062018-GW, CBLmw-002-062018-GW, CBLmw-003-062118-GW, and CBLmw-004-062118-GW.

Sample volume for all requested 9056 nitrate analyses were received at the laboratory with less than 8 hours left of the holding time. The laboratory was not able to analyze these samples within the 48 hour sample hold time.

1.3 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
U	B	Non-detection; blank criteria not met.
UJ	S	Estimated non-detection; surrogate recovery exceedance.
UJ	M	Estimated non-detection; MS/MSD recovery or RPD exceedance.
UJ	L	Estimated non-detection; LCS/LCSD recovery or RPD exceedance.
J	S	Estimated detection; surrogate recovery exceedance.
J	M	Estimated detection; MS/MSD recovery or RPD exceedance.
J	L	Estimated detection; LCS/LCSD recovery or RPD exceedance.
J	CC	Estimated detection; CCV recovery exceedance.
J	H	Estimated detection; holding time exceedance.
J	D	Estimated detection; laboratory duplicate RPD exceedance.
J	Q	Estimated detection; professional judgement.
R	L	Rejected result; extremely low (<10%) LCS recovery.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- Method blank
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Trip blank

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 LCS/LCSD Recoveries and RPDs

1,1,2-Trichloroehtane (120%) recovered above the control limits (80-119%) in the LCSD. The LCS recovery (112%) and RPD (6%) were within the control limits; therefore, no qualification was necessary.

1.4.1.2 Continuing Calibration Verification

2-Hexananoe (+21.7%) recovered above the control limits (±20%) in the continuing calibration verification CCV 280-421119/2. All associated samples were non-detect for 2-hexanone; therefore, no qualification was necessary.

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Method blanks
- MS/MSD recoveries and RPDs
- LODs and LOQs
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Field duplicates

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.2.1 Surrogate Recoveries

Surrogate terphenyl-d14 recovered below control limits (50-134%) in sample FWGmw-021-062118-GW. All associated sample results were qualified as estimated (UJ S).

1.4.2.2 LCS/LCSD Recoveries and RPDs

Hexachlorocyclopentadiene (4%) recovered below the control limits (10-120%) in the LCS associated with analytical batch 422564. All associated hexachlorocyclopentadiene sample results were rejected due to the extremely low (<10%) LCS recovery (R L). It is noted that hexachlorocyclopentadiene is a poor performer for this method.

1.4.3 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Method blank
- Surrogate recoveries
- LCS/LCSD recoveries and RPDs

- Initial calibration
- Initial calibration verification
- LODs and LOQs

All analytical or quality parameters requiring further discussion for Method 8081B are described in the sections below.

1.4.3.1 Sample Preparation

Samples LL1mw-088-062118-GW and FWGmw-021-062118-GW required a mercury clean-up, via EPA Method 3660A, to reduce matrix interferences caused by sulfur.

Only a portion of the sample volume submitted for sample FWGmw-021-062118-GW was used for analysis due the sample container not being the appropriate size. As such, the required solvent rinse of the original container could not be performed. Based on professional judgement, no qualifications were made.

1.4.3.2 Continuing Calibration Verifications

4,4-DDD (+21%) recovered above the control limits (±20%) in the continuing calibration verification. All associated samples were non-detect for 4,4-DDD; therefore, no qualification was necessary.

1.4.4 Polychlorinated Biphenyls (PCBs) by Method 8082A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Method blank
- Surrogate recoveries
- LCS/LCSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- LODs and LOQs

All analytical or quality parameters requiring further discussion for Method 8082A are described in the sections below.

1.4.4.1 Sample Preparation

Samples FWGmw-020-062118-GW, CBLmw-001-062018-GW, CBLmw-001-D-062018-GW, CBLmw-002-062018-GW, FWGmw-021-062118-GW, CBLmw-003-062118-GW, CBLmw-004-

062118, and FWGmw-018-062118-GW required a sulfuric acid clean-up, via EPA Method 3665A, to reduce matrix interferences.

1.4.5 Nitroguanidine by Method 8330 (Modified)

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Method blanks
- LCS recoveries
- Initial calibration
- Initial calibration verification
- Initial calibration blank
- Continuing calibration verification
- Continuing calibration blank
- LODs and LOQs
- Initial calibration verification

No analytical or quality parameters required further discussion for Method 8330 (Modified).

1.4.6 Perchlorate by Method 6860

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- Method blank
- Initial calibration verification
- Initial calibration blank
- Continuing calibration verification
- Continuing calibration blank
- Detection limit check
- Interference check standards

No analytical or quality parameters required further discussion for Method 6860.

1.4.7 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Method blank
- Initial calibration
- Initial calibration verification
- Initial calibration blank
- Continuing calibration blank
- LODs and LOQs

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.7.1 Surrogate Recoveries

Surrogate 1,2-dinitrobenzene recovered above the control limits (83-119%) in method blank MB 280-420406/1-A (122%). All associated method blank analytes were non-detect and the surrogate recoveries an all associated samples were within control; therefore, no qualification was necessary.

Surrogate 1,2-dinitrobenze recovered below the control limits (83-119%) in method blank MB 280-420242/1-A. All associated sample results were qualified as estimated (UJ/J S).

Surrogate 1,2-dinitrobenzene recovered below the control limits (83-119%) in laboratory control sample LCS 280-420242/2-A (60%). All associated sample results were qualified as estimated (UJ/J S).

1.4.7.2 LCS/LCSD Recoveries and RPDs

Several analytes recovered outside of the control limits in the LCS/LCSD associated with prep batch 420242. The following table outlines these exceedances:

Analyte	LCS %R	LCSD %R	%R Limits	RPD	RPD Limit
1,3,5-Trinitrobenzene	**70**	105	73-125	**40**	20
1,3-Dinitrobenzene	**56**	92	78-120	**49**	20
2,4,6-Trinitrotoluene	**58**	91	71-123	**45**	20
2,4-Dinitrotoluene	**48**	84	78-120	**54**	20
2,6-Dinitrotoleune	**46**	81	77-127	**55**	20
2-Amino-4,6-dinitrotoluene	**41**	**73**	79-120	**56**	20
2-Nitrotoluene	**33**	**66**	70-127	**67**	20
3-Nitrotoluene	**33**	**64**	73-125	**65**	20
4-Amino-2,6-dinitrotoluene	**42**	**70**	76-125	**51**	20
4-Nitrotoluene	**34**	**67**	71-127	**65**	20
HMX	83	103	65-135	**22**	20
Nitrobenzene	**47**	82	65-134	**55**	20
Nitroglycerin	79	113	74-127	**36**	20
PETN	73	103	73-127	**34**	20
RDX	76	104	68-130	**31**	20
Tertyl	65	99	64-128	**41**	20

%R = percent recovery
Bolded values are outside control limits.

The LCS recovery and RPD were outside of control limits for analytes 1,3,5-trinitrobenzene, 1,3-dinitrobenzene, 2,4,6-trinitrotoluene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, and nitrobenzene. All associated sample results were qualified as estimated (UJ/J L).

The LCS recovery, LCSD recovery and RPD were outside of control limits for analytes 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, and 4-nitrotoluene. All associated sample results were qualified as estimated (UJ/J L).

The RPD was outside of control limits for analytes HMX, nitroglycerin, PETN, RDX, and tertyl. The LCS and LCSD recoveries were within control limits for these analytes; therefore, no qualification was necessary.

m-Nitrotoluene (71%) recovered below the control limits (73-125%) in the LCS associated with prep batch 420406 on the secondary confirmation column. m-Nitrotoluene recovered within the control limits on the primary column; therefore, no qualification was necessary.

1.4.7.3 MS/MSD Recoveries and RPDs

An MS/MSD was performed on sample LL3mw-246-062118-GW. Several analytes exceeded the control limits for the MS/MSD. The following table outlines the exceedances:

Analyte	MS %R	MSD %R	%R Limits	RPD	RPD Limit
1,3-Dinitrobenzene	107	91	78-120	**23**	20
2,4-Dinitrotoluene	103	86	78-120	**25**	20
2,6-Dinitrotoleune	99	83	77-127	**24**	20
2-Amino-4,6-dinitrotoluene	99	**74**	79-120	**30**	20
2-Nitrotoluene	96	**67**	70-127	**42**	20
3-Nitrotoluene	95	**66**	73-125	**42**	20
4-Amino-2,6-dinitrotoluene	94	**71**	76-125	**29**	20
Nitrobenzene	100	73	65-134	**37**	20

%R = percent recovery
Bolded values are outside control limits.

The RPD for 1,3-dinitrobenzene, 2,4-dinitrotoluene, 2,6-ditnitrotoluene, and nitrobenzene were above the control limit. The MS and MSD recoveries are within the control limits for these analytes; therefore, no qualification was necessary.

The MSD recovery and RPD were above the control limits for 2-amino-4,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, and 4-amino-2,6-dinitrotoluene. The associated parent sample results were qualified as estimated (UJ/J M).

1.4.7.4 Continuing Calibration Verification

m-Nitrotoluene recovered outside of the control limits in a continuing calibration verification on the secondary confirmation column. All of these analytes were within the control limits on the primary column; therefore, no qualification was necessary.

1.4.7.5 Sample Preparation

The laboratory analyst inadvertently used a 1L sample volume for analysis instead of the method required 500mL for samples CBLmw-001-062018-GW, CBLmw-001-D-062018-GW, and CBLmw-002-062018-GW, so only a portion of the sample was used in preparation. As such, the required solvent rinse of the original container could not be performed. Based on professional judgement, no qualification was necessary.

The incorrect sample volume was received by the laboratory for samples FWGmw-020-062118-GW, FWGmw-024-062118-GW, and FWGmw-017-062118-GW. A 1L sample volume for analysis instead of the method required 500mL. As such, the required solvent rinse of the original container could not be performed. Based on professional judgement, no qualification was necessary.

Samples LL1mw-088-062118-GW and FWGmw-021-062118-GW were filtered prior to analysis to reduce matrix interferences.

1.4.7.6 Confirmation Column

The RPD between the primary and confirmation column results for 2-amino-4,6-dinitrotoluene in samples FWGmw-021-062118-GW (85%), LL3mw-246-D-062118-GW (58%), and LL3mw-246-062118-GW (50%) exceeded 40%. The higher of the two results will be reported and qualified as estimated (J Q).

The RPD between the primary and confirmation column results for RDX in samples FWGmw-021-062118-GW (63%) and LL3mw-246-062118-GW (78%) exceeded 40%. The higher of the two results will be reported and qualified as estimated (J Q).

The RPD between the primary and confirmation column results for 4-amino-2,6-dinitrotoluene in samples FWGmw-021-062118-GW (77%) and LL3mw-246-D-062118-GW (42%) exceeded 40%. The higher of the two results will be reported and qualified as estimated (J Q).

1.4.8 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS/LCSD recoveries and RPDs
- Post digestion spike
- Serial dilution
- Initial and continuing calibration blanks
- Contract required detection limit standard
- Instrument tuning
- Interference check solutions
- Field duplicate

All analytical or quality issues requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.8.1 Sample Dilution

Sample LL3mw-246-062118-GW required a 5x dilution prior to mercury analysis. The reporting limits were adjusted accordingly.

1.4.8.2 Method Blank

Calcium (51.8 µg/L), magnesium (12.1 µg/L), and sodium (158 µg/L) were detected in the method blank at a concentration above their respective LOQs (1000 µg/L, 100 µg/L, & 5000 µg/L).

Calcium and magnesium were detected at concentrations above the LOQ in all associated samples; therefore, no qualification was necessary.

Sodium was detected at a concentration below the LOQ in samples CBLmw-001-06218-GW (1700 µg/L), CBLmw-001-D-062018-GW (1600 µg/L), CBLmw-002-062018-GW (2600 µg/L), FWGmw-021-062118-GW (3500 µg/L), CBLmw-003-062118-GW (1500 µg/L), CBLmw-004-062118-GW (2100 µg/L), LL3mw-246-D-062118-GW (3200 µg/L), LL3mw-246-062118-GW (3200 µg/L). These results were qualified as non-detect at the LOQ (U B). All other associated sample results were at concentrations above the LOQ; therefore, no qualification was necessary.

1.4.8.3 MS/MSD Recoveries and RPDs

An MS/MSD was performed on sample LL3mw-246-062118-GW. Mercury recovered below the control limits (82-119%) in the MS (77%) and MSD (78%). The associated parent sample result was qualified as estimated (J M).

1.4.8.4 Initial/Continuing Calibrations Verifications

Sodium recovered above control limits (80-120%) in the low-level continuing calibration verification CCVL 280-421256/74 (125%). All associated, detected sample results were qualified as estimated (J CC).

Barium recovered below control limits (80-120%) in the low-level continuing calibration verification CCVL 280-421258/134 (68%) and CCVL 280-421258/146 (79%). All associated sample results were qualified as estimated (J CC).

1.4.9 Alkalinity by Method 2320B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank
- Field duplicate

All analytical or quality issues requiring further discussion for Method 2320B are described in the sections below.

1.4.9.1 Method Blanks

Alkalinity was detected in the method blanks MB 280-421103/5 (2.86 mg/L) and MB 280-421103/31 (1.167mg/L) at a concentration below the LOQ (5.0 mg/L). All associated samples had alkalinity concentrations above the LOQ; therefore, no qualification was necessary.

1.4.10 Nitrocellulose by Method 353.2

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank
- Field duplicate

No analytical or quality issues required further discussion for Method 353.2.

1.4.11 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- MS/MSD recoveries and RPDs
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank
- Low and high level control sample recoveries
- Field duplicate

No analytical or quality issues required further discussion for Method 9012B.

1.4.12 Sulfide by Method 9034

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- MS/MSD recoveries and RPDs

No analytical or quality issues required further discussion for Methods 9034.

1.4.13 Corrosivity (pH) by Method 9040C

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries

No analytical or quality issues required further discussion for Methods 9040C.

1.4.14 Anions by Method 9056A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- MS/MSD recoveries and RPDs
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank

All analytical or quality issues requiring further discussion for Method 9056A are described in the sections below.

1.4.14.1 Holding Time

Samples FWGmw-020-062118-GW, CBLmw-003-062118-GW and CBLmw-062118-GW were analyzed for nitrate as N outside of the sample holding time. All nitrate as N results for these samples were qualified as estimated (J H).

1.4.14.2 Laboratory Duplicate

A laboratory duplicate was performed on sample CBLmw-004-062118-GW. The RPD for nitrate as N (14%) exceeded the control limit (10%). The associated parent sample result was qualified as estimated (J D).

	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	AnalyticMethod	Reason
W	280-111344-1	Ground Water	Sodium	7440-23-5	µg/L	16000	v	j	y	5000	350	120	6010C	CC
W	280-111344-1	Ground Water	Barium	7440-39-3	µg/L	84	q	j	y	3	0.95	0.29	6020A	CC
W	280-111344-1	Ground Water	Hexachlorocyclopentadiene	77-47-4	µg/L	28	u q	r	n	47	28	9.5	8270D	L
W	280-111344-1	Ground Water	Nitrate as N	14797-55-8	mg/L	0.19	j h	j	y	0.5	0.1	0.042	9056A	H
V	280-111344-10	Ground Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	120	6010C	B
V	280-111344-10	Ground Water	Barium	7440-39-3	µg/L	20	q	j	y	3	0.95	0.29	6020A	CC
V	280-111344-10	Ground Water	Hexachlorocyclopentadiene	77-47-4	µg/L	30	u q	r	n	50	30	10	8270D	L
V	280-111344-10	Ground Water	Nitrate as N	14797-55-8	mg/L	0.37	j h	j	y	0.5	0.1	0.042	9056A	H D
GW	280-111344-11	Ground Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	120	6010C	B
GW	280-111344-11	Ground Water	Barium	7440-39-3	µg/L	14	q	j	y	3	0.95	0.29	6020A	CC
GW	280-111344-11	Ground Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.47	j1 m	j	y	0.22	0.13	0.055	8330B	Q
GW	280-111344-11	Ground Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.42	j1	j	y	0.22	0.13	0.063	8330B	Q
W	280-111344-12	Ground Water	Sodium	7440-23-5	µg/L	18000	v	j	y	5000	350	120	6010C	CC
W	280-111344-12	Ground Water	Barium	7440-39-3	µg/L	69	q	j	y	3	0.95	0.29	6020A	CC
W	280-111344-12	Ground Water	Hexachlorocyclopentadiene	77-47-4	µg/L	28	u q	r	n	47	28	9.4	8270D	L
W	280-111344-14	Ground Water	Sodium	7440-23-5	µg/L	5500	v	j	y	5000	350	120	6010C	CC
W	280-111344-14	Ground Water	Barium	7440-39-3	µg/L	8.5	v	j	y	3	0.95	0.29	6020A	CC
W	280-111344-14	Ground Water	Hexachlorocyclopentadiene	77-47-4	µg/L	29	u q	r	n	48	29	9.6	8270D	L
W	280-111344-15	Ground Water	Sodium	7440-23-5	µg/L	14000	v	j	y	5000	350	120	6010C	CC
W	280-111344-15	Ground Water	Barium	7440-39-3	µg/L	120	q	j	y	3	0.95	0.29	6020A	CC
W	280-111344-15	Ground Water	Hexachlorocyclopentadiene	77-47-4	µg/L	28	u q	r	n	47	28	9.5	8270D	L
/	280-111344-17	Ground Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	120	6010C	B
/	280-111344-17	Ground Water	Barium	7440-39-3	µg/L	13	q	j	y	3	0.95	0.29	6020A	CC
/	280-111344-17	Ground Water	Mercury	7439-97-6	µg/L	0.93	j j1 d	j	y	1	0.4	0.14	7470A	M
/	280-111344-17	Ground Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.29	j1	j	y	0.22	0.13	0.056	8330B	M
/	280-111344-17	Ground Water	2-Nitrotoluene	88-72-2	µg/L	0.22	u j1	uj	n	0.44	0.22	0.094	8330B	M
/	280-111344-17	Ground Water	3-Nitrotoluene	99-08-1	µg/L	0.22	u j1	uj	n	0.44	0.22	0.092	8330B	M
/	280-111344-17	Ground Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.3	j1	j	y	0.22	0.13	0.063	8330B	M
/	280-111344-17	Ground Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.5	j1	j	y	0.22	0.13	0.056	8330B	Q
/	280-111344-17	Ground Water	RDX	121-82-4	µg/L	0.25	j1	j	y	0.22	0.13	0.057	8330B	Q
V	280-111344-3	Ground Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	120	6010C	B
V	280-111344-3	Ground Water	Barium	7440-39-3	µg/L	33	q	j	y	3	0.95	0.29	6020A	CC
V	280-111344-3	Ground Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	0.46	u q	uj	n	1.2	0.46	0.23	8330B	S L
V	280-111344-3	Ground Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.23	u q	uj	n	0.46	0.23	0.1	8330B	S L
V	280-111344-3	Ground Water	2,4,6-Trinitrotoluene	118-96-7	µg/L	0.23	u q	uj	n	0.46	0.23	0.084	8330B	S L
V	280-111344-3	Ground Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.23	u q	uj	n	0.46	0.23	0.097	8330B	S L
V	280-111344-3	Ground Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.23	u q	uj	n	0.23	0.23	0.074	8330B	S L
V	280-111344-3	Ground Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.14	u q	uj	n	0.23	0.14	0.059	8330B	S L
V	280-111344-3	Ground Water	2-Nitrotoluene	88-72-2	µg/L	0.23	u q	uj	n	0.46	0.23	0.099	8330B	S L
V	280-111344-3	Ground Water	3-Nitrotoluene	99-08-1	µg/L	0.23	u q	uj	n	0.46	0.23	0.096	8330B	S L
V	280-111344-3	Ground Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.14	u q	uj	n	0.23	0.14	0.067	8330B	S L
V	280-111344-3	Ground Water	4-Nitrotoluene	99-99-0	µg/L	0.46	u q	uj	n	1.2	0.46	0.23	8330B	S L
/	280-111344-3	Ground Water	HMX	2691-41-0	µg/L	0.23	u m q	uj	n	0.46	0.23	0.1	8330B	S

V	280-111344-3	Ground Water	Nitroglycerin	55-63-0	µg/L	2.5	u q	uj	n	3.3	2.5	1.1	8330B	S
V	280-111344-3	Ground Water	PETN	78-11-5	µg/L	1.4	u q	uj	n	2.3	1.4	0.48	8330B	S
V	280-111344-3	Ground Water	RDX	121-82-4	µg/L	0.14	u q	uj	n	0.23	0.14	0.06	8330B	S
V	280-111344-3	Ground Water	Tetryl	479-45-8	µg/L	0.23	u q	uj	n	0.28	0.23	0.092	8330B	S
V	280-111344-3	Ground Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.21	u h q	uj	n	0.41	0.21	0.086	8330B	S
V	280-111344-3	Ground Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u h q	uj	n	0.21	0.21	0.066	8330B	S
V	280-111344-3	Ground Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.12	u h q	uj	n	0.21	0.12	0.052	8330B	S
GW	280-111344-4	Ground Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	120	6010C	B
GW	280-111344-4	Ground Water	Barium	7440-39-3	µg/L	32	q	j	y	3	0.95	0.29	6020A	CC
GW	280-111344-4	Ground Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	0.5	u q	uj	n	1.3	0.5	0.25	8330B	S L
GW	280-111344-4	Ground Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.25	u q	uj	n	0.5	0.25	0.11	8330B	S L
GW	280-111344-4	Ground Water	2,4,6-Trinitrotoluene	118-96-7	µg/L	0.25	u q	uj	n	0.5	0.25	0.091	8330B	S L
GW	280-111344-4	Ground Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.25	u q	uj	n	0.5	0.25	0.11	8330B	S L
GW	280-111344-4	Ground Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.25	u q	uj	n	0.25	0.25	0.081	8330B	S L
GW	280-111344-4	Ground Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.15	u q	uj	n	0.25	0.15	0.064	8330B	S L
GW	280-111344-4	Ground Water	2-Nitrotoluene	88-72-2	µg/L	0.25	u q	uj	n	0.5	0.25	0.11	8330B	S L
GW	280-111344-4	Ground Water	3-Nitrotoluene	99-08-1	µg/L	0.25	u q	uj	n	0.5	0.25	0.1	8330B	S L
GW	280-111344-4	Ground Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.15	u q	uj	n	0.25	0.15	0.073	8330B	S L
GW	280-111344-4	Ground Water	4-Nitrotoluene	99-99-0	µg/L	0.5	u q	uj	n	1.3	0.5	0.25	8330B	S L
GW	280-111344-4	Ground Water	HMX	2691-41-0	µg/L	0.25	u m q	uj	n	0.5	0.25	0.11	8330B	S
GW	280-111344-4	Ground Water	Nitrobenzene	98-95-3	µg/L	0.25	u q	uj	n	0.5	0.25	0.11	8330B	S L
GW	280-111344-4	Ground Water	Nitroglycerin	55-63-0	µg/L	2.5	u q	uj	n	3.8	2.5	1.2	8330B	S
GW	280-111344-4	Ground Water	PETN	78-11-5	µg/L	1.5	u q	uj	n	2.5	1.5	0.52	8330B	S
GW	280-111344-4	Ground Water	RDX	121-82-4	µg/L	0.15	u q	uj	n	0.25	0.15	0.066	8330B	S
GW	280-111344-4	Ground Water	Tetryl	479-45-8	µg/L	0.25	u q	uj	n	0.3	0.25	0.1	8330B	S
GW	280-111344-4	Ground Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.21	u h m q	uj	n	0.42	0.21	0.088	8330B	S
GW	280-111344-4	Ground Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u h q	uj	n	0.21	0.21	0.068	8330B	S
GW	280-111344-4	Ground Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.13	u h q	uj	n	0.21	0.13	0.053	8330B	S
V	280-111344-5	Ground Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	120	6010C	B
V	280-111344-5	Ground Water	Barium	7440-39-3	µg/L	51	q	j	y	3	0.95	0.29	6020A	CC
V	280-111344-5	Ground Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	0.49	u q	uj	n	1.2	0.49	0.25	8330B	S L
V	280-111344-5	Ground Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.25	u q	uj	n	0.49	0.25	0.11	8330B	S L
V	280-111344-5	Ground Water	2,4,6-Trinitrotoluene	118-96-7	µg/L	0.25	u q	uj	n	0.49	0.25	0.089	8330B	S L
V	280-111344-5	Ground Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.25	u q	uj	n	0.49	0.25	0.1	8330B	S L
V	280-111344-5	Ground Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.25	u q	uj	n	0.25	0.25	0.08	8330B	S L
V	280-111344-5	Ground Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.15	u q	uj	n	0.25	0.15	0.063	8330B	S L
V	280-111344-5	Ground Water	2-Nitrotoluene	88-72-2	µg/L	0.25	u q	uj	n	0.49	0.25	0.11	8330B	S L
V	280-111344-5	Ground Water	3-Nitrotoluene	99-08-1	µg/L	0.25	u q	uj	n	0.49	0.25	0.1	8330B	S L
V	280-111344-5	Ground Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.15	u q	uj	n	0.25	0.15	0.071	8330B	S L
V	280-111344-5	Ground Water	4-Nitrotoluene	99-99-0	µg/L	0.49	u q	uj	n	1.2	0.49	0.25	8330B	S L
V	280-111344-5	Ground Water	HMX	2691-41-0	µg/L	0.25	u m q	uj	n	0.49	0.25	0.11	8330B	S
V	280-111344-5	Ground Water	Nitrobenzene	98-95-3	µg/L	0.25	u q	uj	n	0.49	0.25	0.11	8330B	S L
V	280-111344-5	Ground Water	Nitroglycerin	55-63-0	µg/L	2.5	u q	uj	n	3.7	2.5	1.1	8330B	S
V	280-111344-5	Ground Water	PETN	78-11-5	µg/L	1.5	u q	uj	n	2.5	1.5	0.51	8330B	S
V	280-111344-5	Ground Water	RDX	121-82-4	µg/L	0.15	u q	uj	n	0.25	0.15	0.064	8330B	S

W	280-111344-5	Ground Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.081	j n q	j	y	0.21	0.21	0.069	8330B	S
W	280-111344-5	Ground Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.13	u h q	uj	n	0.21	0.13	0.054	8330B	S
W	280-111344-6	Ground Water	Sodium	7440-23-5	µg/L	27000	v	j	y	5000	350	120	6010C	CC
W	280-111344-6	Ground Water	Barium	7440-39-3	µg/L	40	q	j	y	3	0.95	0.29	6020A	CC
W	280-111344-7	Ground Water	Sodium	7440-23-5	µg/L	3500	j	j	y	5000	350	120	6010C	CC
W	280-111344-7	Ground Water	Barium	7440-39-3	µg/L	14	q	j	y	3	0.95	0.29	6020A	CC
W	280-111344-7	Ground Water	bis(2-Ethylhexyl)phthalate	117-81-7	µg/L	1.9	u	uj	n	9.5	1.9	0.53	8270D	S
W	280-111344-7	Ground Water	Butyl benzyl phthalate	85-68-7	µg/L	1.9	u	uj	n	19	1.9	0.95	8270D	S
W	280-111344-7	Ground Water	Diethylphthalate	84-66-2	µg/L	0.95	u	uj	n	19	0.95	0.36	8270D	S
W	280-111344-7	Ground Water	Dimethyl phthalate	131-11-3	µg/L	0.47	u	uj	n	19	0.47	0.2	8270D	S
W	280-111344-7	Ground Water	Di-N-Butyl phthalate	84-74-2	µg/L	4.2	u	uj	n	19	4.2	1.1	8270D	S
W	280-111344-7	Ground Water	Di-N-Octyl phthalate	117-84-0	µg/L	0.95	u	uj	n	19	0.95	0.33	8270D	S
W	280-111344-7	Ground Water	RDX	121-82-4	µg/L	0.11	j j1 m	j	y	0.2	0.12	0.053	8330B	Q
W	280-111344-7	Ground Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.42	j1	j	y	0.2	0.12	0.052	8330B	Q
W	280-111344-7	Ground Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.43	j1	j	y	0.2	0.12	0.059	8330B	Q
W	280-111344-9	Ground Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	120	6010C	B
W	280-111344-9	Ground Water	Barium	7440-39-3	µg/L	38	q	j	y	3	0.95	0.29	6020A	CC
W	280-111344-9	Ground Water	Hexachlorocyclopentadiene	77-47-4	µg/L	28	u q	r	n	47	28	9.5	8270D	L
W	280-111344-9	Ground Water	Nitrate as N	14797-55-8	mg/L	0.91	h	j	y	0.5	0.1	0.042	9056A	H

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual & Quarterly Sampling Event for June 2018

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008
Task Order Number: 0003

Laboratory SDG 280-111344-2

Prepared For:

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.

PC for Erica Fisher — 10/15/18

Erica Fisher, Validation Chemist, TEC-WESTON JV — Date

Peter Chapman — 10/15/18

Peter Chapman, Senior Chemist, TEC-WESTON JV — Date

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INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-111344-2**.

TestAmerica, Inc., Canton, Ohio performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Sulfate/Nitrite	SW-846 Method 9056A	Arvada, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*); and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*), the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	SO4/NO2
CBLmw-003-062118-GW	280-111344-9	06/21/2018	Groundwater		✓
CBLmw-004-062118-GW	280-111344-10	06/21/2018	Groundwater		✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 SAMPLE RECEIPT

The samples were received by the laboratory on June 27, 2018; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.3 TECHNICAL DATA VALIDATION

1.3.1 Sulfate/Nitrite by Method 9056A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- LODs and LOQs
- LCS recoveries
- Method blank
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank
- Field duplicate

The nitrate analyses were conducted past the 48 hour holding time as required by the method. Therefore, the non-detect and detected nitrate/nitrite results for these two samples were qualified as estimated values (UJ H).

No analytical or quality parameters requiring further discussion were identified for Method 9056A.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	Units	Result	Lab Flag	DV Flag	Detect	LOQ	LOD	MDL	Method	Reason Code
280-111344-2	CBLmw-003-062118-GW	280-111344-9	Ground Water	Nitrite	µg/L	100	u h	uj	n	500	100	49	9056A	H
280-111344-2	CBLmw-004-062118-GW	280-111421-10	Ground Water	Nitrite	µg/L	100	u h	uj	n	500	100	49	9056A	H

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual & Quarterly Sampling Event for June 2018

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-111377-1

Prepared For:

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validator and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.



Erica Fisher, Validator, TEC-WESTON JV — Date: 08/01/2018



Peter Chapman, Senior Chemist, TEC-WESTON JV — Date: 8/1/18

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INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-111377-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semi-Volatile Organic Compounds (SVOCs)	8270D	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Alkalinity	2320B	Denver, CO
Total Cyanide	9012B	Denver, CO
Sulfide	9034	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*); and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*), the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data*

Review (*EPA 2014*) and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*). Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs	Explosives	Metals	Arsenic	Total Cyanide	Alkalinity
FWGmw-007-062518-GW	280-111377-1	06/25/18	Groundwater			✓	✓	✓			
FBQmw-171-062518-GW	280-111377-2	06/25/18	Groundwater						✓	✓	✓
FBQmw-171-D-062518-GW	280-111377-3	06/25/18	Groundwater	Field Duplicate					✓	✓	✓
FBQmw-172-062518-GW	280-111377-4	06/25/18	Groundwater							✓	
LL11mw-005-062518-GW	280-111377-5	06/25/18	Groundwater							✓	
LL7mw-001-062518-GW	280-111377-6	06/25/18	Groundwater		✓	✓	✓	✓		✓	
LL7mw-006-62518-GW	280-111377-7	06/25/18	Groundwater				✓				
TB-062518-01	280-111377-8	06/25/18	Groundwater	Trip Blank	✓						

Some samples were analyzed for natural attenuation parameters. Natural attenuation parameters are reported, but not validated in accordance with the QAPP.

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 SAMPLE RECEIPT

The samples were received by the laboratory on June 26, 2018; the samples were received in good condition, under chain-of-custody, properly preserved and cooler temperatures were less than 4°C. The laboratory noted that the coolers were received without a custody seal present; however, the shipping tape was intact and no evidence of sample volume tampering was evident.

1.3 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
UJ	Q	Estimated non-detection; professional judgement.
J	L	Estimated detection; LCS/LCSD percent recovery or RPD exceedance.
J	IC	Estimated detection; initial calibration criteria not met.

Validation Flag	Reason Code	Description
J	CC	Estimated detection; continuing calibration criteria not met.
UJ	CC	Estimated non-detection; continuing calibration criteria not met.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Method blanks
- MS/MSD recoveries and RPDs
- LODs and LOQs
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Closing calibration verification
- Trip blank

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 LCS/LCSD Recoveries and RPDs

All LCS/LCSD recoveries and RPDs were within control limits with the exception of the exceedances presented in the following table:

Analyte	LCS %R	LCSD %R	%R QC Limits	RPD	RPD Limits
Bromoethane	**168**	**164**	53-141	2	20
Chloroethane	**156**	**160**	60-138	2	20
Chloromethane	**144**	**143**	50-139	1	20
Vinyl chloride	**138**	**128**	58-137	**7**	20

%R = percent recovery
Bolded values are outside control limits.

The LCS and LCSD recoveries for bromoethane, chloroethane, chloromethane and vinyl chloride are above the acceptable limits, although the RPD was within acceptable limits. However, the analytes were not detected in the associated samples, therefore no qualification is necessary.

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Method blanks
- Surrogate recoveries
- LCS/LCSD recoveries and RPDs
- LODs and LOQs
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Field duplicates

1.4.3 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Method blank
- Surrogate recoveries
- LCS/LCSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- LODs and LOQs

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.3.1 Sample Preparation

Samples FWGmw-007-062518-GW, LL7mw-001-062518-GW and LL7mw-006-62518-GW were filtered prior to analysis to reduce matrix interferences.

1.4.3.2 Continuing Calibration Verifications

The percent difference (%D) for 2-nitrotoluene (-32.9%), 2,4,6-trinitrotoluene (-33.8%) and PETN (-31.1%) exceeded the QC limit (±20%) on the secondary column for continuing calibration verification sample CCV 280-421027/7 bracketing the samples in the SDG. All associated sample results are therefore qualified estimated (UJ CC).

The percent difference (%D) for 2-nitrotoluene (-33.5%) 3-nitrotoluene (-21.5%), 2,6-dinitrotoluene (-23.5%), 2,4,6-trinitrotoluene (-37.3%) and PETN (-33.6%) exceeded the QC limit (±20%) on the second column for continuing calibration verification sample CCV 280-421027/18

bracketing the samples in this SDG. All associated sample results are therefore qualified estimated (UJ CC).

1.4.3.3 Second Column Confirmation

The RPD between the primary and secondary column (40.1%) marginally exceeded the acceptable limit (40%) for RDX in sample LL7mw-006-62518-GW and is therefore qualified estimated (J Q).

1.4.4 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Method blank
- LODs and LOQs
- LCS/LCSD recoveries and RPDs
- Post digestion spike
- Serial dilution
- Initial and continuing calibration blanks
- Contract required detection limit standard
- Instrument tuning
- Interference check solutions
- Field duplicate

All analytical or quality issues requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.4.1 Initial/Continuing Calibrations Verifications

Beryllium (126%) recovered above control limits (80-120%) in the low-level initial calibration verification ICVL 280-42124/11. Beryllium (125%) also recovered above control limits in the low-level continuing calibration verification 280-421124/206. All associated samples are qualified estimated (J/UJ IC/CC).

Manganese (126%) recovered above control limits (80-120%) in the low-level continuing calibration verification CCVL 280-421124/193. All associated sample results are qualified estimated (J/CC).

1.4.5 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- Method blank
- MS/MSD sample recovery and RPD
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank
- Low and high level control sample recoveries
- Field duplicate

All analytical or quality issues requiring further discussion for Methods 9012B are described in the sections below.

1.4.5.1 LCS/LCSD Recoveries and RPDs

Total cyanide recovered above the control limits (83-116%) in the LCS (133%) and LCSD (131%), though the RPD (1%) was within control limits (20%). Total cyanide was detected in all associated samples below the LOQ and are therefore qualified estimated (J L).

1.4.6 Alkalinity by Method 2320B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Field duplicate

All analytical or quality issues requiring further discussion for Methods 2320B are described in the sections below.

1.4.6.1 Method Blanks

Alkalinity (2.21 mg/L) was detected in the method blank at a concentration below the LOQ (5.0 mg/L). Alkalinity was detected at a concentration above the LOQ in all associated samples; therefore, no qualification was necessary.

1.4.6.2 Continuing Calibration Blanks

Alkalinity was detected in one continuing calibration blanks (1.64 mg/L) below the LOQ (5 mg/L). Alkalinity was detected at a concentration above the LOQ in all associated samples; therefore, no qualification was necessary.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	AnalyticMethod	Reason Code
280-111377-1	FWGmw-007-062518-GW	280-111377-1	Ground Water	2,4,6-Trinitrotoluene	118-96-7	µg/L	0.21	u	uj	n	0.43	0.21	0.077	Explosives	CC
280-111377-1	FWGmw-007-062518-GW	280-111377-1	Ground Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u	uj	n	0.43	0.21	0.077	Explosives	CC
280-111377-1	FWGmw-007-062518-GW	280-111377-1	Ground Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u	uj	n	0.42	0.21	0.091	Explosives	CC
280-111377-1	FWGmw-007-062518-GW	280-111377-1	Ground Water	3-Nitrotoluene	99-08-1	µg/L	0.21	u	uj	n	0.42	0.21	0.089	Explosives	CC
280-111377-1	FWGmw-007-062518-GW	280-111377-1	Ground Water	PETN	78-11-5	µg/L	1.3	u	uj	n	2.1	1.3	0.44	Explosives	CC
280-111377-1	FWGmw-007-062518-GW	280-111377-1	Ground Water	Beryllium	7440-41-7	µg/L	0.12	j	j	y	1.0	0.30	0.080	Metals	IC CC
280-111377-1	FWGmw-007-062518-GW	280-111377-1	Ground Water	Manganese	7439-96-5	µg/L	170		j	y	3.5	0.95	0.31	Metals	CC
280-111377-1	FWGmw-007-062518-GW	280-111377-1	Ground Water	Total Cyanide	57-12-5	µg/L	3.5	jq	j	y	10	5.0	2.0	Total Cyanide	L
280-111377-1	FBQmw-171-D-062518-GW	280-111377-3	Ground Water	Total Cyanide	57-12-5	µg/L	3.2	jq	j	y	10	5.0	2.0	Total Cyanide	L
280-111377-1	FBQmw-172-062518-GW	280-111377-4	Ground Water	Total Cyanide	57-12-5	µg/L	2.3	jq	j	y	10	5.0	2.0	Total Cyanide	L
280-111377-1	LL11mw-005-062518-GW	280-111377-5	Ground Water	Total Cyanide	57-12-5	µg/L	2.1	jq	j	y	10	5.0	2.0	Total Cyanide	L
280-111377-1	LL7mw-001-062518-GW	280-111377-6	Ground Water	2,4,6-Trinitrotoluene	118-96-7	µg/L	0.41	u	uj	n	1.0	0.41	0.20	Explosives	CC
280-111377-1	LL7mw-001-062518-GW	280-111377-6	Ground Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u	uj	n	0.21	0.21	0.069	Explosives	CC
280-111377-1	LL7mw-001-062518-GW	280-111377-6	Ground Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u	uj	n	0.43	0.21	0.091	Explosives	CC
280-111377-1	LL7mw-001-062518-GW	280-111377-6	Ground Water	3-Nitrotoluene	99-08-1	µg/L	0.21	u m	uj	n	0.43	0.21	0.089	Explosives	CC
280-111377-1	LL7mw-001-062518-GW	280-111377-6	Ground Water	PETN	78-11-5	µg/L	1.3	u	uj	n	2.1	1.3	0.43	Explosives	CC
280-111377-1	LL7mw-001-062518-GW	280-111377-6	Ground Water	Beryllium	7440-41-7	µg/L	0.32	j	j	y	1.0	0.30	0.080	Metals	IC CC
280-111377-1	LL7mw-001-062518-GW	280-111377-6	Ground Water	Manganese	7439-96-5	µg/L	430		j	y	3.5	0.95	0.31	Metals	CC
280-111377-1	LL7mw-001-062518-GW	280-111377-6	Ground Water	Total Cyanide	57-12-5	µg/L	3.8	jq	j	y	10	5.0	2.0	Total Cyanide	L
280-111377-1	LL7mw-006-062518-GW	280-111377-7	Ground Water	2,4,6-Trinitrotoluene	118-96-7	µg/L	0.21	u	uj	n	0.43	0.21	0.077	Explosives	CC
280-111377-1	LL7mw-006-062518-GW	280-111377-7	Ground Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.43	0.21	0.091	Explosives	CC
280-111377-1	LL7mw-006-062518-GW	280-111377-7	Ground Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u q	uj	n	0.43	0.21	0.089	Explosives	CC
280-111377-1	LL7mw-006-062518-GW	280-111377-7	Ground Water	3-Nitrotoluene	99-08-1	µg/L	0.13	u q	uj	n	0.21	0.13	0.061	Explosives	CC
280-111377-1	LL7mw-006-062518-GW	280-111377-7	Ground Water	3-Nitrotoluene	99-08-1	µg/L	0.13	u q	uj	n	0.21	0.13	0.061	Explosives	CC
280-111377-1	LL7mw-006-062518-GW	280-111377-7	Ground Water	PETN	78-11-5	µg/L	0.43	u q	uj	n	1.1	0.43	0.21	Explosives	CC
280-111377-1	LL7mw-006-062518-GW	280-111377-7	Ground Water	RDX	121-82-4	µg/L	0.43	m j1	uj	n	0.21	0.13	0.056	Explosives	Q

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Cardno
2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903
ATTN: Peter Chapman

August 7, 2018

SUBJECT: Ravenna, Ohio, Data Validation

Dear Mr. Chapman,

Enclosed are the final validation reports for the fractions listed below. This SDG was received on July 31, 2018. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #42791:

SDG #	Fraction
280-111421-1	Volatiles, Semivolatiles, Polynuclear Aromatic Hydrocarbons, Chlorinated Pesticides, Polychlorinated Biphenyls, Metals, Wet Chemistry, Explosives, Nitroguanidine, Perchlorate

The data validation was performed under Stage 4 guidelines. The analyses were validated using the following documents, as applicable to each method:

- The Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Former Ravenna Army Ammunition Plant Portage and Trumbull Counties, Ohio; December 20, 2016
- U.S. Department of Defense, Quality Systems Manual, for Environmental Laboratories, Version 5.0; July 2013
- USEPA National Functional Guidelines for Superfund Organic Methods Data Review; August 2014
- USEPA National Functional Guidelines for Inorganic Superfund Data Review; August 2014
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; update IV, February 2007, update V, July 2014

Please feel free to contact us if you have any questions.

Sincerely,



Pei Geng
Project Manager/Senior Chemist

5,609 pages-DL 1 WEEK TAT Attachment 1

Stage 4 EDD

LDC #42791 (Cardno, GS, Inc-Charlottesville, VA / Ravenna, Ohio)

LDC	SDG#	DATE REC'D	(3) DATE DUE	VOA (8260B)		SVOA (8270D)		PAHs (8270D -SIM)		Pest. (8081B)		PCBs (8082A)		Metals (SW846)		Hg (7470A)		Expl. (8330B)		Nitroguanidine (8330)		CLO_4 (6860)		Alk. (2320B)		S= (9034)		Cl,SO4 NO3-N (9056A)		CN- (9012B)		Nitrocelluose (353.2)			
Matrix:	Water/Soil			W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S
A	280-111421-1	07/31/18	08/07/18	7	0	14	0	4	0	3	0	2	0	11	0	11	0	11	0	2	0	2	0	2	0	2	0	4	0	10	0	2	0		
Total	J/PG			7	0	14	0	4	0	3	0	2	0	11	0	11	0	11	0	2	0	2	0	2	0	2	0	4	0	10	0	2	0	0	87

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). Sample counts do not include MS, MSD, or DUP's.

L:\Cardno - GSI\Ravenna\42791ST.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Ravenna, Ohio

LDC Report Date: August 3, 2018

Parameters: Volatiles

Validation Level: Stage 4

Laboratory: TestAmerica, Inc.

Sample Delivery Group (SDG): 280-111421-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
NTAmw-119-062518-GW	280-111421-8	Water	06/25/18
NTAmw-119-D-062518-GW	280-111421-9	Water	06/25/18
TB-062518-02	280-111421-12	Water	06/25/18
DETmw-003-D-062618-GW	280-111421-16	Water	06/26/18
DETmw-003-062618-GW	280-111421-18	Water	06/26/18
LL10mw-003-062618-GW	280-111421-19	Water	06/26/18
TB-062618-01	280-111421-20	Water	06/26/18
LL10mw-003-062618-GWMS	280-111421-19MS	Water	06/26/18
LL10mw-003-062618-GWMSD	280-111421-19MSD	Water	06/26/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with The Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Former Ravenna Army Ammunition Plant Portage and Trumbull Counties, Ohio (December 20, 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Volatile Organic Compounds (VOCs) by Environmental Protection Agency (EPA) SW 846 Method 8260B

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A bromofluorobenzene (BFB) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) were less than or equal to 15.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the ending continuing calibration verifications (CCVs) were less than or equal to 50.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

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

VI. Field Blanks

Samples TB-062518-02 and TB-062618-01 were identified as trip blanks. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
TB-062618-01	06/26/18	Methylene chloride	0.78 ug/L	NTAmw-119-062518-GW NTAmw-119-D-062518-GW DETmw-003-D-062618-GW DETmw-003-062618-GW LL10mw-003-062618-GW

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 with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
DETmw-003-D-062618-GW	Methylene chloride	0.62 ug/L	5.0U ug/L
DETmw-003-062618-GW	Methylene chloride	0.43 ug/L	5.0U ug/L

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LL10mw-003-062618-GWMS/MSD (LL10mw-003-062618-GW)	Carbon tetrachloride	-	69 (72-136)	J (all detects)	A

Relative percent differences (RPD) were within QC limits.

IX. 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 with the following exceptions:

LCS ID (Associated Samples)	Compound	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
LCS/D 280-421459/8,9 (NTAmw-119-062518-GW NTAmw-119-D-062518-GW TB-062518-02)	Bromomethane Chloroethane Chloromethane Vinyl chloride	168 (53-141) 156 (60-138) 144 (50-139) 138 (58-137)	164 (53-141) 160 (60-138) 143 (50-139) -	NA	-

Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples NTAmw-119-062518-GW and NTAmw-119-D-062518-GW and samples DETmw-003-D-062618-GW and DETmw-003-062618-GW were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	NTAmw-119-062518-GW	NTAmw-119-D-062518-GW				
Acetone	10	3.8	-	6.2 (≤10)	-	

Compound	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	DETmw-003-D-062618-GW	DETmw-003-062618-GW				
Acetone	5.2	6.5	-	1.3 (≤10)	-	-
Methylene chloride	0.62	0.43	-	0.19 (≤5.0)	-	-

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations met validation criteria.

XIII. Target Compound Identifications

All target compound identifications met validation criteria.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment of Data

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

Due to MS/MSD %R, data were qualified as estimated in one sample.

Due to trip blank contamination, data were qualified as not detected in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Ravenna, Ohio
Volatiles - Data Qualification Summary - SDG 280-111421-1

Sample	Compound	Flag	A or P	Reason
LL10mw-003-062618-GW	Carbon tetrachloride	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)

Ravenna, Ohio
Volatiles - Laboratory Blank Data Qualification Summary - SDG 280-111421-1

No Sample Data Qualified in this SDG

Ravenna, Ohio
Volatiles - Field Blank Data Qualification Summary - SDG 280-111421-1

Sample	Compound	Modified Final Concentration	A or P
DETmw-003-D-062618-GW	Methylene chloride	5.0U ug/L	A
DETmw-003-062618-GW	Methylene chloride	5.0U ug/L	A

LDC #: 42791A1 **VALIDATION COMPLETENESS WORKSHEET** Date: 08/02/18
SDG #: 280-111421-1 Stage 4 Page: 1 of 1
Laboratory: Test America, Inc. Reviewer: JV
2nd Reviewer:

METHOD: GC/MS Volatiles (EPA SW 846 Method 8260B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	ICAL ≤ 15%, r ICV ≤ 20%
IV.	Continuing calibration /ending	A	CCV ≤ 20/50%
V.	Laboratory Blanks	A	
VI.	Field blanks	SW	TB = *3, 7
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	SW	
IX.	Laboratory control samples	SW	LCS/D
X.	Field duplicates	SW	D = 1/2, 4/5
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	A	
XIII.	Target compound identification	A	
XIV.	System performance	A	
XV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; * ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID		Lab ID	Matrix	Date
+ 1 1	NTAmw-119-062518-GW	D1	280-111421-8	Water	06/25/18
+ 2 1	NTAmw-119-D-062518-GW	D1	280-111421-9	Water	06/25/18
- 3 1	TB-062518-02		280-111421-12	Water	06/25/18
+ 4 2	DETmw-003-D-062618-GW	D2	280-111421-16	Water	06/26/18
+ 5 2	DETmw-003-062618-GW	D2	280-111421-18	Water	06/26/18
+ 6 2	LL10mw-003-062618-GW		280-111421-19	Water	06/26/18
+ 7 2	TB-062618-01		280-111421-20	Water	06/26/18
8 2	LL10mw-003-062618-GWMS		280-111421-19MS	Water	06/26/18
9 2	LL10mw-003-062618-GWMSD		280-111421-19MSD	Water	06/26/18
10					

Notes:

1	MB 280-421459/11						
2	" -421566/6						

LDC #: 42791A1

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/MS Instrument performance check				
Were the BFB performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?	✓			
Were all percent relative standard deviations (%RSD) ≤ 30%/15% and relative response factors (RRF) ≥ 0.05?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) ≥ 0.05?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
VI. Field blanks				
Were field blanks were identified in this SDG?	✓			
Were target compounds detected in the field blanks?	✓			
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	*	✓		
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?		✓		

LDC #: 42791 A1

VALIDATION FINDINGS CHECKLIST

Reviewer: JWG
2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	✓			
Was a MS/MSD analyzed every 20 samples of each matrix?	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?		✓		
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?		✓		
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	✓			
Were retention times within + 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

TARGET COMPOUND WORKSHEET

METHOD: VOA

A. Chloromethane	AA. Tetrachloroethene	AAA. 1,3,5-Trimethylbenzene	AAAA. Ethyl tert-butyl ether	A1. 1,3-Butadiene	A2.
B. Bromomethane	BB. 1,1,2,2-Tetrachloroethane	BBB. 4-Chlorotoluene	BBBB. tert-Amyl methyl ether	B1. Hexane	B2.
C. Vinyl choride	CC. Toluene	CCC. tert-Butylbenzene	CCCC. 1-Chlorohexane	C1. Heptane	C2.
D. Chloroethane	DD. Chlorobenzene	DDD. 1,2,4-Trimethylbenzene	DDDD. Isopropyl alcohol	D1. Propylene	D2.
E. Methylene chloride	EE. Ethylbenzene	EEE. sec-Butylbenzene	EEEE. Acetonitrile	E1. Freon 11	E2.
F. Acetone	FF. Styrene	FFF. 1,3-Dichlorobenzene	FFFF. Acrolein	F1. Freon 12	F2.
G. Carbon disulfide	GG. Xylenes, total	GGG. p-Isopropyltoluene	GGGG. Acrylonitrile	G1. Freon 113	G2.
H. 1,1-Dichloroethene	HH. Vinyl acetate	HHH. 1,4-Dichlorobenzene	HHHH. 1,4-Dioxane	H1. Freon 114	H2.
I. 1,1-Dichloroethane	II. 2-Chloroethylvinyl ether	III. n-Butylbenzene	IIII. Isobutyl alcohol	I1. 2-Nitropropane	I2.
J. 1,2-Dichloroethene, total	JJ. Dichlorodifluoromethane	JJJ. 1,2-Dichlorobenzene	JJJJ. Methacrylonitrile	J1. Dimethyl disulfide	J2.
K. Chloroform	KK. Trichlorofluoromethane	KKK. 1,2,4-Trichlorobenzene	KKKK. Propionitrile	K1. 2,3-Dimethyl pentane	K2.
L. 1,2-Dichloroethane	LL. Methyl-tert-butyl ether	LLL. Hexachlorobutadiene	LLLL. Ethyl ether	L1. 2,4-Dimethyl pentane	L2.
M. 2-Butanone	MM. 1,2-Dibromo-3-chloropropane	MMM. Naphthalene	MMMM. Benzyl chloride	M1. 3,3-Dimethyl pentane	M2.
N. 1,1,1-Trichloroethane	NN. Methyl ethyl ketone	NNN. 1,2,3-Trichlorobenzene	NNNN. Iodomethane	N1. 2-Methylpentane	N2.
O. Carbon tetrachloride	OO. 2,2-Dichloropropane	OOO. 1,3,5-Trichlorobenzene	OOOO.1,1-Difluoroethane	O1. 3-Methylpentane	O2.
P. Bromodichloromethane	PP. Bromochloromethane	PPP. trans-1,2-Dichloroethene	PPPP. Tetrahydrofuran	P1. 3-Ethylpentane	P2.
Q. 1,2-Dichloropropane	QQ. 1,1-Dichloropropene	QQQ. cis-1,2-Dichloroethene	QQQQ. Methyl acetate	Q1. 2,2-Dimethylpentane	Q2.
R. cis-1,3-Dichloropropene	RR. Dibromomethane	RRR. m,p-Xylenes	RRRR. Ethyl acetate	R1. 2,2,3- Trimethylbutane	R2.
S. Trichloroethene	SS. 1,3-Dichloropropane	SSS. o-Xylene	SSSS. Cyclohexane	S1. 2,2,4-Trimethylpentane	S2.
T. Dibromochloromethane	TT. 1,2-Dibromoethane	TTT. 1,1,2-Trichloro-1,2,2-trifluoroethane	TTTT. Methylcyclohexane	T1. 2-Methylhexane	T2.
U. 1,1,2-Trichloroethane	UU. 1,1,1,2-Tetrachloroethane	UUU. 1,2-Dichlorotetrafluoroethane	UUUU. Allyl chloride	U1. Nonanal	U2.
V. Benzene	VV. Isopropylbenzene	VVV. 4-Ethyltoluene	VVVV. Methyl methacrylate	V1. 2-Methylnaphthalene	V2.
W. trans-1,3-Dichloropropene	WW. Bromobenzene	WWW. Ethanol	WWWW. Ethyl methacrylate	W1. Methanol	W2.
X. Bromoform	XX. 1,2,3-Trichloropropane	XXX. Di-isopropyl ether	XXXX. cis-1,4-Dichloro-2-butene	X1. 1,2,3-Trimethylbenzene	X2.
Y. 4-Methyl-2-pentanone	YY. n-Propylbenzene	YYY. tert-Butanol	YYYY. trans-1,4-Dichloro-2-butene	Y1.	Y2.
Z. 2-Hexanone	ZZ. 2-Chlorotoluene	ZZZ. tert-Butyl alcohol	ZZZZ. Pentachloroethane	Z1.	Z2.

LDC #: 42791 A1

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

(Y) N N/A Were field blanks identified in this SDG?
Y N N/A Were target compounds detected in the field blanks?

Blank units: ug/L **Associated sample units:** ug/L
Sampling date: 06/26/18
Field blank type: (circle one) Field Blank / Rinsate / (Trip Blank) / Other: Associated Samples: All except 3,7

Compound	Blank ID	Sample Identification									
	7		4	5							
E	0.78		0.62/5.0U	0.43/5.0U							

Blank units: **Associated sample units:**
Sampling date:
Field blank type: (circle one) Field Blank / Rinsate / Trip Blank / Other: Associated Samples:

Compound	Blank ID	Sample Identification									

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Common contaminants such as Methylene chloride, Acetone, 2-Butanone and Carbon disulfide that were detected in samples within ten times the associated field blank concentration were qualified as not detected, "U". Other contaminants within five times the field blank concentration were also qualified as not detected, "U".

LDC #: 42791 A1

VALIDATION FINDINGS WORKSHEET
Surrogate Spikes

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y (N) N/A Were all surrogate %R within QC limits?

Y (N) N/A If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R out of outside of criteria?

#	Date	Sample ID	Surrogate	%Recovery (Limits)	Qualifications
		MB 280-421459/11	BFB	117 (85-114)	J dets/P
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
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				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

SMC1 (TOL) = Toluene-d8
SMC2 (BFB) = Bromofluorobenzene
SMC3 (DCE) = 1,2-Dichloroethane-d4
SMC4 (DFM) = Dibromofluoromethane

LDC #: 42791A1

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD : GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.

Y N N/A Was a MS/MSD analyzed every 20 samples of each matrix?

Y N N/A Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	8/9	0	( )	69 (72-136)	( )	6 (Det)	J/UJ/A
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC #: 42791 A1

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was a LCS required?

Y (N) N/A Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	LCS/D 280-421459/8,9	B	168 (53-141)	164 (53-141)	( )	1-3, MB1 (ND)	J dets/p
		D	156 (60-138)	160 (60-138)	( )		
		A	144 (50-139)	143 (50-139)	( )		
		C	138 (58-137)	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC#: 42791A1

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: ~~~

METHOD: GCMS VOA (EPA SW 846 Method 8260B)

(Y) N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/L)		RPD (≤_____ %)	Difference (ug/L)	Limits (<LOQ)	Qualifications (Parent Only)
	1	2				
F	10	3.8		6.2	(≤10)	

Compound	Concentration (ug/L)		RPD (≤_____ %)	Difference (ug/L)	Limits (<LOQ)	Qualifications (Parent Only)
	4	5				
F	5.2	6.5		1.3	(≤10)	
E	0.62	0.43		0.19	(≤5.0)	

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LDC #: 42791A1

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of Compound
C_x = Concentration of compound
S= Standard deviation of the RRFs

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (RRF 10 std)	Recalculated RRF (RRF 10 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL VMS_Q	7/5/2018	Carbon tetrachloride (FB)	0.4734	0.4734	0.4035	0.4036	11.9	11.9
			Tetrachloroethene (CBZ)	1.2964	1.2964	1.1964	1.1964	8.4	8.4
			1,1,2,2-TCA (DCB)	0.4674	0.4674	0.4226	0.4226	6.4	6.4
3	ICAL VMS_Z	7/4/2018	Carbon tetrachloride (FB)	0.7305	0.7305	0.7606	0.7606	7.7	7.7
			Tetrachloroethene (CBZ)	1.8005	1.8005	1.8179	1.8179	7.0	7.0
			1,1,2,2-TCA (DCB)	0.8326	0.8326	0.8513	0.8514	3.1	3.1

LDC#: 42791A1

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (IS)	Average RRF (Initial)	Reported RRF (CCV)	Recalculated RRF (CCV)	Reported % D	Recalculated %D
1	Q5568	7/9/2018	Carbon tetrachloride (FB)	0.4035	0.4185	0.4185	3.7	3.7
			Tetrachloroethene (CBZ)	1.196	1.283	1.283	7.2	7.2
			1,1,2,2-TCA (DCB)	0.4226	0.4232	0.4232	0.1	0.1
2	Z8967	7/10/2018	Carbon tetrachloride (FB)	0.7606	0.7852	0.7852	3.2	3.2
			Tetrachloroethene (CBZ)	1.818	1.885	1.885	3.7	3.7
			1,1,2,2-TCA (DCB)	0.8513	0.818	0.818	3.9	3.9

LDC #: 42791A1

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG
2nd reviewer: ~~~

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: 1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane	10.5	11.3	107	108	1
1,2-Dichloroethane-d4	"	10.9	104	104	0
Toluene-d8	"	10.7	102	102	"
Bromofluorobenzene	"	11.5	110	110	"

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

LDC #: 42791 A1

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA Where: SSC = Spiked sample concentration; SA = Spike added; SC = Sample concentration

RPD = I MSC - MSC I * 2/(MSC + MSDC) MSC = Matrix spike concentration MSDC = Matrix spike duplicate concentration

MS/MSD sample: 8/9

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	------	MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
1,1-Dichloroethene	5.00	5.00	0	4.56	4.62	91	91	92	92	1	1
Trichloroethene				4.29	4.57	86	86	90	90	5	5
Benzene				4.41	4.54	88	88	91	91	3	3
Toluene				4.35	4.55	87	87	91	91	5	5
Chlorobenzene				4.11	4.46	82	82	89	89	8	8

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 42791A1

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratoy control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA Where: SSC = Spiked sample concentration; SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC) LCSC = Laboraotry control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS ID: LCS ID 280-421459/8,9

Compound	Spike Added (ug/L)		Spiked Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
1,1-Dichloroethene	5.00	5.00	4.90	5.23	98	98	105	105	6	6
Trichloroethene			5.11	5.00	102	102	100	100	2	2
Benzene			5.35	5.25	107	107	105	105	2	2
Toluene			5.08	5.12	102	102	102	102	1	1
Chlorobenzene			5.15	5.08	103	103	102	102	1	1

Comments: Refer to Laboratory Control Sample findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 42791A1

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: JVG
2nd reviewer:

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

(Y) N N/A Were all reported results recalculated and verified for all level IV samples?

(Y) N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x = Area of the characteristic ion (EICP) for the compound to be measured

A_{is} = Area of the characteristic ion (EICP) for the specific internal standard

I_s = Amount of internal standard added in nanograms (ng)

RRF = Relative response factor of the calibration standard.

V_o = Volume or weight of sample pruged in milliliters (ml) or grams (g).

Df = Dilution factor.

%S = Percent solids, applicable to soils and solid matrices only.

Example:

Sample I.D. 6, Carbon Tetrachloride

Conc. = $\frac{(597066)(12.5)(\quad)}{(1301145)(0.7666)(\quad)(\quad)}$

= 7.54 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration ( )	Qualification
			7.5		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Ravenna, Ohio

LDC Report Date: August 3, 2018

Parameters: Semivolatiles

Validation Level: Stage 4

Laboratory: TestAmerica, Inc.

Sample Delivery Group (SDG): 280-111421-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
FBQmw-174-062518-GW	280-111421-1	Water	06/25/18
LL12mw-247-062618-GW	280-111421-4	Water	06/26/18
LL12mw-247-D-062618-GW	280-111421-5	Water	06/26/18
LL10mw-003-062618-GW	280-111421-7	Water	06/26/18
NTAmw-119-062518-GW	280-111421-8	Water	06/25/18
NTAmw-119-D-062518-GW	280-111421-9	Water	06/25/18
FWGmw-016-062518-GW	280-111421-13	Water	06/25/18
FWGmw-015-062518-GW	280-111421-14	Water	06/25/18
FWGmw-004-062518-GW	280-111421-15	Water	06/25/18
DETmw-003-D-062618-GW	280-111421-16	Water	06/26/18
DA2mw-115-062618-GW	280-111421-21	Water	06/26/18
DETmw-003-062618-GW	280-111421-22	Water	06/26/18
NTAmw-120-062618-GW	280-111421-23	Water	06/26/18
NTAmw-120-D-062618-GW	280-111421-24	Water	06/26/18
LL12mw-247-062618-GWMS	280-111421-4MS	Water	06/26/18
LL12mw-247-062618-GWMSD	280-111421-4MSD	Water	06/26/18
LL10mw-003-062618-GWMS	280-111421-7MS	Water	06/26/18
LL10mw-003-062618-GWMSD	280-111421-7MSD	Water	06/26/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with The Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Former Ravenna Army Ammunition Plant Portage and Trumbull Counties, Ohio (December 20, 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270D

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 15.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the ending continuing calibration verifications (CCVs) were less than or equal to 50.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. 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 with the following exceptions:

LCS ID (Associated Samples)	Compound	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
LCS/D 280-420810/2,3-A (DETmw-003-D-062618-GW DETmw-003-062618-GW NTAmw-120-062618-GW NTAmw-120-D-062618-GW)	Hexachlorocyclopentadiene	9 (10-120)	8 (10-120)	R (all non-detects)	P

Relative percent differences (RPD) were within QC limits with the following exceptions:

LCS ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
LCS/D 280-420810/2,3-A (DETmw-003-D-062618-GW DETmw-003-062618-GW NTAmw-120-062618-GW NTAmw-120-D-062618-GW)	Hexachlorocyclopentadiene	21 (≤20)	NA	-

X. Field Duplicates

Samples LL12mw-247-062618-GW and LL12mw-247-D-062618-GW, samples NTAmw-119-062518-GW and NTAmw-119-D-062518-GW, samples DETmw-003-D-062618-GW and DETmw-003-062618-GW, and samples NTAmw-120-062618-GW and NTAmw-120-D-062618-GW were identified as field duplicates. No results were detected in any of the samples.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations were within validation criteria.

XIII. Target Compound Identifications

All target compound identifications were within validation criteria.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to MS/MSD %R, data were rejected in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be rejected (R) are unusable for all purposes. Based upon the data validation all other results are considered valid and usable for all purposes.

Ravenna, Ohio
Semivolatiles - Data Qualification Summary - SDG 280-111421-1

Sample	Compound	Flag	A or P	Reason
DETmw-003-D-062618-GW DETmw-003-062618-GW NTAmw-120-062618-GW NTAmw-120-D-062618-GW	Hexachlorocyclopentadiene	R (all non-detects)	P	Matrix spike/Matrix spike duplicate (%R)

Ravenna, Ohio
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 280-111421-1

No Sample Data Qualified in this SDG

Ravenna, Ohio
Semivolatiles - Field Blank Data Qualification Summary - SDG 280-111421-1

No Sample Data Qualified in this SDG

LDC #: 42791A2a
SDG #: 280-111421-1
Laboratory: Test America, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 4

Date: 08/02/18
Page: 1 of 2
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270D)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	ICAL ≤ 15% r² ICV ≤ 20%
IV.	Continuing calibration/ending	A	CCV ≤ 20/50%
V.	Laboratory Blanks	SW	
VI.	Field blanks	ND	FB = 1
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	SW	LCS/D
X.	Field duplicates	ND	D = 2/3, 5/6, 10/12, 13/14
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	A	
XIII.	Target compound identification	A	
XIV.	System performance	A	
XV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID		Lab ID	Matrix	Date
1	FBQmw-174-062518-GW		280-111421-1	Water	06/25/18
2	LL12mw-247-062618-GW	D1	280-111421-4	Water	06/26/18
3	LL12mw-247-D-062618-GW	D1	280-111421-5	Water	06/26/18
4	LL10mw-003-062618-GW		280-111421-7	Water	06/26/18
5	NTAmw-119-062518-GW	D1	280-111421-8	Water	06/25/18
6	NTAmw-119-D-062518-GW	D1	280-111421-9	Water	06/25/18
7	FWGmw-016-062518-GW		280-111421-13	Water	06/25/18
8	FWGmw-015-062518-GW		280-111421-14	Water	06/25/18
9	FWGmw-004-062518-GW		280-111421-15	Water	06/25/18
10	DETmw-003-D-062618-GW	D3	280-111421-16	Water	06/26/18
11	DA2mw-115-062618-GW		280-111421-21	Water	06/26/18
12	DETmw-003-062618-GW	D3	280-111421-22	Water	06/26/18
13	NTAmw-120-062618-GW	D4	280-111421-23	Water	06/26/18

LDC #: 42791A2a
SDG #: 280-111421-1
Laboratory: Test America, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 4

Date: 08/02/18
Page: 2 of 2
Reviewer: JG
2nd Reviewer:

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270D)

	Client ID	Lab ID	Matrix	Date
1 14	NTAmw-120-D-062618-GW D4	280-111421-24	Water	06/26/18
2 15	LL12mw-247-062618-GWMS	280-111421-4MS	Water	06/26/18
2 16	LL12mw-247-062618-GWMSD	280-111421-4MSD	Water	06/26/18
2 17	LL10mw-003-062618-GWMS	280-111421-7MS	Water	06/26/18
2 18	LL10mw-003-062618-GWMSD	280-111421-7MSD	Water	06/26/18
19				
20				
21				

Notes:

1	MB 280-420810/1-A						
2	↓ -421012/1-A						

List 4 = 1-3, 7-9, 11
List 2 = 4, 5, 6
List 1 = 10, 12
Full list = 13, 14

LDC #: 42791A2a

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: CF

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/MS Instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ ~~20%~~ 15 and relative response factors (RRF) within method criteria?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ ~~30%~~ 20 or ~~percent recoveries (%R) 70-130%~~?	✓			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) within method criteria?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.	✓			
VI. Field blanks				
Were field blanks were identified in this SDG?	✓			
Were target compounds detected in the field blanks?		✓		
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	✓			
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis?			✓	
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?			✓	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	✓			
Was a MS/MSD analyzed every 20 samples of each matrix?	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	✓			
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?		✓		
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?		✓		
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU.. 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW.. 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

LDC #: 42791 A2a

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Reviewer: JVG
2nd Reviewer: [signature]

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was a LCS required?

Y (N) N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	Date	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		LCS/D 280-420810/2	3-A X	9 (10-120)	8 (10-120)	( )	10, 12-14, MB 1 (ND)	J/R/P
			X	( )	( )	21 (20)	↓ ↓	J dets/P
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		

LDC #: 42791A2a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS SVOA (EPA SW 846 Method 8270D)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$ — A_x = Area of Compound — A_{is} = Area of associated internal standard

average RRF = sum of the RRFs/number of standards — C_x = Concentration of compound, — C_{is} = Concentration of internal standard

%RSD = 100 * (S/X) — S= Standard deviation of the RRFs, — X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (50 std)	Recalculated RRF (50 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL SMS G6	6/28/2018	Phenol (IS1)	1.8823	1.8823	1.8893	1.8893	2.8	2.8
			Naphthalene (IS2)	1.1038	1.1038	1.1002	1.1002	2.4	2.4
			Diethyl phthalate (IS3)	1.5222	1.5222	1.5150	1.5150	4.4	4.4
			Hexachlorobenzene (IS4)	0.2447	0.2447	0.2415	0.2415	3.0	3.0
			Butylbenzylphthalate (IS5)	0.7352	0.7352	0.7262	0.7262	2.4	2.4
			Benzo(a)pyrene (IS6)	1.2362	1.2362	1.2256	1.2256	3.4	3.4

LDC#: _42791A2a__

VALIDATION FINDINGS WORSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS SVOA (EPA SW 846 Method 8270D)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound

Cx = Concentration of compound
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (IS)	Average RRF (Initial RRF)	Reported (CC RRF)	Recalculated (CC RRF)	Reported %D	Recalculated %D
1	G6_34594	07/13/18	Phenol (IS1)	1.8893	1.8841	1.8841	0.3	0.3
			Naphthalene (IS2)	1.1002	1.1080	1.1080	0.7	0.7
			Diethyl phthalate (IS3)	1.5150	1.5874	1.5874	4.8	4.8
			Hexachlorobenzene (IS4)	0.2415	0.2446	0.2446	1.3	1.3
			Butylbenzylphthalate (IS5)	0.7262	0.7415	0.7415	2.1	2.1
			Benzo(a)pyrene (IS6)	1.2256	1.2820	1.2820	4.6	4.6
2	G6_34628	7/14/2018	Diethyl phthalate (IS3)	1.5150	1.4966	1.4966	1.2	1.2
			Butylbenzylphthalate (IS5)	0.7262	0.7214	0.7214	0.7	0.7
3	G6_34662	07/16/18	Diethyl phthalate (IS3)	1.5150	1.4931	1.4931	1.4	1.4
			Butylbenzylphthalate (IS5)	0.7262	0.6986	0.6986	3.8	3.8
4	G6_34732	07/18/18	Phenol (IS1)	1.8893	1.9268	1.9268	2.0	2.0
			Naphthalene (IS2)	1.1002	1.1076	1.1076	0.7	0.7
			Diethyl phthalate (IS3)	1.5150	1.4962	1.4962	1.2	1.2
			Hexachlorobenzene (IS4)	0.2415	0.2314	0.2314	4.2	4.2
			Butylbenzylphthalate (IS5)	0.7262	0.7241	0.7241	0.3	0.3
			Benzo(a)pyrene (IS6)	1.2256	1.2960	1.2960	5.7	5.7

LDC #: 42791A2a

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1
Reviewer: JVG
2nd reviewer: ~~~

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270D)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: #1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	100	71.5	71	71	0
2-Fluorobiphenyl		70.6	71	71	
Terphenyl-d14		78.6	79	79	
Phenol-d5		77.1	77	77	
2-Fluorophenol		79.2	79	79	
2,4,6-Tribromophenol	↓	74.8	74	74	↓
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID: _____

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID: _____

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

LDC #: 42791 A2a

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA Where: SSC = Spiked sample concentration; SA = Spike added; SC = Sample concentation

RPD = I MSC - MSC I * 2/(MSC + MSDC) MSC = Matrix spike concentration MSDC = Matrix spike duplicate concentration

MS/MSD samples: 15/16

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	------	MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalc
Phenol											
N-Nitroso-di-n-propylamine											
4-Chloro-3-methylphenol											
Acenaphthene											
Pentachlorophenol											
Pyrene											
EEE	75.6	76.5	0	57.9	56.4	77	77	74	74	3	3

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 42791A2a

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SC/SA Where: SSC = Spike concentration
SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC) LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS/LCSD samples: LCS ID 280-420810/2, 3-4

Compound	Spike Added (ug/L)		Spike Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Phenol	80.0	80.0	57.1	66.0	71	71	82	82	14	14
N-Nitroso-di-n-propylamine			59.0	65.3	74	74	82	82	10	10
4-Chloro-3-methylphenol			62.9	68.4	79	79	86	86	8	8
Acenaphthene			61.9	65.6	77	77	82	82	6	6
Pentachlorophenol	160.0	160.0	120	129	75	75	81	81	7	7
Pyrene	80.0	80.0	64.8	68.6	81	81	86	86	6	6

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 42791 42a

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: JVG
2nd reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

(Y) N N/A Were all reported results recalculated and verified for all level IV samples?
(Y) N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(V_t)(DF)(2.0)}{(A_{is})(RRF)(V_o)(V_i)(\%S)}$

A_x = Area of the characteristic ion (EICP) for the compound to be measured

A_{is} = Area of the characteristic ion (EICP) for the specific internal standard

I_s = Amount of internal standard added in nanograms (ng)

V_o = Volume or weight of sample extract in milliliters (ml) or grams (g).

V_i = Volume of extract injected in microliters (ul)

V_t = Volume of the concentrated extract in microliters (ul)

Df = Dilution Factor.

%S = Percent solids, applicable to soil and solid matrices only.

2.0 = Factor of 2 to account for GPC cleanup

Example:

Sample I.D. MD, Phenol
LCS - 420810

Conc. = $\frac{(121168)(40.0)(1ml)(\quad)(\quad)(\quad)}{(44896)(1.8893)(1L)(\quad)(\quad)(\quad)}$

= 57.1 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration ( )	Qualification
			57.1		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Ravenna, Ohio

LDC Report Date: August 3, 2018

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Stage 4

Laboratory: TestAmerica, Inc.

Sample Delivery Group (SDG): 280-111421-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
NTAmw-119-062518-GW	280-111421-8	Water	06/25/18
NTAmw-119-D-062518-GW	280-111421-9	Water	06/25/18
DETmw-003-D-062618-GW	280-111421-16	Water	06/26/18
DETmw-003-062618-GW	280-111421-22	Water	06/26/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with The Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Former Ravenna Army Ammunition Plant Portage and Trumbull Counties, Ohio (December 20, 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polynuclear Aromatic Hydrocarbons (PAHs) by Environmental Protection Agency (EPA) SW 846 Method 8270D in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 15.0% for all compounds.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the ending continuing calibration verifications (CCVs) were less than or equal to 50.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

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

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
MB 280-420756/1-A	07/01/18	Acenaphthylene Benzo(a)anthracene Chrysene Fluoranthene Phenanthrene Pyrene	0.0135 ug/L 0.0131 ug/L 0.0124 ug/L 0.0323 ug/L 0.0729 ug/L 0.0209 ug/L	NTAmw-119-062518-GW NTAmw-119-D-062518-GW
MB 280-420946/1-A	07/03/18	Anthracene Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene Fluoranthene Naphthalene Phenanthrene Pyrene	0.00951 ug/L 0.0250 ug/L 0.0282 ug/L 0.0285 ug/L 0.0320 ug/L 0.0166 ug/L 0.0170 ug/L 0.0246 ug/L 0.0122 ug/L	DETmw-003-D-062618-GW DETmw-003-062618-GW

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 with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
NTAmw-119-062518-GW	Fluoranthene Phenanthrene Pyrene	0.025 ug/L 0.038 ug/L 0.015 ug/L	0.10U ug/L 0.10U ug/L 0.10U ug/L
NTAmw-119-D-062518-GW	Acenaphthylene Fluoranthene Phenanthrene Pyrene	0.014 ug/L 0.027 ug/L 0.051 ug/L 0.021 ug/L	0.10U ug/L 0.10U ug/L 0.10U ug/L 0.10U ug/L
DETmw-003-D-062618-GW	Anthracene Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene Fluoranthene Naphthalene Phenanthrene Pyrene	0.015 ug/L 0.037 ug/L 0.030 ug/L 0.029 ug/L 0.035 ug/L 0.045 ug/L 0.020 ug/L 0.045 ug/L 0.033 ug/L	0.11U ug/L 0.11U ug/L 0.11U ug/L 0.11U ug/L 0.11U ug/L 0.11U ug/L 0.11U ug/L 0.11U ug/L 0.11U ug/L
DETmw-003-062618-GW	Chrysene Fluoranthene Naphthalene Phenanthrene Pyrene	0.012 ug/L 0.012 ug/L 0.012 ug/L 0.022 ug/L 0.011 ug/L	0.099U ug/L 0.099U ug/L 0.099U ug/L 0.099U ug/L 0.099U ug/L

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. 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 this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

IX. 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 with the following exceptions:

LCS ID (Associated Samples)	Compound	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
LCS/D 280-420756/2,3-A (NTAmw-119-062518-GW NTAmw-119-D-062518-GW)	Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(g,h,i)perylene Chrysene Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene	- - - - - - 	136 (59-120) 148 (53-126) 148 (54-125) 148 (44-128) 171 (57-120) 134 (44-131) 140 (48-130)	NA	-
LCS/D 280-420756/2,3-A (NTAmw-119-062518-GW NTAmw-119-D-062518-GW)	Fluoranthene Pyrene	- -	121 (58-120) 124 (53-121)	J (all detects) J (all detects)	A

Relative percent differences (RPD) were within QC limits with the following exceptions:

LCS ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
LCS/D 280-420756/2,3-A (NTAmw-119-062518-GW NTAmw-119-D-062518-GW)	Anthracene Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(g,h,i)perylene Benzo(a)pyrene Chrysene Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene	38 (≤20) 62 (≤20) 65 (≤20) 69 (≤20) 61 (≤20) 51 (≤20) 67 (≤20) 66 (≤20) 66 (≤20)	NA	-
LCS/D 280-420756/2,3-A (NTAmw-119-062518-GW NTAmw-119-D-062518-GW)	Fluoranthene Phenanthrene Pyrene	53 (≤20) 32 (≤20) 53 (≤20)	J (all detects) J (all detects) J (all detects)	A
LCS/D 280-420946/2,3-A (DETmw-003-D-062618-GW)	Benzo(k)fluoranthene	21 (≤20)	J (all detects)	A

LCS ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
LCS/D 280-420946/2,3-A (DETmw-003-062618-GW)	Benzo(k)fluoranthene	21 (≤20)	NA	-

X. Field Duplicates

Samples NTAmw-119-062518-GW and NTAmw-119-D-062518-GW and samples DETmw-003-D-062618-GW and DETmw-003-062618-GW were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	NTAmw-119-062518-GW	NTAmw-119-D-062518-GW				
Acenaphthylene	0.042U	0.014	-	0.028 (≤0.10)	-	-
Fluoranthene	0.025	0.027	-	0.002 (≤0.10)	-	-
Naphthalene	0.022	0.025	-	0.003 (≤0.10)	-	-
Phenanthrene	0.038	0.051	-	0.013 (≤0.10)	-	-
Pyrene	0.015	0.021	-	0.006 (≤0.10)	-	-

Compound	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	DETmw-003-D-062618-GW	DETmw-003-062618-GW				
Anthracene	0.015	0.040U	-	0.025 (≤0.099)	-	-
Benzo(a)anthracene	0.037	0.012U	-	0.025 (≤0.099)	-	-
Benzo(b)fluoranthene	0.030	0.012U	-	0.018 (≤0.099)	-	-
Benzo(k)fluoranthene	0.029	0.012U	-	0.017 (≤0.099)	-	-
Benzo(a)pyrene	0.019	0.012U	-	0.007 (≤0.099)	-	-
Chrysene	0.035	0.012	-	0.023 (≤0.11)	-	-
Fluoranthene	0.045	0.012	-	0.033 (≤0.11)	-	-
Naphthalene	0.020	0.012	-	0.008 (≤0.11)	-	-

Compound	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	DETmw-003-D-062618-GW	DETmw-003-062618-GW				
Phenanthrene	0.045	0.022	-	0.023 (≤0.11)	-	-
Pyrene	0.033	0.011	-	0.022 (≤0.11)	-	-

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations were within validation criteria.

XIII. Target Compound Identifications

All target compound identifications were within validation criteria.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment of Data

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

Due to LCS/LCSD %R and RPD, data were qualified as estimated in three samples.

Due to laboratory blank contamination, data were qualified as not detected in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Ravenna, Ohio
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 280-111421-1

Sample	Compound	Flag	A or P	Reason
NTAmw-119-062518-GW NTAmw-119-D-062518-GW	Fluoranthene Pyrene	J (all detects) J (all detects)	A	Laboratory control samples (%R)
NTAmw-119-062518-GW NTAmw-119-D-062518-GW	Fluoranthene Phenanthrene Pyrene	J (all detects) J (all detects) J (all detects)	A	Laboratory control samples (RPD)
DETmw-003-D-062618-GW	Benzo(k)fluoranthene	J (all detects)	A	Laboratory control samples (RPD)

Ravenna, Ohio
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification Summary - SDG 280-111421-1

Sample	Compound	Modified Final Concentration	A or P
NTAmw-119-062518-GW	Fluoranthene Phenanthrene Pyrene	0.10U ug/L 0.10U ug/L 0.10U ug/L	A
NTAmw-119-D-062518-GW	Acenaphthylene Fluoranthene Phenanthrene Pyrene	0.10U ug/L 0.10U ug/L 0.10U ug/L 0.10U ug/L	A
DETmw-003-D-062618-GW	Anthracene Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene Fluoranthene Naphthalene Phenanthrene Pyrene	0.11U ug/L 0.11U ug/L 0.11U ug/L 0.11U ug/L 0.11U ug/L 0.11U ug/L 0.11U ug/L 0.11U ug/L 0.11U ug/L	A
DETmw-003-062618-GW	Chrysene Fluoranthene Naphthalene Phenanthrene Pyrene	0.099U ug/L 0.099U ug/L 0.099U ug/L 0.099U ug/L 0.099U ug/L	A

Ravenna, Ohio
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary - SDG 280-111421-1

No Sample Data Qualified in this SDG

LDC #: 42791A2b
SDG #: 280-111421-1
Laboratory: Test America, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 4

Date: 08/02/18
Page: 1 of 1
Reviewer: AG
2nd Reviewer:

METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (EPA SW 846 Method 8270D-SIM)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	ICAL ≤ 15%, ICV ≤ 20%
IV.	Continuing calibration / ending	A	CCV ≤ 20/50%
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	SW	LCS/D
X.	Field duplicates	SW	D = 1/2, 3/4
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	A	
XIII.	Target compound identification	A	
XIV.	System performance	A	
XV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID		Lab ID	Matrix	Date
1	NTAmw-119-062518-GW	D1	280-111421-8	Water	06/25/18
2	NTAmw-119-D-062518-GW	D1	280-111421-9	Water	06/25/18
3	DETmw-003-D-062618-GW	D2	280-111421-16	Water	06/26/18
4	DETmw-003-062818-GW	D2	280-111421-22	Water	06/26/18
5					
6					
7					
8					

Notes:

1	MB 280-420756/1-A						
2	1 - 420946/1-A						

LDC #: 42791 A 26

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [signature]

Method: PAH (EPA SW 846 Method 8270D-SIM)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/MS Instrument performance check (Not required)				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ ~~20%~~ 15 and relative response factors (RRF) ≥ 0.05?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?		✓		
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ ~~30%~~ 20 or ~~percent recoveries (%R) 70-130%~~?	✓			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) ≥ 0.05?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.	✓	✓		
VI. Field blanks				
Were field blanks identified in this SDG?	•	✓		
Were target compounds detected in the field blanks?			✓	
VII. Surrogate spikes				
Were all surrogate percent differences (%R) within QC limits?	✓			
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any percent recoveries (%R) was less than 10 percent, was a reanalysis performed to confirm %R?			✓	

LDC #: 42791A26

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		✓		
Was a MS/MSD analyzed every 20 samples of each matrix?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
XI. Internal standards				
Were internal standard area counts within -50% or +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU.. 2,3,4,6-Tetrachlorophenol	U1. Famphur
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1. 1,4-phenylenediamine
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW.. 2-Picoline	W1. Methapyrilene
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1. Pentachloroethane
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1. 3,3'-Dimethylbenzidine
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1. o-Toluidine

LDC #: 42791 A2b

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer: [signature]

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a method blank analyzed for each matrix?
Y N N/A Was a method blank analyzed for each concentration preparation level?
Y N N/A Was a method blank associated with every sample?
Y N N/A Was the blank contaminated? If yes, please see qualification below.

Blank extraction date: 07/01/18 **Blank analysis date:** 07/19/18
Conc. units: ug/L Associated Samples: 1, 2

Compound	Blank ID								
	MB 280-420756/1-A		1	2					
DD	0.0135			0.014/0.10U					
CCC	0.0131								
DDD	0.0124								
YY	0.0323		0.025/0.10U	0.027/0.10U					
UU	0.0729		0.038/	0.051/					
ZZ	0.0209		0.015/	0.021/					

Blank extraction date: 07/03/18 **Blank analysis date:** 07/12/18
Conc. units: ug/L Associated Samples: 3, 4

Compound	Blank ID								
	MB 280-420946/1-A		3	4					
VV	0.00951		0.015/0.11U						
CCC	0.0250		0.037/						
GGG	0.0282		0.030/						
HHH	0.0285		0.029/						
DDD	0.0320		0.035/	0.012/0.099U					
YY	0.0166		0.045/	0.012/					
S	0.0170		0.020/	0.012/					
UU	0.0246		0.045/	0.022/					
ZZ	0.0122		0.033/	0.011/					

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated method blank concentration were qualified as not detected, "U". Other contaminants within five times the method blank concentration were also qualified as not detected, "U".

LDC #: 42791 A2b

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a LCS required?
Y N N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	Date	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		LCS/D 280-420756/2,3-A		See attached ( )	( )	( )	1, 2, MB 1	J dets/p
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
		LCS/D 280-420946/2,3-A HHH		( )	( )	21 (20)	3, 4, MB 2	J dets/p
				( )	( )	( )	(Det = 3)	
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		

FORM III
GC/MS SEMI VOA LAB CONTROL SAMPLE DUPLICATE RECOVERY

Lab Name: TestAmerica Denver Job No.: 280-111421-1

SDG No.:

Matrix: Water Level: Low Lab File ID: F2459.D

Lab ID: LCSD 280-420756/3-A Client ID:

COMPOUND	SPIKE ADDED (ug/L)	LCSD CONCENTRATION (ug/L)	LCSD % REC	% RPD	QC LIMITS RPD	QC LIMITS REC	#	
Acenaphthene	0.900	0.758	84	11	20	48-114		
Acenaphthylene	0.900	0.625	69	6	20	35-121		
Anthracene VV	0.900	0.939	104	38	20	53-119	Q	(ND)
Benzo[a]anthracene CCC	0.900	1.22	136	62	20	59-120	Q	
Benzo[b]fluoranthene GGG	0.900	1.33	148	65	20	53-126	Q	
Benzo[k]fluoranthene HHH	0.900	1.33	148	69	20	54-125	Q	
Benzo[g,h,i]perylene LLL	0.900	1.33	148	61	20	44-128	Q	
Benzo[a]pyrene III	0.900	0.973	108	51	20	53-120	Q	
Chrysene DDD	0.900	1.54	171	67	20	57-120	Q	
Dibenz(a,h)anthracene KKK	0.900	1.21	134	66	20	44-131	Q	
Fluoranthene YY	0.900	1.08	121	53	20	58-120	Q	(Det)
Fluorene	0.900	0.819	91	17	20	50-118		
Indeno[1,2,3-cd]pyrene JJJ	0.900	1.26	140	66	20	48-130	Q	(ND)
Naphthalene	0.900	0.713	79	4	20	43-114		
Phenanthrene UU	0.900	1.02	113	32	20	53-115	Q	(Det)
Pyrene ZZ	0.900	1.12	124	53	20	53-121	Q	

Column to be used to flag recovery and RPD values

FORM III 8270D SIM

LDC#: 42791A2b

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer: ~~~

METHOD: GCMS PAH (EPA SW 846 Method 8270D-SIM)

(Y)N NA Were field duplicate pairs identified in this SDG?
(Y)N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/L)		RPD (≤_____ %)	Difference (ug/L)	Limits (<LOQ)	Qualifications (Parent Only)
	1	2				
DD	0.042U	0.014		0.028	(≤0.10)	
YY	0.025	0.027		0.002	(≤0.10)	
S	0.022	0.025		0.003	(≤0.10)	
UU	0.038	0.051		0.013	(≤0.10)	
ZZ	0.015	0.021		0.006	(≤0.10)	

Compound	Concentration (ug/L)		RPD (≤_____ %)	Difference (ug/L)	Limits (<LOQ)	Qualifications (Parent Only)
	3	4				
VV	0.015	0.040U		0.025	(≤0.099)	
CCC	0.037	0.012U		0.025	(≤0.099)	
GGG	0.030	0.012U		0.018	(≤0.099)	
HHH	0.029	0.012U		0.017	(≤0.099)	
III	0.019	0.012U		0.007	(≤0.099)	
DDD	0.035	0.012		0.023	(≤0.11)	
YY	0.045	0.012		0.033	(≤0.11)	
S	0.020	0.012		0.008	(≤0.11)	
UU	0.045	0.022		0.023	(≤0.11)	
ZZ	0.033	0.011		0.022	(≤0.11)	

LDC#: 42791A2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of Compound
C_x = Concentration of compound,
S= Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (600 std)	Recalculated RRF (600 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL SMS F	7/10/18	Naphthalene (ANT)	2.0502	2.0502	2.1060	2.1060	4.4	4.4
			Phenanthrene (PHN)	1.3230	1.3230	1.3927	1.3927	8.5	8.5
			Benzo(a)pyrene (CRY)	1.2018	1.2018	1.2242	1.2242	10.5	10.5

LDC#: 42791A2b

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound
Cx = Concentration of compound
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound	Ave RRF	Reported RRF	Recalculated RRF	Reported % D	Recalculated %D
1	F2272	7/11/2018	Naphthalene (ANT)	2.106	1.982	1.982	5.9	5.9
			Phenanthrene (PHN)	1.393	1.313	1.313	5.7	5.7
			Benzo(a)pyrene (CRY)	1.224	1.005	1.005	17.9	17.9
2	F2299	7/12/2018	Naphthalene (ANT)	2.106	2.161	2.161	2.6	2.6
			Phenanthrene (PHN)	1.393	1.282	1.282	7.9	7.9
			Benzo(a)pyrene (CRY)	1.224	0.979	0.979	20.0	20.0
3	F2354	7/16/2018	Naphthalene (ANT)	2.106	2.226	2.226	5.7	5.7
			Phenanthrene (PHN)	1.393	1.385	1.385	0.6	0.6
			Benzo(a)pyrene (CRY)	1.224	1.059	1.059	13.5	13.5
4	F2456	7/19/2018	Naphthalene (ANT)	2.106	2.218	2.218	5.3	5.3
			Phenanthrene (PHN)	1.393	1.412	1.412	1.4	1.4
			Benzo(a)pyrene (CRY)	1.224	1.100	1.100	10.1	10.2

LDC #: f2 791A26

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG
2nd reviewer:

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: #1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	500	351.8	70	70	0
2-Fluorobiphenyl	↓	355.5	71	71	↓
Terphenyl-d14	↓	483.4	97	97	↓

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					

LDC #: 42791A26

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: [signature]

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SC/SA Where: SSC = Spike concentration
SA = Spike added

RPD = | LCSC - LCSDC | * 2/(LCSC + LCSDC) LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS/LCSD samples: LCSD 280-420756/2,3-A

Compound	Spike Added (ug/L)		Spike Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Acenaphthene	0.900	0.900	0.681	0.758	76	76	84	84	11	11
Pyrene	↓	↓	0.649	1.12	72	72	124	124	53	53

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 42791 A26

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: JVG
2nd reviewer: [redacted]

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

(Y) N N/A Were all reported results recalculated and verified for all level IV samples?
Y (N) N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(V_t)(DF)(2.0)}{(A_{is})(RRF)(V_o)(V_i)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
V_i	=	Volume of extract injected in microliters (ul)
V_t	=	Volume of the concentrated extract in microliters (ul)
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.
2.0	=	Factor of 2 to account for GPC cleanup

Example:

Sample I.D. 4 , Naphthalene

Conc. = $\frac{(598)(600)(1\text{ mL})(\quad)(\quad)}{(57971)(2.1061)(251.9\text{ mL})(\quad)}$

= 0.012 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration ( )	Qualification
			0.012		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Ravenna, Ohio

LDC Report Date: August 3, 2018

Parameters: Chlorinated Pesticides

Validation Level: Stage 4

Laboratory: TestAmerica, Inc.

Sample Delivery Group (SDG): 280-111421-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
FBQmw-174-062518-GW	280-111421-1	Water	06/25/18
DETmw-003-D-062618-GW	280-111421-16	Water	06/26/18
DETmw-003-062618-GW	280-111421-22	Water	06/26/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with The Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Former Ravenna Army Ammunition Plant Portage and Trumbull Counties, Ohio (December 20, 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Chlorinated Pesticides by Environmental Protection Agency (EPA) SW 846 Method 8081A

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average calibration factors were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Retention time windows were established as required by the method.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
07/20/18	07190034	CLP 1	Toxaphene	30.38	All samples in SDG 280-111421-1	UJ (all non-detects)	A

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

Retention times of all compounds in the calibration standards were within the established retention time windows.

V. Laboratory Blanks

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

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
MB 280-421000/1-A	07/02/18	4,4'-DDT	0.0123 ug/L	DETmw-003-D-062618-GW DETmw-003-062618-GW

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

Sample FBQmw-174-062518-GW was identified as a field blank. No contaminants were found.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. 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 this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

IX. 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.

X. Field Duplicates

Samples DETmw-003-D-062618-GW and DETmw-003-062618-GW were identified as field duplicates. No results were detected in any of the samples.

XI. Compound Quantitation

All compound quantitations met validation criteria.

XII. Target Compound Identification

All target compound identifications met validation criteria.

XIII. System Performance

The system performance was acceptable.

XIV. Overall Assessment of Data

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

Due to ICV %D, data were qualified as estimated in three samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Ravenna, Ohio
Chlorinated Pesticides - Data Qualification Summary - SDG 280-111421-1

Sample	Compound	Flag	A or P	Reason
FBQmw-174-062518-GW DETmw-003-D-062618-GW DETmw-003-062618-GW	Toxaphene	UJ (all non-detects)	A	Initial calibration verification (%D)

Ravenna, Ohio
Chlorinated Pesticides - Laboratory Blank Data Qualification Summary - SDG 280-111421-1

No Sample Data Qualified in this SDG

Ravenna, Ohio
Chlorinated Pesticides - Field Blank Data Qualification Summary - SDG 280-111421-1

No Sample Data Qualified in this SDG

LDC #: 42791A3a
SDG #: 280-111421-1
Laboratory: Test America, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 4

Date: 08/02/18
Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC Chlorinated Pesticides (EPA SW846 Method 8081B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC Instrument Performance Check	A	
III.	Initial calibration/ICV	A / SW	ICAL ≤ 20% r² ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	SW	
VI.	Field blanks	ND	FB = 1
VII.	Surrogate spikes /IS	A/A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS/D
X.	Field duplicates	ND	b = 2/3
XI.	Compound quantitation/RL/LOQ/LODs	A	
XII.	Target compound identification	A	
XIII.	System Performance	A	
XIV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID		Lab ID	Matrix	Date
1	FBQmw-174-062518-GW		280-111421-1	Water	06/25/18
2	DETmw-003-D-062618-GW	b	280-111421-16	Water	06/26/18
3	DETmw-003-062618-GW	b	280-111421-22	Water	06/26/18
4					
5					
6					
7					
8					
9					
10					

Notes:

1	MB 280-420760/1-A						
2	1 - 421000/1						

LDC #: 42791 A3a

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: Q

Method: Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/ECD Instrument performance check				
Was the instrument performance found to be acceptable?	✓			
Were Evaluation mix standards analyzed prior to the initial calibration and at beginning of each 12-hour shift?	✓			
Were endrin and 4,4'-DDT breakdowns ≤ 15% for individual breakdown in the Evaluation mix standards?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?	✓			
Were the RT windows properly established?	✓			
IIIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
IV. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
Were all the retention times within the acceptance windows?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.	✓			
VI. Field blanks				
Were field blanks identified in this SDG?	✓			
Were target compounds detected in the field blanks?		✓		
VII. Surrogate spikes/Internal Standards				
Were all surrogate percent recovery (%R) within the QC limits?	✓			

Validation Area	Yes	No	NA	Findings/Comments
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?	.		✓	
If any percent recovery (%R) was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
Were internal standard area counts within ± 50% of the average area calculated during calibration?	✓			
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		✓		
Was a MS/MSD analyzed every 20 samples of each matrix?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?		✓		
XI. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions, dry weight factors, and clean-up activities applicable to level IV validation?	✓			
Were relative percent difference (RPD) of the results between two columns ≤ 40%?	✓			
XII. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: Pesticide/PCBs (EPASW 846 Method 8081/8082)

A. alpha-BHC	K. Endrin	U. Toxaphene	EE. 2,4'-DDT	OO.
B. beta-BHC	L. Endosulfan II	V. Aroclor-1016	FF. Hexachlorobenzene	PP.
C. delta-BHC	M. 4,4'-DDD	W. Aroclor-1221	GG. Chlordane	QQ
D. gamma-BHC	N. Endosulfan sulfate	X. Aroclor-1232	HH. Chlordane (Technical)	RR.
E. Heptachlor	O. 4,4'-DDT	Y. Aroclor-1242	II. Aroclor 1262	SS.
F. Aldrin	P. Methoxychlor	Z. Aroclor-1248	JJ. Aroclor 1268	TT.
G. Heptachlor epoxide	Q. Endrin ketone	AA. Aroclor-1254	KK. Oxychlordane	UU.
H. Endosulfan I	R. Endrin aldehyde	BB. Aroclor-1260	LL. trans-Nonachlor	VV
I. Dieldrin	S. alpha-Chlordane	CC. 2,4'-DDD	MM. cis-Nonachlor	WW.
J. 4,4'-DDE	T. gamma-Chlordane	DD. 2,4'-DDE	NN.	XX.

Notes:_____

LDC #: 42791A3a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [signature]

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
What type of initial calibration verification calculation was performed? /%D or __%R
(Y) N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y (N) N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	07/20/18	07190034	CLP1	U	30.38	All (ND)	J / UJ / A

LDC #: 42791 A 3a

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer: [signature]

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were all samples associated with a method blank?
Y N N/A Was a method blank performed for each matrix and whenever a sample extraction was performed?
Y N N/A If extract clean-up was performed, were extract clean-up blanks analyzed at the proper frequencies?
Y N N/A Was there contamination in the method blanks? If yes, please see the qualifications below.

Blank extraction date: 07/02/18 Blank analysis date: 07/25/18 Associated samples: 2, 3 (ND)
Conc. units: ug/L

Compound	Blank ID	Sample Identification								
	MB 280-421000/1-A									
0	0.0123									

Blank extraction date: _____ Blank analysis date: _____ Associated samples: _____
Conc. units: _____

Compound	Blank ID	Sample Identification								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".

Privileged and Confidential

LDC #: 42791A3a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC Pesticides (EPA SW 846 Method 8081B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$

average RRF = sum of the RRFs/number of standards

%RSD = 100 * (S/X)

Where

A_x = Area of Compound

C_x = Concentration of compound,

S= Standard deviation of the RRFs,

A_{is} = Area of associated internal standard

C_{is} = Concentration of internal standard

X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound	Reported RRF (25 std)	Recalculated RRF (25 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL SGC_P2	7/20/2018	Dieldrin (CLP1)	1.3270	1.3270	1.3747	1.3747	4.2	4.2
			Endrin ketone (CLP1)	1.3581	1.3581	1.4296	1.4296	4.7	4.7
			Dieldrin (CLP2)	1.2900	1.2900	1.3142	1.3142	2.8	2.8
			Endrin ketone (CLP2)	1.4065	1.4065	1.4936	1.4936	8.0	8.0

IS= 1-Bromo-2-nitrobenzene - 75 ug/L

LDC # 42791A3a

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC Pesticides (EPA SW 846 Method 8081B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound,
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound	Average RRF Conc	Reported RRF (CC)	Recalculated RRF (CC)	Reported % D	Recalculated % D
1	07250011	7/25/2018	Dieldrin (CLP1)	25.0	21.2	21.2	15.4	15.4
			Endrin ketone (CLP1)	25.0	21.8	21.8	12.8	12.8
			Dieldrin (CLP2)	25.0	21.5	21.5	14.0	14.0
			Endrin ketone (CLP2)	25.0	20.8	20.8	16.7	16.7
2	07250023	7/25/2018	Dieldrin (CLP1)	25.0	24.0	24.0	3.8	3.8
			Endrin ketone (CLP1)	25.0	23.0	23.0	7.9	7.9
			Dieldrin (CLP2)	25.0	24.4	24.4	2.3	2.3
			Endrin ketone (CLP2)	25.0	22.1	22.1	11.6	11.6

LDC #: 42791A3c

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG
2nd reviewer: [illegible]

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: ~~#~~ 2

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Tetrachloro-m-xylene	CLP 1	10.0	5.11	51	51	0
Tetrachloro-m-xylene	2		4.77	48	48	
Decachlorobiphenyl	1		6.80	68		
Decachlorobiphenyl	2		6.35	63		

Sample ID:

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Sample ID:

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Sample ID:

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Notes:

LDC #: 42791A3a

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicate Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

The percent recoveries (%R) and Relative Percent difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100* (SSC-SC)/SA

Where: SSC = Spiked sample concentration
SA = Spike added
SC = Concentration

RPD = I LCS - LCSD I * 2/(LCS + LCSD)

LCS = Laboratory control sample percent recovery

LCSD = Laboratory control sample duplicate percent recovery

LCS/LCSD samples: LCS/D 280-421060/2,3-A

Compound	Spike Added (ug/L)		Spiked Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
gamma-BHC	2.00	2.00	1.75	1.54	88	88	77	77	13	13
4,4'-DDT	↓	↓	2.59	2.15	129	129	167	167	18	18
Aroclor 1260										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 42791 A3L

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer:

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

(Y) N N/A Were all reported results recalculated and verified for all level IV samples?
(Y) N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Example:

Sample I.D. LCS-42[illegible]000 ND Dieldrin

Conc. = $\frac{(1078476603)(75\text{ml})(5\text{ml})}{(64425317\text{4})(1.3747)(250\text{ml})}$

= 1.827

≈ 1.83

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration ( )	Qualification
			1.83		

Note:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Ravenna, Ohio

LDC Report Date: August 3, 2018

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 4

Laboratory: TestAmerica, Inc.

Sample Delivery Group (SDG): 280-111421-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
DETmw-003-D-062618-GW	280-111421-16	Water	06/26/18
DETmw-003-062618-GW	280-111421-22	Water	06/26/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with The Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Former Ravenna Army Ammunition Plant Portage and Trumbull Counties, Ohio (December 20, 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

A curve fit, based on the initial calibration, was established for quantitation. The coefficient of determination (r^2) was greater than or equal to 0.990.

Retention time windows were established as required by the method.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

Retention times of all compounds in the calibration standards were within the established retention time windows.

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 this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VII. 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 this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

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

IX. Field Duplicates

Samples DETmw-003-D-062618-GW and DETmw-003-062618-GW were identified as field duplicates. No results were detected in any of the samples.

X. Compound Quantitation

All compound quantitations met validation criteria.

XI. Target Compound Identification

All target compound identifications met validation criteria.

XII. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Ravenna, Ohio
Polychlorinated Biphenyls - Data Qualification Summary - SDG 280-111421-1

No Sample Data Qualified in this SDG

Ravenna, Ohio
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 280-111421-1

No Sample Data Qualified in this SDG

Ravenna, Ohio
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 280-111421-1

No Sample Data Qualified in this SDG

LDC #: 42791A3b
SDG #: 280-111421-1
Laboratory: Test America, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 4

Date: 08/02/18
Page: 1 of 1
Reviewer: DVG
2nd Reviewer:

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	Initial calibration/ICV	A / A	r² ICV ≤ 20 %
III.	Continuing calibration	A	CCV ≤ 20 %
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /IS	A/A	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	ND	b = 1/2
X.	Compound quantitation/RL/LOQ/LODs	A	
XI.	Target compound identification	A	
XII	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID		Lab ID	Matrix	Date
1	DETmw-003-D-062618-GW	D	280-111421-16	Water	06/26/18
2	DETmw-003-062618-GW	b	280-111421-22	Water	06/26/18
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Notes:

-	MB 280-421495/1-	A					

LDC #: 42791 A3b

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: CP

Method: Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/ECD Instrument performance check				
Was the instrument performance found to be acceptable?	•		✓	
Were Evaluation mix standards analyzed prior to the initial calibration and at beginning of each 12-hour shift?			✓	
Were endrin and 4,4'-DDT breakdowns ≤ 15% for individual breakdown in the Evaluation mix standards?			✓	
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?			✓	
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?	✓			
Were the RT windows properly established?	✓			
IIIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
IV. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
Were all the retention times within the acceptance windows?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Surrogate spikes/Internal Standards				
Were all surrogate percent recovery (%R) within the QC limits?	✓			

Validation Area	Yes	No	NA	Findings/Comments
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?	✓		✓	
If any percent recovery (%R) was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
Were internal standard area counts within ± 50% of the average area calculated during calibration?	✓			
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		✓		
Was a MS/MSD analyzed every 20 samples of each matrix?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?		✓		
XI. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions, dry weight factors, and clean-up activities applicable to level IV validation?	✓			
Were relative percent difference (RPD) of the results between two columns ≤ 40%?	✓			
XII. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC#: 42791A3b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: PCBs (EPA SW 846 Method 8082A)

Parameter: 1260-1

Order of regression: Linear

Date	Instrument	Compound	Points	x Response ratio	y Conc ratio
5/20/2018	SGC P3 CLP1	1260-1	Point 1	0.01571	0.025
			Point 2	0.02859	0.050
			Point 3	0.05090	0.100
			Point 4	0.11745	0.250
			Point 5	0.22784	0.500
			Point 6	0.34479	0.750
			Point 7	0.44910	1.000

Regression Output:			Reported WLR	
Constant	b =	0.00591	b =	5.2247
Std Err of Y Est		0.04		
R Squared	r^2 =	0.99982	r^2 =	1.00000
No. of Observations		6.00		
Degrees of Freedom		4.00		
X Coefficient(s)	m =	0.44598	m =	0.4478
Std Err of Coef.	0.01			

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

METHOD: PCBs (EPA SW 846 Method 8082A)

Parameter: 1260-1

Order of regression: Linear

Date	Instrument	Compound	Points	x Response ratio	y Conc ratio
5/20/2018	SGC P3 CLP2	1260-1	Point 1	0.01796	0.025
			Point 2	0.03408	0.050
			Point 3	0.06217	0.100
			Point 4	0.14558	0.250
			Point 5	0.29219	0.500
			Point 6	0.43002	0.750
			Point 7	0.57516	1.000

Regression Output:			Reported WLR	
Constant	b =	0.00467	b =	4.36800
Std Err of Y Est		0.04		
R Squared	r^2 =	0.99994	r^2 =	1.00000
No. of Observations		6.00		
Degrees of Freedom		4.00		
X Coefficient(s)	m =	0.56991	m =	0.57070
Std Err of Coef.	0.01			

LDC#: 42791A3b

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC ✓ HPLC____

The percent difference (%D) of the initial calibration average Calibration Factors (CF) and the continuing calibration percent difference (%D) values were recalculated for the compounds identified below using the following calculation:

Percent difference (%D) = 100 * (N - C)/N

Where:

N = Initial Calibration Factor or Nominal Amount

C = Calibration Factor from Continuing Calibration Standard or Calculated Amount

#	Standard ID	Calibration Date	Compound	CCV Conc	Reported Conc	Recalculated Conc	Reported % D	Recalculated %D
1	07111803	7/11/2018	1260-1 CLP1	500	481.2	481.2	3.7	3.8
			1260-2 CLP2	500	491.4	491.4	1.7	1.7

LDC #: 42791 A3b

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG
2nd reviewer: [signature]

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: #1

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene						
Tetrachloro-m-xylene	CLP 2	20.0	16.3	82	82	9
Decachlorobiphenyl	↓	↓	18.3	92	92	↓
Decachlorobiphenyl						

Sample ID: _____

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Sample ID: _____

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Sample ID: _____

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Notes: _____

LDC #: 42791A3b

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicate Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

The percent recoveries (%R) and Relative Percent difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100* (SSC-SC)/SA

Where: SSC = Spiked sample concentration
SA = Spike added
SC = Concentration

RPD = I LCS - LCSD I * 2/(LCS + LCSD)

LCS = Laboratory control sample percent recovery

LCSD = Laboratory control sample duplicate percent recovery

LCS/LCSD samples: LCS 280-421495/2-A

Compound	Spike Added (ug/L)		Spiked Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
gamma-BHC										
4,4'-DDT										
Aroclor 1260	0.200	NA	0.186	NA	93	93				

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 42791 A3b

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer: [signature]

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Example:

Sample I.D. ND LCS 1260 CLP2

1260-1

Conc. = $\dfrac{\left[\dfrac{(106922507)(1000)}{(1014150374)}\right] - (4.368)}{(0.5707)}$

= 177.08

1260 Total = $\dfrac{177.08 + 169.4 + 199.7 + 192.4 + 191.3}{5}$

= 186.0

final conc. = $\dfrac{(186.0)(1\,ml)}{(1000\,ml)}$

= 0.186 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration ( )	Qualification
			0.186		

Note:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Ravenna, Ohio

LDC Report Date: August 3, 2018

Parameters: Metals

Validation Level: Stage 4

Laboratory: TestAmerica, Inc.

Sample Delivery Group (SDG): 280-111421-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
LL12mw-247-062618-GW	280-111421-4	Water	06/26/18
LL12mw-247-D-062618-GW	280-111421-5	Water	06/26/18
LL10mw-003-062618-GW	280-111421-7	Water	06/26/18
NTAmw-119-062518-GW	280-111421-8	Water	06/25/18
NTAmw-119-D-062518-GW	280-111421-9	Water	06/25/18
FWGmw-016-062518-GW	280-111421-13	Water	06/25/18
FWGmw-015-062518-GW	280-111421-14	Water	06/25/18
FWGmw-004-062518-GW	280-111421-15	Water	06/25/18
DETmw-003-D-062618-GW	280-111421-16	Water	06/26/18
DA2mw-115-062618-GW	280-111421-21	Water	06/26/18
DETmw-003-062618-GW	280-111421-22	Water	06/26/18
LL12mw-247-062618-GWMS	280-111421-4MS	Water	06/26/18
LL12mw-247-062618-GWMSD	280-111421-4MSD	Water	06/26/18
LL10mw-003-062618-GWMS	280-111421-7MS	Water	06/26/18
LL10mw-003-062618-GWMSD	280-111421-7MSD	Water	06/26/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with The Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Former Ravenna Army Ammunition Plant Portage and Trumbull Counties, Ohio (December 20, 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc by Environmental Protection Agency (EPA) SW 846 Methods 6010C/6020A
Mercury by EPA SW 846 Method 7470A

All sample results were subjected to Stage 4 evaluation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. 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.

IV. ICP Interference Check Sample Analysis

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

V. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Silver Vanadium	0.0380 ug/L 0.610 ug/L	All samples in SDG 280-11421-1
ICB/CCB	Antimony	0.617 ug/L	LL12mw-247-062618-GW LL12mw-247-D-062618-GW LL10mw-003-062618-GW NTAmw-119-062518-GW
ICB/CCB	Antimony	0.464 ug/L	NTAmw-119-D-062518-GW FWGmw-016-062518-GW FWGmw-015-062518-GW FWGmw-004-062518-GW DETmw-003-D-062618-GW DA2mw-115-062618-GW DETmw-003-062818-GW

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
LL12mw-247-D-062618-GW	Vanadium	1.8 ug/L	6.0U ug/L

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
LL10mw-003-062618-GWMS/MSD (LL10mw-003-062618-GW)	Sodium Iron	43 (87-115) -	36 (87-115) (75-87-115)	J (all detects) J (all detects)	A

For LL12mw-247-062618-GWMS/MSD, no data were qualified for Manganese percent recoveries (%R) outside the QC limits since the parent sample results were greater than 4X the spike concentration.

For LL10mw-003-062618-GWMS/MSD, no data were qualified for Calcium 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

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

IX. Serial Dilution

Serial dilution analysis was performed on an associated project sample. Percent differences (%D) were within QC limits with the following exceptions:

Diluted Sample	Analyte	%D (Limits)	Associated Samples	Flag	A or P
LL12mw-247-062618-GW	Manganese	11 (≤10)	LL12mw-247-062618-GW	J (all detects)	A

X. 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.

XI. Field Duplicates

Samples LL12mw-247-062618-GW and LL12mw-247-D-062618-GW, samples NTAmw-119-062518-GW and NTAmw-119-D-062518-GW, and samples DETmw-003-D-062618-GW and DETmw-003-062818-GW were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	LL12mw-247-062618-GW	LL12mw-247-D-062618-GW				
Aluminum	480	1100	-	620 (≤300)	-	-
Calcium	92000	96000	4 (≤20)	-	-	-
Iron	1700	2600	42 (≤20)	-	-	-
Magnesium	50000	51000	2 (≤20)	-	-	-
Potassium	2500	2700	-	200 (≤3000)	-	-
Sodium	22000	22000	-	0 (≤5000)	-	-
Arsenic	8.3	8.8	-	0.5 (≤5.0)	-	-
Barium	24	30	22 (≤20)	-	-	-
Beryllium	0.30U	0.11	-	0.19 (≤1.0)	-	-
Chromium	0.72	2.0	-	1.28 (≤10)	-	-
Cobalt	0.80	1.5	-	0.7 (≤1.0)	-	-
Copper	1.8U	1.0	-	0.8 (≤2.0)	-	-
Lead	0.35	0.84	-	0.49 (≤3.0)	-	-
Manganese	220	250	13 (≤20)	-	-	-
Nickel	0.97	2.4	-	1.43 (≤3.0)	-	-
Vanadium	2.0U	1.8	-	0.2 (≤6.0)	-	-

Analyte	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	LL12mw-247-062618-GW	LL12mw-247-D-062618-GW				
Zinc	3.0	7.0	-	4 (≤20)	-	-

Analyte	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	NTAmw-119-062518-GW	NTAmw-119-D-062518-GW				
Aluminum	100	50	-	50 (≤300)	-	-
Calcium	83000	83000	0 (≤20)	-	-	-
Iron	1100	1000	10 (≤20)	-	-	-
Magnesium	21000	21000	0 (≤20)	-	-	-
Potassium	1300	1400	-	100 (≤3000)	-	-
Sodium	6700	6600	-	100 (≤5000)	-	-
Arsenic	6.7	6.1	-	0.6 (≤5.0)	-	-
Barium	89	84	6 (≤20)	-	-	-
Cobalt	0.16	0.081	-	0.079 (≤1.0)	-	-
Manganese	360	340	6 (≤20)	-	-	-

Analyte	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	DETmw-003-D-062618-GW	DETmw-003-062818-GW				
Calcium	88000	88000	0 (≤20)	-	-	-
Iron	1800	1800	0 (≤20)	-	-	-
Magnesium	33000	32000	3 (≤20)	-	-	-
Potassium	2000	2000	-	0 (≤3000)	-	-
Sodium	12000	12000	-	0 (≤5000)	-	-
Arsenic	12	11	-	1 (≤5.0)	-	-
Barium	49	50	2 (≤20)	-	-	-

Analyte	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	DETmw-003-D-062618-GW	DETmw-003-062818-GW				
Cobalt	0.33	0.35	-	0.02 (≤1.0)	-	-
Manganese	270	260	4 (≤20)	-	-	-

XII. Internal Standards (ICP-MS)

All internal standard percent recoveries (%R) were within QC limits.

XIII. Sample Result Verification

All sample result verifications were acceptable.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to MS/MSD %R and serial dilution, data were qualified as estimated in two samples.

Due to laboratory blank contamination, data were qualified as not detected in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Ravenna, Ohio
Metals - Data Qualification Summary - SDG 280-111421-1

Sample	Analyte	Flag	A or P	Reason
LL10mw-003-062618-GW	Sodium Iron	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
LL12mw-247-062618-GW	Manganese	J (all detects)	A	Serial dilution (%D)

Ravenna, Ohio
Metals - Laboratory Blank Data Qualification Summary - SDG 280-111421-1

Sample	Analyte	Modified Final Concentration	A or P
LL12mw-247-D-062618-GW	Vanadium	6.0U ug/L	A

Ravenna, Ohio
Metals - Field Blank Data Qualification Summary - SDG 280-111421-1

No Sample Data Qualified in this SDG

LDC #: 42791A4a

SDG #: 280-111421-1

Laboratory: Test America, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 4

Date: 8/2/18

Page: 1 of 2

Reviewer: JB

2nd Reviewer: [signature]

METHOD: Metals (EPA SW 846 Method 6010C/6020A/7470A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	SW	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	SW	
VIII.	Duplicate sample analysis	N	
IX.	Serial Dilution	SW	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	SW	(1,2) (4,5) (9,11)
XII.	Internal Standard (ICP-MS)	A	
XIII.	Sample Result Verification	A	
XIV.	Overall Assessment of Data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	LL12mw-247-062618-GW	280-111421-4	Water	06/26/18
2	LL12mw-247-D-062618-GW	280-111421-5	Water	06/26/18
3	LL10mw-003-062618-GW	280-111421-7	Water	06/26/18
4	NTAmw-119-062518-GW	280-111421-8	Water	06/25/18
5	NTAmw-119-D-062518-GW	280-111421-9	Water	06/25/18
6	FWGmw-016-062518-GW	280-111421-13	Water	06/25/18
7	FWGmw-015-062518-GW	280-111421-14	Water	06/25/18
8	FWGmw-004-062518-GW	280-111421-15	Water	06/25/18
9	DETmw-003-D-062618-GW	280-111421-16	Water	06/26/18
10	DA2mw-115-062618-GW	280-111421-21	Water	06/26/18
11	DETmw-003-062818-GW	280-111421-22	Water	06/26/18
12	LL12mw-247-062618-GWMS	280-111421-4MS	Water	06/26/18
13	LL12mw-247-062618-GWMSD	280-111421-4MSD	Water	06/26/18
14	LL10mw-003-062618-GWMS	280-111421-7MS	Water	06/26/18
15	LL10mw-003-062618-GWMSD	280-111421-7MSD	Water	06/26/18

LDC #: 42791A4a

SDG #: 280-111421-1

Laboratory: Test America, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 4

Date: 8/21/18

Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: Metals (EPA SW 846 Method 6010C/6020A/7470A)

	Client ID	Lab ID	Matrix	Date
16				
17				
18				

Notes:

LDC #: 42791A4a

VALIDATION FINDINGS CHECKLIST

Reviewer: JB
2nd Reviewer: CV

Method: Metals (EPA SW 846 Method 6010/6020/7000)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. ICP/MS Tune				
Were all isotopes in the tuning solution mass resolution within 0.1 amu?	✓			
Were %RSD of isotopes in the tuning solution ≤5%?	✓			
III. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% (80-120% for mercury) QC limits?	✓			
Were the low standard checks within 70-130%	✓			
Were all initial calibration correlation coefficients within limits as specified by the method?	✓			
IV. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.	✓			
V. ICP Interference Check Sample				
Were ICP interference check samples performed daily?	✓			
Were the AB solution percent recoveries (%R) with the 80-120% QC limits?	✓			
VI. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.		✓		
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of +/- RL(+/-2X RL for soil) was used for samples that were ≤ 5X the RL, including when only one of the duplicate sample values were ≤ 5X the RL.	✓			
VII. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% QC limits for water samples and laboratory established QC limits for soils?	✓			

Validation Area	Yes	No	NA	Findings/Comments
VIII. Internal Standards (EPA SW 846 Method 6020/EPA 200.8)				
Were all the percent recoveries (%R) within the 30-120% (6020)/60-125% (200.8) of the intensity of the internal standard in the associated initial calibration?	✓			
If the %Rs were outside the criteria, was a reanalysis performed?			✓	
IX. ICP Serial Dilution				
Was an ICP serial dilution analyzed if analyte concentrations were > 50X the MDL (ICP)/>100X the MDL(ICP/MS)?	✓			
Were all percent differences (%Ds) < 10%?		✓		
Was there evidence of negative interference? If yes, professional judgement will be used to qualify the data.		✓		
X. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
XII. Field duplicates				
Field duplicate pairs were identified in this SDG.	✓			
Target analytes were detected in the field duplicates.	✓			
XIII. Field blanks				
Field blanks were identified in this SDG.		✓		
Target analytes were detected in the field blanks.			✓	

LDC #: 42791A4c

VALIDATION FINDINGS WORKSHEET
Sample Specific Element Reference

Reviewer: JB
2nd reviewer: [illegible]

All circled elements are applicable to each sample.

Sample ID	Matrix	Target Analyte List (TAL)
1-11	W	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
DC		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
12-15	W	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___

LDC #: 42791A4a

VALIDATION FINDINGS WORKSHEET
PB/ICB/CCB QUALIFIED SAMPLES

Reviewer: JB
2nd Reviewer:

METHOD: Trace metals (EPA SW 864 Method 6010B/6020/7000)
Soil preparation factor applied: NA
Sample Concentration units, unless otherwise noted: ug/L
Associated Samples: All

Analyte	Maximum PB[a] (mg/Kg)	Maximum PB[a] (ug/L)	Maximum ICB/CCB[a] (ug/L)	Action Level	2								
Ag			0.0380 J										
V			0.610 J		1.8 / 6.0								

Sample Concentration units, unless otherwise noted: ug/L
Associated Samples: 1 - 4

Analyte	Maximum PB[a] (mg/Kg)	Maximum PB[a] (ug/L)	Maximum ICB/CCB[a] (ug/L)	Action Level									
Sb			0.617 J										

Sample Concentration units, unless otherwise noted: ug/L
Associated Samples: 5 - 11

Analyte	Maximum PB[a] (mg/Kg)	Maximum PB[a] (ug/L)	Maximum ICB/CCB[a] (ug/L)	Action Level									
Sb			0.464 J										

Samples with analyte concentrations within five times the associated ICB, CCB or PB concentration are listed above with the identifications from the Validation Completeness Worksheet. These sample results were qualified as not detected, "U".
Note : a - The listed analyte concentration is the highest ICB, CCB, or PB detected in the analysis of each element.

LDC #: 42791A4a

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Reviewer: JB
2nd Reviewer:

METHOD: Trace metals (EPA SW 846 Method 6010/7000)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was a matrix spike analyzed for each matrix in this SDG?

Y (N) N/A Were matrix spike percent recoveries (%R) within the control limits of 75-125? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.

(Y) N N/A Were all duplicate sample relative percent differences (RPD) ≤ 20% for samples?

LEVEL IV ONLY:

(Y) N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	MS/MSD ID	Matrix	Analyte	MS %Recovery	MSD %Recovery	RPD (Limits)	Associated Samples	Qualifications
	(14,15)	W	Na	43 (87-115)	36 (87-115)		3	J (LV) A (Det)
			Fe		75 (87-115)		3	↓

Comments: (12,13); Mn > 4x (14,15); Ca > 4x

LDC #: 42791A4a

VALIDATION FINDINGS WORKSHEET
ICP Serial Dilution

Reviewer: 3
2nd Reviewer:

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A If analyte concentrations were > 50X the MDL (ICP) ,or >100X the MDL (ICP/MS), was a serial dilution analyzed?
Y (N) N/A Were ICP serial dilution percent differences (%D) ≤10%?
Y (N) N/A Is there evidence of negative interference? If yes, professional judgement will be used to qualify the data.

LEVEL IV ONLY:

(Y) N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	Diluted Sample ID	Matrix	Analyte	~~RPD~~ 7.D (Limits)	Associated Samples	Qualifications
	1	W	Mn	11 (10)	1	J/UJ/A (Det)

Comments:

LDC#: 42791A4a

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: VB
2nd Reviewer: [illegible]

METHOD: Metals (EPA Method 6010C/6020A/7470A)

Analyte	Concentration (ug/L)		RPD (≤30)	Difference	Limits	Qualifiers
	1	2				
Aluminum	480	1100		620	(≤300)	Jdet/A
Calcium	92000	96000	4			
Iron	1700	2600	42			Jdet/A
Magnesium	50000	51000	2			
Potassium	2500	2700		200	(≤3000)	
Sodium	22000	22000		0	(≤5000)	
Arsenic	8.3	8.8		0.5	(≤5.0)	
Barium	24	30	22			
Beryllium	0.30U	0.11		0.19	(≤1.0)	
Chromium	0.72	2.0		1.28	(≤10)	
Cobalt	0.80	1.5		0.7	(≤1.0)	
Copper	1.8U	1.0		0.8	(≤2.0)	
Lead	0.35	0.84		0.49	(≤3.0)	
Manganese	220	250	13			
Nickel	0.97	2.4		1.43	(≤3.0)	
Vanadium	2.0U	1.8		0.2	(≤6.0)	
Zinc	3.0	7.0		4	(≤20)	

Analyte	Concentration (ug/L)		RPD (≤20)	Difference	Limits	Qualifiers
	4	5				
Aluminum	100	50		50	(≤300)	
Calcium	83000	83000	0			

METHOD: Metals (EPA Method 6010/6020/7000)

Analyte	Concentration (ug/L)		RPD (≤20)	Difference	Limits	Qualifiers
	4	5				
Iron	1100	1000	10			
Magnesium	21000	21000	0			
Potassium	1300	1400		100	(≤3000)	
Sodium	6700	6600		100	(≤5000)	
Arsenic	6.7	6.1		0.6	(≤5.0)	
Barium	89	84	6			
Cobalt	0.16	0.081		0.079	(≤1.0)	
Manganese	360	340	6			

Analyte	Concentration (ug/L)		RPD (≤20)	Difference	Limits	Qualifiers
	9	11				
Calcium	88000	88000	0			
Iron	1800	1800	0			
Magnesium	33000	32000	3			
Potassium	2000	2000		0	(≤3000)	
Sodium	12000	12000		0	(≤5000)	
Arsenic	12	11		1	(≤5.0)	
Barium	49	50	2			
Cobalt	0.33	0.35		0.02	(≤1.0)	
Manganese	270	260	4			

LDC #: 42791A4a

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

Reviewer: JB
2nd Reviewer:

METHOD: Trace metals (EPA SW 846 Method 6010/6020/7000)

An initial and continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = Found / True x 100

Where, Found = concentration (in ug/L) of each analyte measured in the analysis of the ICV or CCV solution
True = concentration (in ug/L) of each analyte in the ICV or CCV source

Standard ID	Type of Analysis	Element	Found (ug/L)	True (ug/L)	Recalculated %R	Reported %R	Acceptable (Y/N)
ICVL	ICP (Low Level calibration) 7/6 13:30	K	2.773320 mg/L	3000 ug/L	92%	92%	Y
CRI	ICP/MS (Low Level calibration) 7/6 09:51	Sb	1.058 ug/L	1.00 ug/L	106%	106%	Y
ICV	ICP (Initial calibration) 7/9 13:34	Mg	10.016700 mg/L	10000 ug/L	100%	100%	Y
ICV	ICP/MS (Initial calibration) 7/6 9:41	Se	40.450 ug/L	40.0 ug/L	101%	101%	Y
ICV	CVAA (Initial calibration) 7/11 17:05	Hg	3.943 ug/L	4.00 ug/L	99%	99%	Y
CCV	ICP (Continuing calibration) 7/7 02:45	Ca	5.011288 mg/L	5000 ug/L	100%	100%	Y
CCV	ICP/MS (Continuing calibration) 7/6 23:51	Pb	52.641 ug/L	50.0 ug/L	105%	105%	Y
CCV	CVAA (Continuing calibration) 20:19	Hg	5.038 ug/L	5.00 ug/L	101%	101%	Y

ICP-MS TUNE	Calculation	Mass	Actual (Mean Counts / Axis)	Required (Counts / Axis)	Recalculated /Found %RSD / X%	Acceptable (Y/N)
	Mass Axis	208	208.000	± 0.1 AMU	NA	Y
	%RSD	59	14765	≤ 5% RSD	1.21%	Y

Comments:

LDC #: 42791A4a

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: JB
2nd Reviewer:

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

Percent recoveries (%R) for an ICP interference check sample, a laboratory control sample and a matrix spike sample were recalculated using the following formula:

%R = Found x 100 / True

Where, Found = Concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = Concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

RPD = |S-D| x 100 / (S+D)/2

Where, S = Original sample concentration
D = Duplicate sample concentration

An ICP serial dilution percent difference (%D) was recalculated using the following formula:

%D = |I-SDR| x 100 / I

Where, I = Initial Sample Result (mg/L)
SDR = Serial Dilution Result (mg/L) (Instrument Reading x 5)

Sample ID	Type of Analysis	Element	Found / S / I (units)	True / D / SDR (units)	Recalculated %R / RPD / %D	Reported %R / RPD / %D	Acceptable (Y/N)
ICSAB	ICP interference check 420/16 10:09	V	104.245 ug/L	100ug/L	104.	104.	Y
LCS	Laboratory control sample 02:11	Fe	1.026895 mg/L	1000 ug/L	103.	103.	Y
MS	Matrix spike -4 19:54	Hg	ND (SSR-SR) 5.10 ug/L	5.00ug/L	102.	102.	Y
MSD	Duplicate -4 53	Hg	5.447 ug/L	FOUND: 5.10 ug/L	7 RPD	7 RPD	Y
PDS	Post digestion spike -4	Ag	53.007ug/L	SR= ND SA = 50.0 ug/L	106.	106.	Y
SD	ICP serial dilution -4 02:18	Ca	92004 ug/L	SR = 92000 ug/L	07.7	0.107.7	Y

Comments: _____

LDC #: 42791A4a
SDG #: 280-111421-1

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JB
2nd reviewer: [illegible]

METHOD: Trace metals (EPA CLP SOW ILM02.1)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments and within the linear range of the ICP?
Y N N/A Are all detection limits below the CRDL?

Detected analyte results for Mg #10 were recalculated and verified using the following equation:

Concentration = (RD)(FV)(Dil) / (In. Vol.)

RD = Raw data concentration
FV = Final volume (ml)
In. Vol. = Initial volume (ml) or weight (G)
Dil = Dilution factor

Recalculation:

Mg #10 From Raw Data = 29.456300 mg/L
= 29456.300 ug/L

#	Sample ID	Analyte	Reported Concentration (ug/L)	Calculated Concentration (ug/L)	Acceptable (Y/N)
23:04	1	Zn	3.0	3.0	Y
2:31	2	Fe	2600	2600	Y
23:37	3	Ba	1.3	1.3	Y
2:58	4	Al	100	100	Y
00:01	5	Mn	340	340	Y
3:05	6	K	2300	2300	Y
03	7	Co	0.25	0.25	Y
3:12	8	Na	4400	4400	Y
15	9	As	12	12	Y
7/10 1:13	10	Mg	29000	29000	Y
3:27	11	Ca	88000	88000	Y

Note: _____

LDC Report# 42791A6

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Ravenna, Ohio

LDC Report Date: August 3, 2018

Parameters: Wet Chemistry

Validation Level: Stage 4

Laboratory: TestAmerica, Inc.

Sample Delivery Group (SDG): 280-111421-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
FBQmw-174-062518-GW	280-111421-1	Water	06/25/18
FBQmw-175-062518-GW	280-111421-2	Water	06/25/18
FBQmw-176-062518-GW	280-111421-3	Water	06/25/18
LL12mw-247-062618-GW	280-111421-4	Water	06/26/18
LL12mw-247-D-062618-GW	280-111421-5	Water	06/26/18
LL4mw-193-062618-GW	280-111421-6	Water	06/26/18
NTAmw-117-062518-GW	280-111421-10	Water	06/25/18
NTAmw-118-062518-GW	280-111421-11	Water	06/25/18
DETmw-003-D-062618-GW	280-111421-16	Water	06/26/18
FWGmw-010-062618-GW	280-111421-17	Water	06/26/18
DA2mw-115-062618-GW	280-111421-21	Water	06/26/18
DETmw-003-062818-GW	280-111421-22	Water	06/26/18
NTAmw-120-062618-GW	280-111421-23	Water	06/26/18
NTAmw-120-D-062618-GW	280-111421-24	Water	06/26/18
LL12mw-247-062618-GWMS	280-111421-4MS	Water	06/26/18
LL12mw-247-062618-GWMSD	280-111421-4MSD	Water	06/26/18
LL12mw-247-062618-GWDUP	280-111421-4DUP	Water	06/26/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with The Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Former Ravenna Army Ammunition Plant Portage and Trumbull Counties, Ohio (December 20, 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Alkalinity by Standard Method 2320B
Sulfide by Environmental Protection Agency (EPA) SW 846 Method 9034
Chloride, Sulfate, and Nitrate as Nitrogen by EPA SW 846 method 9056A
Total Cyanide by EPA SW 846 Method 9012B
Nitrocellulose by EPA Method 353.2

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

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

III. Continuing Calibration

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

IV. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Chloride Sulfate Alkalinity	627 ug/L 520 ug/L 2.21 mg/L	FBQmw-174-062518-GW FBQmw-175-062518-GW
ICB/CCB	Sulfate Alkalinity	0.493 ug/L 1.69 ug/L	FBQmw-174-062518-GW FBQmw-175-062518-GW
PB (prep blank)	Cyanide	2.77 ug/L	FBQmw-176-062518-GW LL12mw-247-062618-GW LL12mw-247-D-062618-GW LL4mw-193-062618-GW NTAmw-117-062518-GW NTAmw-118-062518-GW DETmw-003-D-062618-GW FWGmw-010-062618-GW DA2mw-115-062618-GW DETmw-003-062818-GW
ICB/CCB	Chloride	0.619 ug/L	FBQmw-174-062518-GW
ICB/CCB	Chloride	0.669 ug/L	FBQmw-175-062518-GW

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
FBQmw-174-062518-GW	Chloride	1400 ug/L	3000U ug/L
FBQmw-175-062518-GW	Chloride Alkalinity	2000 ug/L 4.9 mg/L	3000U ug/L 5.0U mg/L
FBQmw-176-062518-GW	Cyanide	6.1 ug/L	20U ug/L
LL12mw-247-062618-GW	Cyanide	2.1 ug/L	10U ug/L
LL12mw-247-D-062618-GW	Cyanide	3.0 ug/L	10U ug/L
LL4mw-193-062618-GW	Cyanide	2.8 ug/L	10U ug/L
NTAmw-117-062518-GW	Cyanide	2.7 ug/L	10U ug/L
NTAmw-118-062518-GW	Cyanide	3.9 ug/L	10U ug/L
FWGmw-010-062618-GW	Cyanide	2.6 ug/L	10U ug/L

V. Field Blanks

Samples FBQmw-174-062518-GW, FBQmw-175-062518-GW, and FBQmw-176-062518-GW were identified as field blanks. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration	Associated Samples
FBQmw-174-062518-GW	06/25/18	Chloride Sulfate Alkalinity	1400 ug/L 12000 ug/L 5.5 mg/L	No associated samples in this SDG
FBQmw-175-062518-GW	06/25/18	Sulfide Chloride Sulfate Alkalinity	800 ug/L 2000 ug/L 17000 ug/L 4.9 mg/L	No associated samples in this SDG
FBQmw-176-062518-GW	06/25/18	Cyanide	6.1 ug/L	LL12mw-247-062618-GW LL12mw-247-D-062618-GW LL4mw-193-062618-GW NTAmw-117-062518-GW NTAmw-118-062518-GW DETmw-003-D-062618-GW FWGmw-010-062618-GW DA2mw-115-062618-GW DETmw-003-062818-GW

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 with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
LL12mw-247-062618-GW	Cyanide	2.1 ug/L	10U ug/L
LL12mw-247-D-062618-GW	Cyanide	3.0 ug/L	10U ug/L
LL4mw-193-062618-GW	Cyanide	2.8 ug/L	10U ug/L
NTAmw-117-062518-GW	Cyanide	2.7 ug/L	10U ug/L
NTAmw-118-062518-GW	Cyanide	3.9 ug/L	10U ug/L
FWGmw-010-062618-GW	Cyanide	2.6 ug/L	10U ug/L

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VII. Duplicate Sample Analysis

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

VIII. 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.

IX. Field Duplicates

Samples LL12mw-247-062618-GW and LL12mw-247-D-062618-GW, samples DETmw-003-D-062618-GW and DETmw-003-062818-GW, and samples NTAmw-120-062618-GW and NTAmw-120-D-062618-GW were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	LL12mw-247-062618-GW	LL12mw-247-D-062618-GW				
Cyanide	2.1	3.0	-	0.9 (≤10)	-	-

X. Sample Result Verification

All sample result verifications were acceptable.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to laboratory blank contamination, data were qualified as not detected in nine samples.

Due to field blank contamination, data were qualified as not detected in six samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Based upon the data validation all other results are considered valid and usable for all purposes.

Ravenna, Ohio
Wet Chemistry - Data Qualification Summary - SDG 280-111421-1

No Sample Data Qualified in this SDG

Ravenna, Ohio
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 280-111421-1

Sample	Analyte	Modified Final Concentration	A or P
FBQmw-174-062518-GW	Chloride	3000U ug/L	A
FBQmw-175-062518-GW	Chloride Alkalinity	3000U ug/L 5.0U mg/L	A
FBQmw-176-062518-GW	Cyanide	20U ug/L	A
LL12mw-247-062618-GW	Cyanide	10U ug/L	A
LL12mw-247-D-062618-GW	Cyanide	10U ug/L	A
LL4mw-193-062618-GW	Cyanide	10U ug/L	A
NTAmw-117-062518-GW	Cyanide	10U ug/L	A
NTAmw-118-062518-GW	Cyanide	10U ug/L	A
FWGmw-010-062618-GW	Cyanide	10U ug/L	A

Ravenna, Ohio
Wet Chemistry - Field Blank Data Qualification Summary - SDG 280-111421-1

Sample	Analyte	Modified Final Concentration	A or P
LL12mw-247-062618-GW	Cyanide	10U ug/L	A
LL12mw-247-D-062618-GW	Cyanide	10U ug/L	A
LL4mw-193-062618-GW	Cyanide	10U ug/L	A
NTAmw-117-062518-GW	Cyanide	10U ug/L	A
NTAmw-118-062518-GW	Cyanide	10U ug/L	A

Sample	Analyte	Modified Final Concentration	A or P
FWGmw-010-062618-GW	Cyanide	10U ug/L	A

LDC #: 42791A6
SDG #: 280-111421-1
Laboratory: Test America, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 4

Date: 8/2/19
Page: 1 of 2
Reviewer: VB
2nd Reviewer: [signature]

METHOD: (Analyte) Alkalinity (SM 2320B), Sulfide (EPA SW846 Method 9034), Chloride, Sulfate, Nitrate as N (EPA SW846 Method 9056A)Total Cyanide (EPA SW846 Method 9012B), Nitrocellulose (EPA Method 353.2)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	SW	FB = 1-3
VI.	Matrix Spike/Matrix Spike Duplicates	A	(15,16)
VII.	Duplicate sample analysis	A	17
VIII.	Laboratory control samples	A	LCS ID
IX.	Field duplicates	SW	(4,5) (9,12)* (13,14)*
X.	Sample result verification	A	
XI	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; *ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	FBQmw-174-062518-GW	280-111421-1	Water	06/25/18
2	FBQmw-175-062518-GW	280-111421-2	Water	06/25/18
3	FBQmw-176-062518-GW	280-111421-3	Water	06/25/18
4	LL12mw-247-062618-GW	280-111421-4	Water	06/26/18
5	LL12mw-247-D-062618-GW	280-111421-5	Water	06/26/18
6	LL4mw-193-062618-GW	280-111421-6	Water	06/26/18
7	NTAmw-117-062518-GW	280-111421-10	Water	06/25/18
8	NTAmw-118-062518-GW	280-111421-11	Water	06/25/18
9	DETmw-003-D-062618-GW	280-111421-16	Water	06/26/18
10	FWGmw-010-062618-GW	280-111421-17	Water	06/26/18
11	DA2mw-115-062618-GW	280-111421-21	Water	06/26/18
12	DETmw-003-062818-GW	280-111421-22	Water	06/26/18
13	NTAmw-120-062618-GW	280-111421-23	Water	06/26/18
14	NTAmw-120-D-062618-GW	280-111421-24	Water	06/26/18
15	LL12mw-247-062618-GWMS	280-111421-4MS	Water	06/26/18
16	LL12mw-247-062618-GWMSD	280-111421-4MSD	Water	06/26/18
17	LL12mw-247-062618-GWDUP	280-111421-4DUP	Water	06/26/18

LDC #: 42791A6

SDG #: 280-111421-1

Laboratory: Test America, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 4

Date: 8/2/18

Reviewer:

2nd Reviewer:

METHOD: (Analyte) Alkalinity (SM 2320B), Sulfide (EPA SW846 Method 9034), Chloride, Sulfate, Nitrate as N (EPA SW846 Method 9056A)Total Cyanide (EPA SW846 Method 9012B), Nitrocellulose (EPA Method 353.2)

	Client ID	Lab ID	Matrix	Date
18				
19				
20				

Notes:

LDC #: 42791A6

VALIDATION FINDINGS CHECKLIST

Reviewer: JB
2nd Reviewer:

Method: Inorganics (EPA Method See Cover)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
II. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial calibration correlation coefficients ≥ 0.995?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% QC limits?	✓			
Were titrant checks performed as required? (Level IV only)	✓			
Were balance checks performed as required? (Level IV only)			✓	
III. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.	✓			
IV. Matrix spike/Matrix spike duplicates and Duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	✓			
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of ≤ CRDL(≤ 2X CRDL for soil) was used for samples that were ≤ 5X the CRDL, including when only one of the duplicate sample values were ≤ 5X the CRDL.	✓			
V. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% (85-115% for Method 300.0) QC limits?	✓			
VI. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?			✓	
Were the performance evaluation (PE) samples within the acceptance limits?			✓	

LDC #: 42791A6

VALIDATION FINDINGS CHECKLIST

Reviewer: JB
2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
VII. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were detection limits < RL?	✓			
VIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
IX. Field duplicates				
Field duplicate pairs were identified in this SDG.	✓			
Target analytes were detected in the field duplicates.	✓			
X. Field blanks				
Field blanks were identified in this SDG.	✓			
Target analytes were detected in the field blanks.	✓			

LDC #: 42791A4

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: JB
2nd reviewer:

All circled methods are applicable to each sample.

Sample ID	Parameter
1, 2	pH TDS (Cl) F NO_3 NO_2 (SO_4) O-PO_4 (Alk) CN NH_3 TKN TOC Cr6+ ClO_4 (S^{2-})
3, 6 - 12	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk (CN) NH_3 TKN TOC Cr6+ ClO_4
4, 5	pH TDS Cl F (NO_3) NO_2 SO_4 O-PO_4 Alk (CN) NH_3 TKN TOC Cr6+ ClO_4
13, 14	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 Nitrocellulose
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
DC	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
15, 16	pH TDS Cl F (NO_3) NO_2 SO_4 O-PO_4 Alk (CN) NH_3 TKN TOC Cr6+ ClO_4
17	pH TDS Cl F (NO_3) NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4

Comments:

LDC #: 42791A6

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JB
2nd Reviewer:

METHOD: Inorganics, Method See Cover

Conc. units: ug/L **Associated Samples** 1, 2

Analyte	Blank ID	Blank ID	Blank Action Limit										
	PB	ICB/CCB (mg/L)		1	2								
Chloride	627 J			1400 / 3000	2000 / 3000								
Sulfate	520 J	0.493 J											
Alkalinity (mg/L)	2.21 J	1.69 J			4.9 / 5.0								

Conc. units: ug/L **Associated Samples:** 3 - 12

Analyte	Blank ID	Blank ID	Blank Action Limit										
	PB	ICB/CCB (mg/L)		3	4	5	6	7	8	10			
Cyanide	2.77 J			6.1 / 20	2.1 / 10	3.0 / 10	2.8 / 10	2.7 / 10	3.9 / 10	2.6 / 10			

Conc. units: ug/L **Associated Samples:** 1

Analyte	Blank ID	Blank ID	Blank Action Limit										
	PB	ICB/CCB (mg/L)		1									
Chloride		0.619 J		1400 / 3000									

Conc. units: ug/L **Associated Samples:** 2

Analyte	Blank ID	Blank ID	Blank Action Limit										
	PB	ICB/CCB (mg/L)		2									
Chloride		0.669 J		2000 / 3000									

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".

LDC #: 42791A6

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reviewer: AG
2nd Reviewer:

METHOD: Inorganics, EPA Method See Cover
Blank units: ug/L **Associated sample units: ug/L**
Sampling date: 6/25/18 Soil factor applied NA
Field blank type: (circle one) Field Blank / Rinsate / Other: FB Associated Samples: NONE

Analyte	Blank ID	Action Limit	Sample Identification							
	1									
Chloride	1400 J									
Sulfate	12000									
Alkalinity (mg/L)	5.5									

Blank units: ug/L **Associated sample units: ug/L**
Sampling date: 6/25/18 Soil factor applied NA
Field blank type: (circle one) Field Blank / Rinsate / Other: FB Associated Samples: NONE

Analyte	Blank ID	Action Limit	Sample Identification							
	2									
Sulfide	800 J									
Chloride	2000 J									
Sulfate	17000									
Alkalinity (mg/L)	4.9 J									

Blank units: ug/L **Associated sample units: ug/L**
Sampling date: 6/25/18 Soil factor applied NA
Field blank type: (circle one) Field Blank / Rinsate / Other: FB Associated Samples: 4 - 12

Analyte	Blank ID	Action Limit	Sample Identification							
	3		4	5	6	7	8	10		
Cyanide	6.1 J		2.1 / 10	3.0 / 10	2.8 / 10	2.7 / 10	3.9 / 10	2.6 / 10		

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Samples with analyte concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, "U".

LDC#: 42791A6

VALIDATION FINDINGS WORKSHEET

Field Duplicates

Reviewer: [illegible]

2nd Reviewer: [illegible]

Inorganics, Method See Cover

Analyte	Concentration (ug/L)		RPD (≤30)	Difference	Limits	Qualification (Parent only)
	4	5				
Cyanide	2.1	3.0		0.9	(≤ 10)	

V:\FIELD DUPLICATES\Field Duplicates\FD_inorganic\2018\42791A6.wpd

LDC #: 42791A6

Validation Findings Worksheet
Initial and Continuing Calibration Calculation Verification

Page: 1 of 1
Reviewer: VB
2nd Reviewer:

Method: Inorganics, Method See Cover

The correlation coefficient (r) for the calibration of CN^- was recalculated. Calibration date: 6/29/18

An initial or continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

$$\%R = \frac{\text{Found} \times 100}{\text{True}}$$

Where, Found = concentration of each analyte measured in the analysis of the ICV or CCV solution
True = concentration of each analyte in the ICV or CCV source

Type of analysis	Analyte	Standard	Conc. (ug/L)	Response	Recalculated r or r^2	Reported r or r^2	Acceptable (Y/N)
Initial calibration	CN^-	s1	0	315.564972	*0.999956*	0.999956	Y
		s2	10	7565.687012			
		s3	20	14719.72949			
		s4	50	36849.75			
		s5	100	72742.10938			
		s6	200	143567.4219			
		s7	400	282311.3438			
6/20 Calibration verification	NO_3	ICV	FOUND: 3.8452 mg/L	TRUE: 4.00 mg/L	96.	96.	Y
Calibration verification	AlK^-	CCV	FOUND: 201 mg/L	TRUE: 200 mg/L	101.	101.	Y
Calibration verification							

Comments: Refer to Calibration Verification findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 42791A4

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: JB
2nd Reviewer:

METHOD: Inorganics, Method See Cover

Percent recoveries (%R) for a laboratory control sample and a matrix spike sample were recalculated using the following formula:

%R = Found x 100 / True Where, Found = concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

RPD = |S-D| x 100 / (S+D)/2 Where, S = Original sample concentration
D = Duplicate sample concentration

Sample ID	Type of Analysis	Element	Found / S (units)	True / D (units)	Recalculated %R / RPD	Reported %R / RPD	Acceptable (Y/N)
LCS	Laboratory control sample 6127	NO_3	5.0599 mg/L	5.00 mg/L	101%	101%	Y
MS	Matrix spike sample	CN	2.1 (SSR-SR) 100.9607 ug/L -SR = 98.8607 ug/L	100 ug/L	99% ~~100 ug/L~~ JB	99%	Y
MSD	Duplicate sample	CN	100.680 ug/L	FOUND: 100.9607 ug/L	ORPD	ORPD	Y

Comments: _____

LDC #: 42791A6

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: JB
2nd reviewer: [illegible]

METHOD: Inorganics, Method See Cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments?
Y N N/A Are all detection limits below the CRQL?

Compound (analyte) results for SO_4 #1 reported with a positive detect were recalculated and verified using the following equation:

Concentration =

Recalculation:

SO_4 - $y = mx + b$

$y = 4794781B$

$m = 4117419.242$

$b = -1700646.886$

$SO_4 = \frac{4117419.242 + 1700646.886}{4117419.242}$

$= 12.057\ mg/L = 12057\ ug/L$

#	Sample ID	Analyte	Reported Concentration (ug/L)	Calculated Concentration (ug/L)	Acceptable (Y/N)
	1	SO_4	12000	12000	Y
	2	S^{2-}	800	800	Y
		Alk	4.9 mg/L	4.9 mg/L	Y
	3	CN	6.1	6.1	Y
	4	CN^-	2.1	2.1	Y
	5	CN^-	3.0	3.0	Y
	6	CN^-	2.8	2.8	Y
	7	CN^-	2.7	2.7	Y
	8	CN^-	3.9	3.9	Y
	10	CN^-	2.6	2.6	Y

Note:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Ravenna, Ohio

LDC Report Date: August 3, 2018

Parameters: Explosives

Validation Level: Stage 4

Laboratory: TestAmerica, Inc.

Sample Delivery Group (SDG): 280-111421-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
FBQmw-174-062518-GW	280-111421-1	Water	06/25/18
LL12mw-247-062618-GW	280-111421-4	Water	06/26/18
LL12mw-247-D-062618-GW	280-111421-5	Water	06/26/18
NTAmw-119-062518-GW	280-111421-8	Water	06/25/18
NTAmw-119-D-062518-GW	280-111421-9	Water	06/25/18
FWGmw-016-062518-GW	280-111421-13	Water	06/25/18
FWGmw-015-062518-GW	280-111421-14	Water	06/25/18
FWGmw-004-062518-GW	280-111421-15	Water	06/25/18
DETmw-003-D-062618-GW	280-111421-16	Water	06/26/18
DA2mw-115-062618-GW	280-111421-21	Water	06/26/18
DETmw-003-062618-GW	280-111421-22	Water	06/26/18
NTAmw-120-062618-GW	280-111421-23	Water	06/26/18
NTAmw-120-D-062618-GW	280-111421-24	Water	06/26/18
LL12mw-247-062618-GWMS	280-111421-4MS	Water	06/26/18
LL12mw-247-062618-GWMSD	280-111421-4MSD	Water	06/26/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with The Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Former Ravenna Army Ammunition Plant Portage and Trumbull Counties, Ohio (December 20, 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Explosives by Environmental Protection Agency (EPA) SW 846 Method 8330B

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average calibration factors were utilized, percent relative standard deviations (%RSD) were less than or equal to 15.0% with the following exceptions:

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

Retention time windows were established as required by the method.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

Retention times of all compounds in the calibration standards were within the established retention time windows.

IV. Laboratory Blanks

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

V. Field Blanks

Sample FBQmw-174-062518-GW was identified as a field blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
FBQmw-174-062518-GW	06/26/18	2,4-Dinitrotoluene 2-Amino-4,6-dinitrotoluene 4-Amino-2,6-dinitrotoluene 2,4,6-Trinitrotoluene	0.29 ug/L 9.1 ug/L 26 ug/L 28 ug/L	LL12mw-247-062618-GW LL12mw-247-D-062618-GW NTAmw-119-062518-GW NTAmw-119-D-062518-GW FWGmw-016-062518-GW FWGmw-015-062518-GW FWGmw-004-062518-GW DETmw-003-D-062618-GW DA2mw-115-062618-GW DETmw-003-062618-GW

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. Surrogates

Surrogates were added to all samples as required by the method. All 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. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples

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

IX. Field Duplicates

Samples LL12mw-247-062618-GW and LL12mw-247-D-062618-GW, samples NTAmw-119-062518-GW and NTAmw-119-D-062518-GW, samples DETmw-003-D-062618-GW and DETmw-003-062618-GW, and samples NTAmw-120-062618-GW and NTAmw-120-D-062618-GW were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	NTAmw-119-062518-GW	NTAmw-119-D-062518-GW				
4-Nitrotoluene	0.58	0.41U	-	0.17 (≤1.0)	-	-

Compound	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	NTAmw-120-062618-GW	NTAmw-120-D-062618-GW				
4-Nitrotoluene	0.40	0.60	-	0.2 (≤1.0)	-	-

X. Compound Quantitation

All compound quantitations met validation criteria.

XI. Target Compound Identifications

All target compound identifications met validation criteria.

XII. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Ravenna, Ohio
Explosives - Data Qualification Summary - SDG 280-111421-1

No Sample Data Qualified in this SDG

Ravenna, Ohio
Explosives - Laboratory Blank Data Qualification Summary - SDG 280-111421-1

No Sample Data Qualified in this SDG

Ravenna, Ohio
Explosives - Field Blank Data Qualification Summary - SDG 280-111421-1

No Sample Data Qualified in this SDG

LDC #: 42791A40a
SDG #: 280-111421-1
Laboratory: Test America, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 4

Date: 08/02/18
Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: HPLC Explosives (EPA SW 846 Method 8330B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	Initial calibration/ICV	A / A	ICAL ≤ 15% r² ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	SW	FB = 1
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	D = 2/3*, 4/5, 9/11*, 14/15
X.	Compound quantitation RL/LOQ/LODs	A	
XI.	Target compound identification	A	
XII.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; * ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID		Lab ID	Matrix	Date
+ 1	FBQmw-174-062518-GW		280-111421-1	Water	06/25/18
- 2	LL12mw-247-062618-GW	D1	280-111421-4	Water	06/26/18
- 3	LL12mw-247-D-062618-GW	D1	280-111421-5	Water	06/26/18
+ 4	NTAmw-119-062518-GW	D2	280-111421-8	Water	06/25/18
- 5	NTAmw-119-D-062518-GW	D2	280-111421-9	Water	06/25/18
- 6	FWGmw-016-062518-GW		280-111421-13	Water	06/25/18
- 7	FWGmw-015-062518-GW		280-111421-14	Water	06/25/18
- 8	FWGmw-004-062518-GW		280-111421-15	Water	06/25/18
- 9	DETmw-003-D-062618-GW	D3	280-111421-16	Water	06/26/18
- 10	DA2mw-115-062618-GW		280-111421-21	Water	06/26/18
+- 11	DETmw-003-062618-GW	D3	280-111421-22	Water	06/26/18
12	LL12mw-247-062618-GWMS		280-111421-4MS	Water	06/26/18
13	LL12mw-247-062618-GWMSD		280-111421-4MSD	Water	06/26/18
14	NTAmw-120-062618-GW	D4	-23		
	Notes: NTAmw-120-D-062618-GW	D4	-24		
F	MB 280-420700/1-A				

X/10X

IS

LDC #: 42791 A40a

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

Method: GC ✓ HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
IIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?	✓			
Were the RT windows properly established?	✓			
IIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
III. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
Were all the retention times within the acceptance windows?	✓			
IV. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
V. Field Blanks				
Were field blanks identified in this SDG?	✓			
Were target compounds detected in the field blanks?	✓			
VI. Surrogate spikes				
Were all surrogate percent recovery (%R) within the QC limits?	✓			
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	✓			
Was a MS/MSD analyzed every 20 samples of each matrix?	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	✓			

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
X. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: ____GC __/__HPLC

8310	8330	8151	8141	8141(Con't)	8021B
A. Acenaphthene	A. HMX	A. 2,4-D	A. Dichlorvos	X. EPN	V. Benzene
B. Acenaphthylene	B. RDX	B. 2,4-DB	B. Mevinphos	Y. Azinphos-methyl	CC. Toluene
C. Anthracene	C. 1,3,5-Trinitrobenzene	C. 2,4,5-T	C. Demeton-O	Z. Coumaphos	EE. Ethyl Benzene
D. Benzo(a)anthracene	D. 1,3-Dinitrobenzene	D. 2,4,5-TP	D. Demeton-S	AA. Parathion	SSS. O-Xylene
E. Benzo(a)pyrene	E. Tetryl	E. Dinoseb	E. Ethoprop	BB. Trichloronate	RRR. MP-Xylene
F. Benzo(b)fluoranthene	F. Nitrobenzene	F. Dichlorprop	F. Naled	CC. Trichlorinate	GG. Total Xylene
G. Benzo(g,h,i)perylene	G. 2.4.6-Trinitrotoluene	G. Dicamba	G. Sulfotep	DD. Trifluralin	
H. Benzo(k)fluoranthene	H. 4-Amino-2,6-dinitrotoluene	H. Dalapon	H. Phorate	EE. Def	**8315A**
I. Chrysene	I. 2-Amino-4,6-dinitrotoluene	I. MCPP	I. Dimethoate	FF. Prowl	A. Formaldehyde
J. Dibenz(a,h)anthracene	J. 2,4-Dinitrotoluene	J. MCPA	J. Diazinon	GG. Ethion	B. Acetaldehyde
K. Fluoranthene	K. 2,6-Dinitrotoluene	K. Pentachlorophenol	K. Disulfoton	HH. Famphur	C. Benzaldehyde
L. Fluorene	L. 2-Nitrotoluene	L. 2,4,5-TP (silvex)	L. Parathion-methyl	II. Phosmet	D. Butyraldehyde
M. Indeno(1,2,3-cd)pyrene	M. 3-Nitrotoluene	M. Silvex	M. Ronnel	JJ. Tetrachlorvinphos	
N. Naphthalene	N. 4-Nitrotoluene	N.	N. Malathion	KK. Demeton (total)	
O. Phenanthrene	O. Nitroglycerin	O.	O. Chlorpyrifos		
P. Pyrene	P. Picric acid	P.	P. Fenthion		
Q.	Q. 2,4-Dinitrophenol	Q.	Q. Parathion-ethyl		
R.	R. 3,5-Dinitroaniline		R. Trichlornate		
S.	S. 2-Nitrophenol		S. Merphos		
	T. 4-Nitrophenol		T. Stirofos		
	U. Picramic acid		U. Tokuthion		
	V. PETN		V. Fensulfothion		
			W. Bolstar		

Notes:_____

LDC #: 42791A40a

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reviewer: JMG
2nd Reviewer:

METHOD: __ GC __HPLC

Y N N/A Were field blanks identified in this SDG?

Y N N/A Were target compounds detected in the field blanks?

Blank units: ug/L **Associated sample units:** ug/L

Sampling date: 06/26/18

Field blank type: (circle one) Field Blank / Trip Blank / Atmospheric Blank / Ambient Blank Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other:_____

Associated Samples: All except 1 (ND)

Compound	Blank ID	Blank ID	Sample Identification							
	1									
J	0.29									
I	9.1									
H	26									
G	28									
CRQL										

Blank units:_____ **Associated sample units:**_____

Sampling date:_____

Field blank type: (circle one) Field Blank / Trip Blank/ Atmospheric Blank/ Ambient Blank Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other:_____

Associated Samples:_____

Compound	Blank ID	Blank ID	Sample Identification							
CRQL										

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:

Samples with compound concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, "U".

LDC#: 42791A40a

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: ~~X~~

METHOD: HPLC Explosives (EPA SW 846 Method 8330B)

(Y) N NA Were field duplicate pairs identified in this SDG?
Y (N) NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/L)		RPD (≤_____ %)	Difference (ug/L)	Limits (<LOQ)	Qualifications (Parent Only)
	4	5				
N	0.58	0.41U		0.17	(≤1.0)	

Compound	Concentration (ug/L)		RPD (≤_____ %)	Difference (ug/L)	Limits (<LOQ)	Qualifications (Parent Only)
	14	15				
N	0.40	0.60		0.2	(≤1.0)	

V:\Josephine\FIELD DUPLICATES\42791A40a cardno ravenna.wpd

LDC #: 42791A40

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC _____ HPLC /

The calibration factors (CF), average CF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

CF = A/C
average CF = sum of the CF/number of standards
%RSD = 100 * (S/X)

Where:
A = Area of compound
C = Concentration of compound
S = Standard deviation of calibration factors
X = Mean of calibration factors

#	Standard ID	Calibration Date	Compound	Reported CF (0.10 std)	Recalculated CF (0.10 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL HPLC X3	5/18/2018	HMX (Ultracarb5u)	81370	81370	84945.63	84945.63	3.5	3.5
			2-4,6-TNT (Ultracarb5u)	210707	210707	214477.88	214477.88	2.8	2.8
2	ICAL G2_Luna	7/10/2018	HMX (Luna-phenyl)	182750	182750	179938.11	179938.11	1.6	1.6
			2-4,6-TNT (Luna-phenyl)	420857	420857	416300.99	416300.99	9.9	9.9

LDC # 42791A40

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC____HPLC✓

The percent difference (%D) of the initial calibration average Calibration Factors (CF) and the continuing calibration percent difference (%D) values were recalculated for the compounds identified below using the following calculation:

Percent difference (%D) = 100 * (N - C)/N

Where:
N = Initial Calibration Factor or Nominal Amount
C = Calibration Factor from Continuing Calibration Standard or Calculated Amount

#	Standard ID	Calibration Date	Compound	CCV Conc	Reported Conc	Recalculated Conc	Reported % D	Recalculated %D
1	07030007 X3	7/3/2018	HMX (Ultracarb5u)	0.2500	0.2577	0.2577	3.1	3.1
			2-4,6-TNT (Ultracarb5u)	0.2500	0.2603	0.2603	4.1	4.1
2	07030007 X3	7/3/2018	HMX (Ultracarb5u)	0.2500	0.2578	0.2578	3.1	3.1
			2-4,6-TNT (Ultracarb5u)	0.2510	0.2602	0.2602	3.7	3.7
3	07110026 G2	7/12/2018	HMX (Luna-phenyl)	0.2500	0.2526	0.2526	1.0	1.0
			2-4,6-TNT (Luna-phenyl)	0.2510	0.2621	0.2621	4.4	4.4

LDC #: 42791A4a

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG
2nd reviewer:

METHOD: __ GC / HPLC

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: 1

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
FF	Ultracarb	0.200	0.1934	97	97	0

Sample ID: _____

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	

	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
A	Chlorobenzene (CBZ)	H	Ortho-Terphenyl	O	Decachlorobiphenyl (DCB)	V	Tri-n-propyltin	CC	2,5-Dibromotoluene
B	4-Bromofluorobenzene (BFB)	I	Fluorobenzene (FBZ)	P	1-methylnaphthalene	W	Tributyl Phosphate	DD	n-Nonatriacontane
C	a,a,a-Trifluorotoluene	J	n-Triacontane	Q	Dichlorophenyl Acetic Acid (DCAA)	X	Triphenyl Phosphate	EE	1,2-Dibromopropane
D	Bromochlorobenene	K	Hexacosane	R	4-Nitrophenol	Y	Tetrachloro-m- xylene	FF	1,2-Dinitrobenzene
E	1,4-Dichlorobutane	L	Bromobenzene	S	1-Chloro-3-Nitrobenzene	Z	2-Bromonaphthalene	GG	2-Nitro-m-xylene
F	1,4-Difluorobenzene (DFB)	M	Benzo(e)Pyrene	T	3,4-Dinitrotoluene	AA	1-Chlorooctadecane	HH	p-Terphenyl
G	Octacosane	N	Terphenyl-D14	U	Tripentyltin	BB	2,4-Dichlorophenylacetic acid	II	

LDC #: 42791 A40a

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: ___ GC ✓ HPLC

The percent recoveries (%R) and relative percent differences (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC - SC)/SA

RPD =({{SSCMS - SSCMSD} * 2) / (SSCMS + SSCMSD))*100

Where SSC = Spiked sample concentration; SC = Sample concentration; SA = Spike added

MS = Matrix spike; MSD = Matrix spike duplicate

MS/MSD samples: 12/13

Compound	Spike Added (mg/L)		Sample Conc. (mg/L)	Spike Sample Concentration (mg/L)		Matrix spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	---	MS	MSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)											
Diesel (8015)											
Benzene (8021B)											
Methane (RSK-175)											
2,4-D (8151)											
Dinoseb (8151)											
Naphthalene (8310)											
Anthracene (8310)											
HMX (8330)	2.09	2.14	0	2.01	1.99	96	96	93	93	1	1
2,4,6-Trinitrotoluene (8330)	↓	↓	↓	2.03	1.99	97	97	93	93	2	2
Phorate (8141A)											
Malathion (8141A)											
Formaldehyde (8315A)											

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 42791 A40a

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: __ GC /HPLC

The percent recoveries (%R) and relative percent differences (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC/SA)
RPD =(({SSCLCS - SSCLCSD} * 2) / (SSCLCS + SSCLCSD))*100

Where SSC = Spiked sample concentration; SA = Spike added
LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: LCS 280-420700/2-A

Compound	Spike Added (ug/L)		Spike Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)										
Diesel (8015)										
Benzene (8021B)										
Methane (RSK-175)										
2,4-D (8151)										
Dinoseb (8151)										
Naphthalene (8310)										
Anthracene (8310)										
HMX (8330)	2.00	NA	1.91	NA	96	96				
2,4,6-Trinitrotoluene (8330)	↓	↓	1.94	↓	97	97				
Phorate (8141A)										
Malathion (8141A)										
Formaldehyde (8315A)										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 42791 A40a

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: __ GC _/ HPLC

(Y) N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds within 10% of the reported results?

Concentration= (A)(Fv)(Df) / (RF)(Vs or Ws)(%S/100)

A= Area or height of the compound to be measured
Fv= Final Volume of extract
Df= Dilution Factor
RF= Average response factor of the compound In the initial calibration
Vs= Initial volume of the sample
Ws= Initial weight of the sample
%S= Percent Solid

Example:

Sample ID. 1 Compound Name 2,4,6-TNT

Concentration = $\frac{(59673)(5\,ml)(10)(1000)}{(214477.88)(493.7\,mL)}$ = 28 ug/L

#	Sample ID	Compound	Reported Concentrations (ug/L)	Recalculated Results Concentrations ( )	Qualifications
			28		

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Ravenna, Ohio

LDC Report Date: August 3, 2018

Parameters: Nitroguanidine

Validation Level: Stage 4

Laboratory: TestAmerica, Inc.

Sample Delivery Group (SDG): 280-111421-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
NTAmw-120-062618-GW	280-111421-23	Water	06/26/18
NTAmw-120-D-062618-GW	280-111421-24	Water	06/26/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with The Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Former Ravenna Army Ammunition Plant Portage and Trumbull Counties, Ohio (December 20, 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Nitroguanidine by Environmental Protection Agency (EPA) SW 846 Method 8330

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

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

Sample	Compound	Total Days From Sample Collection Until Extraction	Required Holding Time (in Days) From Sample Collection Until Extraction	Flag	A or P
NTAmw-120-062618-GW NTAmw-120-D-062618-GW	Nitroguanidine	16	7	UJ (all non-detects)	P

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 15.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

Retention time windows were established as required by the method.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

Retention times of all compounds in the calibration standards were within the established retention time windows.

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 this SDG.

VI. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VII. 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 this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

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

IX. Field Duplicates

Samples NTAmw-120-062618-GW and NTAmw-120-D-062618-GW were identified as field duplicates. No results were detected in any of the samples.

X. Compound Quantitation

All compound quantitations met validation criteria.

XI. Target Compound Identifications

All target compound identifications met validation criteria.

XII. Overall Assessment of Data

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

Due to technical holding time, data were qualified as estimated in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Ravenna, Ohio
Nitroguanidine - Data Qualification Summary - SDG 280-111421-1

Sample	Compound	Flag	A or P	Reason
NTAmw-120-062618-GW NTAmw-120-D-062618-GW	Nitroguanidine	UJ (all non-detects)	P	Technical holding times

Ravenna, Ohio
Nitroguanidine - Laboratory Blank Data Qualification Summary - SDG 280-111421-1

No Sample Data Qualified in this SDG

Ravenna, Ohio
Nitroguanidine - Field Blank Data Qualification Summary - SDG 280-111421-1

No Sample Data Qualified in this SDG

LDC #: 42791A40b
SDG #: 280-111421-1
Laboratory: Test America, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 4

Date: 08/02/18
Page: 1 of 1
Reviewer: DM
2nd Reviewer: [signature]

METHOD: HPLC Nitroguanidine (EPA SW 846 Method 8330)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / SW	
II.	Initial calibration/ICV	A / A	ICAL ≤ 15% ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%.
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	N	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	ND	D = 1/2
X.	Compound quantitation RL/LOQ/LODs	A	
XI.	Target compound identification	A	
XII.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID		Lab ID	Matrix	Date
1	NTAmw-120-062618-GW	D	280-111421-23	Water	06/26/18
2	NTAmw-120-D-062618-GW	D	280-111421-24	Water	06/26/18
3					
4					
5					
6					
7					
8					
9					
10					
11					

Notes:

-	MB 320-233710/1-A						

LDC #: 42791 A40 b

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

Method: GC ✓ HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	~~W~~	✓		
Was cooler temperature criteria met?	✓			
IIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ ~~20%?~~ 15%	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥0.990?			✓	
Were the RT windows properly established?	✓			
IIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
III. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
Were all the retention times within the acceptance windows?	✓			
IV. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
V. Field Blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VI. Surrogate spikes				
Were all surrogate percent recovery (%R) within the QC limits?		✓		
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		✓		
Was a MS/MSD analyzed every 20 samples of each matrix?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?		✓		
X. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC #: 42791A406

VALIDATION FINDINGS WORKSHEET
Technical Holding Times

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

All circled dates have exceeded the technical holding times.
(Y) N N/A Were all cooler temperatures within validation criteria?

METHOD : ___ GC ✓ ___ HPLC

Sample ID	Matrix	Preserved	Sampling Date	Extraction date	Analysis date	Total # of Days	Qualifier
All (ND)	W	N	06/26/18	07/12/18	07/13/18	16	J/UJ/P

TECHNICAL HOLDING TIME CRITERIA

VOLATILES:	Water unpreserved:	Aromatic within 7 days, non-aromatic within 14 days of sample collection.
	Water preserved:	Both within 14 days of sample collection.
	Soils:	Both within 14 days of sample collection.
EXTRACTABLES:		
	Water:	Extracted within 7 days, analyzed within 40 days.
	Soil:	Extracted within 14 days, analyzed within 40 days.

LDC #: 42791A40b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: HPLC Nitroguanidine (EPA SW 846 Method 8330

The calibration factors (CF), average CF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

CF = A/C
average CF = sum of the CF/number of standards
%RSD = 100 * (S/X)

Where:
A = Area of compound
C = Concentration of compound
S = Standard deviation of calibration factors
X = Mean of calibration factors

#	Standard ID	Calibration Date	Compound	Reported CF (100 std)	Recalculated CF (100 std)	Reported Average CF (Initial)	Recalculated Average CF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL LC12	6/5/2018	Nitroguanidine	65.650	65.650	63.754	63.754	3.8	3.8

LDC # 42791A40b

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: HPLC Nitroguanidine (EPA SW 846 Method 8330)

The percent difference (%D) of the initial calibration average Calibration Factors (CF) and the continuing calibration percent difference (%D) values were recalculated for the compounds identified below using the following calculation:

Percent difference (%D) = 100 * (N - C)/N

Where:
N = Initial Calibration Factor or Nominal Amount
C = Calibration Factor from Continuing Calibration Standard or Calculated Amount

#	Standard ID	Calibration Date	Compound	Ave CF	Reported (CCV)	Recalculated (CCV)	Reported % D	Recalculated %D
1	M00003	7/13/2018	Nitroguanidine	63.754	66.255	66.255	3.9	3.9
2	M00009	7/13/2018	Nitroguanidine	63.754	66.790	66.790	4.8	4.8

LDC #: 42791 A40b

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: __ GC ✓ HPLC

The percent recoveries (%R) and relative percent differences (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC/SA)
RPD =(({SSCLCS - SSCLCSD} * 2) / (SSCLCS + SSCLCSD))*100

Where SSC = Spiked sample concentration
LCS = Laboratory Control Sample
SA = Spike added
LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: LCS 320-233710/2-A

Compound	Spike Added (ug/L)		Spike Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)										
Diesel (8015)										
Benzene (8021B)										
Methane (RSK-175)										
2,4-D (8151)										
Dinoseb (8151)										
Naphthalene (8310)										
Anthracene (8310)										
HMX (8330)										
2,4,6-Trinitrotoluene (8330)										
Phorate (8141A)										
Malathion (8141A)										
Formaldehyde (8315A)										
Nitroguanidine (8330)	200	NA	195	NA	97	97				

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 42791A406

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd Reviewer: [signature]

METHOD: __ GC / HPLC

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds within 10% of the reported results?

Concentration= $\frac{(A)(Fv)(Df)}{(RF)(Vs \text{ or } Ws)(\%S/100)}$

A= Area or height of the compound to be measured
Fv= Final Volume of extract
Df= Dilution Factor
RF= Average response factor of the compound In the initial calibration
Vs= Initial volume of the sample
Ws= Initial weight of the sample
%S= Percent Solid

Example:

Sample ID: MB LCS Compound Name Nitroguanidine

Concentration = $\frac{(124.28)(10\text{ml})}{(63.754)(10\text{ml})} = 194.9$

≈ 195 ug/L

#	Sample ID	Compound	Reported Concentrations (ug/L)	Recalculated Results Concentrations ( )	Qualifications
			195		

Comments: _____

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Ravenna, Ohio

LDC Report Date: August 3, 2018

Parameters: Perchlorate

Validation Level: Stage 4

Laboratory: TestAmerica, Inc.

Sample Delivery Group (SDG): 280-111421-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
NTAmw-120-062618-GW	280-111421-23	Water	06/26/18
NTAmw-120-D-062618-GW	280-111421-24	Water	06/26/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with The Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Former Ravenna Army Ammunition Plant Portage and Trumbull Counties, Ohio (December 20, 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Perchlorate by Environmental Protection Agency (EPA) SW 846 Method 6860

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. LC/MS Instrument Performance Check

Instrument performance check was performed at the required frequency.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

A curve fit, based on the initial calibration, was established for quantitation. The coefficient of determination (r^2) was greater than or equal to 0.990.

The isotope ratios were within QC limits.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 15.0%.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 15.0%.

The percent differences (%D) of the limit of detection verification (LODV) standard were less than or equal to 30.0%.

The isotope ratios were within QC limits.

V. Laboratory Blanks

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

VI. Field Blanks

No field blanks were identified in this SDG.

VII. 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 this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. 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.

IX. Interference Check Samples

Interference check samples (ICS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples NTAmw-120-062618-GW and NTAmw-120-D-062618-GW were identified as field duplicates. No results were detected in any of the samples.

XI. Internal Standards

All internal standard recoveries (%R) were within QC limits.

XII. Compound Quantitation

All compound quantitations were within validation criteria.

XIII. Target Compound Identifications

All target compound identifications were within validation criteria.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Ravenna, Ohio
Perchlorate - Data Qualification Summary - SDG 280-111421-1

No Sample Data Qualified in this SDG

Ravenna, Ohio
Perchlorate - Laboratory Blank Data Qualification Summary - SDG 280-111421-1

No Sample Data Qualified in this SDG

Ravenna, Ohio
Perchlorate - Field Blank Data Qualification Summary - SDG 280-111421-1

No Sample Data Qualified in this SDG

LDC #: 42791A87
SDG #: 280-111421-1
Laboratory: Test America, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 4

Date: 8/6/18
Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: LC/MS Perchlorate (EPA SW846 Method 6860)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	LC/MS Instrument performance check	~~A~~	~~rr~~
III.	Initial calibration/ICV	A / A	rr ICV ≤ 15%
IV.	Continuing calibration	A	CCV ≤ 15%.
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	N	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS/D
X.	Interference check sample	A	
XI.	Field duplicates	ND	D = 1/2
XII.	Internal standards	A	
XIII.	Compound quantitation RL/LOQ/LODs	A	
XIV.	Target compound identification	A	
XV.	System performance	A	
XVI.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID		Lab ID	Matrix	Date
1	NTAmw-120-062618-GW	b	280-111421-23	Water	06/26/18
2	NTAmw-120-D-062618-GW	b	280-111421-24	Water	06/26/18
3					
4					
5					
6					
7					

Notes:

MB 280-420424/13						

LDC #: 42791A87

VALIDATION FINDINGS CHECKLIST

Reviewer: JVC
2nd Reviewer:

Method: Perchlorate (EPA SW 846 Method 6850)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. LC/MS Instrument performance check				
Were the instrument performance reviewed and found to be within the specified criteria?	✓		✓	
Were the Perchlorate ions within ±0.3 m/z of mass 99,101 and 107?			✓	
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?			✓	
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit criteria of ≥ 0.990?	✓			
Was the isotope ratio of $^{35}Cl/^{37}Cl$ or m/z 99/101 within 2.3 to 3.8?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 15%?	✓			
IV. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) of the mid-range continuing calibration ≤ 15%?	✓			
Were all percent differences (%D) of the low-range continuing calibration ≤ 50%?	✓			
Was the isotope ratio of $^{35}Cl/^{37}Cl$ or m/z 99/101 within 2.3 to 3.8?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		✓		
Was a MS/MSD analyzed every 20 samples of each matrix?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	

Validation Area	Yes	No	NA	Findings/Comments
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?.		✓		
XI. Internal standards				
Were internal standard area counts within ± 50% of the associated calibration standard?	✓			
Were retention times of m/z 89 ($Cl^{18}O_3^-$) within 0.2 minutes of m/z 83 (ClO_3^-)?	✓			
XII. Compound quantitation				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target compound identification	✓			
Were relative retention times (RRT's) within 0.98 to 1.02?				
Was the isotope ratio of $^{35}Cl/^{37}Cl$ or m/z 99/101 within 2.3 to 3.8?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC#: 42791A87

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

Method: LCMS Perchlorate (EPASW 846 Method 6860)

Calibration Date	System	Compound	Standard	(Y) Area ratio	(X) Conc ratio
6/28/2018	LCMS8	Perchlorate	1	0.13830	0.10
			2	0.32451	0.25
			3	0.62099	0.49
			4	1.22267	0.98
			5	3.13559	2.45
			6	6.25560	4.90

Regression Output		*Calculated*	*Reported WLR*
Constant	*b* =	*0.000513*	*2.144400*
R Squared	*r2* =	*0.999957*	*1.000000*
X Coefficient(s)	*m* =	*1.275773*	*1.26920*
Correlation Coefficient		*0.999979*	
Coefficient of Determination (r^2)		*0.999957*	*1.000000*

LDC#: 42791A87

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

Method: LCMS Perchlorate (EPASW 846 Method 6860)

The percent difference (%D) of the initial calibration average Calibration Factors (CF) and the continuing calibration percent difference (%D) values were recalculated for the compounds identified below using the following calculation:

Percent difference (%D) = 100 * (N - C)/N

Where:
N = Initial Calibration Factor or Nominal Amount
C = Calibration Factor from Continuing Calibration Standard or Calculated Amount

#	Standard ID	Calibration Date	Compound	CCV Conc	Reported Conc	Recalculated Conc	Reported % D	Recalculated %D
1	IC818F28032	6/28/2018	Perchlorate	0.200	0.180	0.180	9.9	9.9

LDC #: 42791A87

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: LC/MS Perchlorate (EPA SW 846 Method 6850/6860)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SC/SA Where: SSC = Spike concentration
SA = Spike added

RPD = I LCS - LCSD I * 2/(LCS + LCSD) LCS = Laboratory control sample percent recovery LCSD = Laboratory control sample duplicate percent recovery

LCS/LCSD samples: LCS/D 280-420424/14,15

Compound	Spike Added (ug/L)		Spike Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalc
Perchlorate	0.0500	0.0500	0.0451	0.0457	90	90	90	90	0	0

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 42791A87

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: JVG
2nd reviewer: 4

METHOD: LCMS Perchlorate (EPA SW 846 Method 6850/6860)

(Y) N N/A Were all reported results recalculated and verified for all level IV samples?
(Y) N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(V_t)(DF)(2.0)}{(A_{is})(RRF)(V_o)(V_i)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
V_i	=	Volume of extract injected in microliters (ul)
V_t	=	Volume of the concentrated extract in microliters (ul)
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.
2.0	=	Factor of 2 to account for GPC cleanup

Example:

Sample I.D. ND (LCS), Perchlorate:

Conc. $\frac{\left[\frac{(610004)(204)}{(2094795)}\right] - (2.1449)}{(1.2692)}$

= 45.115

final conc. = $\frac{(45.115)\,\text{ng}}{(1000)}$ = 0.045115 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration ( )	Qualification
			0.0451		

LDC #: 42791

EDD POPULATION COMPLETENESS WORKSHEET

Date: 08/06/18

2nd Reviewer: JE

The LDC job number listed above was entered by CJ.

Entered from Body or Summary

	EDD Process		Comments/Action
I.	EDD Completeness	-	
Ia.	- All methods present?	y	
Ib.	- All samples present/match report?	y	
Ic.	- All reported analytes present?	y	
Id.	- 10% or 100% verification of EDD?	y	
II.	EDD Preparation/Entry	-	
IIa.	- Carryover U/J?	N	
IIb.	- Reason Codes used? If so, note which codes.	y	LDC
IIc.	- Additional Information (QC Level, Validator, Validated Y/N, etc.)	N	
III.	Reasonableness Checks	-	
IIIa.	- Do all qualified ND results have ND qualifier (e.g. UJ)?	y	
IIIb.	- Do all qualified detect results have detect qualifier (e.g. J)?	y	
IIIc.	- If reason codes are used, do all qualified results have reason code field populated, and vice versa?	y	
IIId.	-Does the detect flag require changing for blank qualifier? If so, are all U results marked ND?	-/-	
IIIe.	- Do blank concentrations in report match EDD where data was qualified due to blank contamination?	y	
IIIf.	- Were multiple results reported due to dilutions/reanalysis? If so, were results qualified appropriately?	N/A	
IIIg.	-Are there any discrepancies between the data packet and the EDD?	N	

Notes: *see discrepancy sheet

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual & Quarterly Sampling Event for June 2018

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008
Task Order Number: 0003

Laboratory SDG 280-111421-2

Prepared For:

National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by the Validator. Signatures indicate the report is approved for release.

Erica Fisher, Validator, TEC-WESTON JV	Date
Peter Chapman, Senior Chemist, TEC-WESTON JV	Date

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INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-111421-2**.

TestAmerica, Inc., Canton, Ohio performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Nitrate/Nitrite	SW-846 Method 9056A	Arvada, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*); and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*), the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	NO3/NO2
FBQmw-174-062518-GW	280-111421-1	06/25/2018	Groundwater		✓
FBQmw-175-062518-GW	280-111421-2	06/25/2018	Groundwater		✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 SAMPLE RECEIPT

The samples were received by the laboratory on June 27, 2018; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.3 TECHNICAL DATA VALIDATION

1.3.1 Nitrate/Nitrite by Method 9056A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- LODs and LOQs
- LCS recoveries
- Method blank
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank
- Field duplicate

The nitrate/nitrate analyses were conducted past the 48 hour holding time as required by the method. Therefore, the non-detect and detected nitrate/nitrite results for these two samples were qualified as estimated values (UJ/J H).

No analytical or quality parameters requiring further discussion were identified for Method 9056A.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	Units	Result	Lab Flag	DV Flag	Detect	LOQ	LOD	MDL	Method	Reason Code
280-111421-2	FBQmw-174-062518-GW	280-111421-1	Ground Water	Nitrate	µg/L	560	h	j	y	500	100	42	9056A	H
280-111421-2	FBQmw-174-062518-GW	280-111421-1	Ground Water	Nitrite	µg/L	100	u h	uj	n	500	100	49	9056A	H
280-111421-2	FBQmw-175-062518-GW	280-111421-2	Ground Water	Nitrate	µg/L	2700	h	j	y	500	100	42	9056A	H
280-111421-2	FBQmw-175-062518-GW	280-111421-2	Ground Water	Nitrite	µg/L	100	u h	uj	n	500	100	49	9056A	H

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater Semi-Annual & Quarterly Sampling Event for June 2018

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-111468-1

Prepared For:

National Guard Bureau

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Prepared By:

TEC-WESTON Joint Venture

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validator and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.



Erica Fisher, Validator, TEC-WESTON JV — 9/10/2018 — Date

Peter Chapman, Senior Chemist, TEC-WESTON JV — 9/10/18 — Date

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INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-111468-1**.

TestAmerica, Inc., Denver, Colorado/Sacramento, California performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Nitroguanidine	8330 Modified	Sacramento, CA
Metals	6010C/6020A/7470A	Denver, CO
Perchlorate	6860	Denver, CO
Alkalinity	2320B	Denver, CO
Total Cyanide	9012B	Denver, CO
Nitrocellulose	WS-WC-0050	Sacramento, CA
Sulfide	9034	Denver, CO
Chloride, Sulfate, nitrate	9056A	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*); and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*), the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R)

should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*) and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*). Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates)	SVOCs (full list)	PCBs	Explosives	Nitroguanidine	Perchlorate	Metals	Total Cyanide	Sulfide	Alkalinity	Nitrocellulose	Anions (Nitrate)	Anions (Sulfate & Chloride)	Pesticides
FWGmw-023-062618-GW	280-111468-1	06/26/2018	Groundwater		✓		✓			✓	✓		✓			✓			
WBGmw-009-062618-GW	280-111468-2	06/26/2018	Groundwater			✓			✓			✓							
TB-062618-02	280-111468-3	06/26/2018	Groundwater	Trip Blank	✓														
LL1mw-089-D-062718-GW	280-111468-4	06/27/2018	Groundwater	Duplicate			✓		✓	✓	✓		✓			✓			
LL1mw-089-062718-GW	280-111468-5	06/27/2018	Groundwater	MS/MSD			✓		✓	✓	✓		✓			✓			
LL2mw-059-062618-GW	280-111468-6	06/26/2018	Groundwater			✓			✓			✓							
LL3mw-244-062618-GW	280-111468-7	06/26/2018	Groundwater			✓			✓			✓							✓
LL3mw-237-062618-GW	280-111468-8	06/26/2018	Groundwater						✓										
LL3mw-234-062618-GW	280-111468-9	06/26/2018	Groundwater										✓						
FWGmw-013-062618-GW	280-111468-10	06/26/2018	Groundwater										✓						
LL12mw-245-062718-GW	280-111468-11	06/27/2018	Groundwater			✓			✓			✓					✓		
LL12mw-187-062718-GW	280-111468-12	06/27/2018	Groundwater			✓						✓					✓		
LL12mw-185-062718-GW	280-111468-13	06/27/2018	Groundwater									✓*	✓				✓		
WBGmw-006-062618-GW	280-111468-14	06/26/2018	Groundwater			✓			✓			✓							
WBGmw-021-062618-GW	280-111468-15	06/26/2018	Groundwater			✓			✓			✓							
WBGmw-020-062618-GW	280-111468-16	06/26/2018	Groundwater			✓			✓			✓							
FWGmw-019-062618-GW	280-111468-17	06/26/2018	Groundwater		✓		✓	✓		✓	✓		✓			✓			
TB-062618-03	280-111468-18	06/26/2018	Groundwater	Trip Blank	✓														
FWGmw-022-062618-GW	280-111468-19	06/26/2018	Groundwater		✓		✓	✓		✓	✓		✓			✓			
CBLmw-002-062618-GW	280-111468-20	06/26/2018	Groundwater										✓						
CBLmw-001-062618-GW	280-111468-21	06/26/2018	Groundwater										✓						
CBLmw-001-D-062618-GW	280-111468-22	06/26/2018	Groundwater	Duplicate									✓						
TB-062618-04	280-111468-23	06/26/2018	Groundwater	Trip Blank	✓														
LL1mw-084-062718-GW	280-111468-24	06/27/2018	Groundwater			✓			✓			✓	✓	✓	✓			✓	✓
LL1mw-081-062718-GW	280-111468-25	06/27/2018	Groundwater						✓				✓						
LL1mw-080-062718-GW	280-111468-26	06/27/2018	Groundwater						✓										

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 SAMPLE RECEIPT

The samples were received by the laboratory on June 28, 2018; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

Nitroguanidine and nitrocellulose analyses were performed by TestAmerica Sacramento. Test America Sacramento reported that the samples were received at their facility on July 2, 2018, four days after they were due to receive the samples. At the time of logging, the ice in the cooler had melted and the cooler temperature was reported to be 18.5°C. This is further discussed in Section 1.4.6.

Three of the HCl preserve vials for the requested VOC analysis for sample FWGmw-022-062618-GW was received with a headspace bubble greater than 6 mm diameter. The laboratory noted this in the sample receipt, and proceeded with the analysis. This is further discussed in Section 1.4.1.

1.3 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
U	B	Non-detection; blank detection.
J	S	Estimated detection; surrogate outlier.
UJ	S	Estimated non-detection; surrogate outlier.
UJ	IC	Estimated non-detection; initial calibration criteria not met.
J	IC	Estimated detection; initial calibration criteria not met.
UJ	CC	Estimated non-detection; continuing calibration criteria not met.
J	CC	Estimated detection; continuing calibration criteria not met.
UJ	L	Estimated non-detection; LCS/LCSD percent recovery or RPD exceedance.
J	L	Estimated detection; LCS/LCSD percent recovery or RPD exceedance.
J	M	Estimated detection; MS/MSD percent recovery or RPD exceedance.
UJ	M	Estimated non-detection; MS/MSD percent recovery or RPD exceedance.
UJ	Q	Estimated non-detection; based on professional judgement, results are qualified.
J	Q	Estimated detection; based on professional judgement, results are qualified.
R	Q	Result is rejected; based on professional judgement.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Method blanks
- LCS recoveries
- Surrogate Recoveries
- LODs and LOQs
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Trip Blanks

Methylene chloride was detected in trip blanks TB-062618-02 (0.70 µg/L), TB-062618-03 (0.54 µg/L), and TB-062618-04 (0.51 µg/L), at concentrations below the LOQ (5 µg/L). Methylene chloride was detected below the LOQ (5 µg/L) in associated samples FWGmw-019-062618-GW (0.53 µg/L), FWGmw-023-062618-GW (0.41 µg/L), and FWGmw-022-062618-GW (0.76 µg/L) and are therefore qualified non-detect at the LOQ due to blank contamination (U B).

1.4.1.2 Sample Integrity and Preservation

The laboratory note in the case narrative that samples FWGmw-023-062618-GW, FWGmw-019-062618-GW, and FWGmw-022-062618-GW were analyzed with headspace greater than 6 mm in diameter in the sample containers. The laboratory proceeded with the analysis. All VOC sample results associated with these samples were qualified as estimated (J/UJ Q), with the exception of methylene chloride, which has been previously qualified in these samples as non-detect at the LOQ due to blank contaminaton (Section 1.4.1.1).

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Method blanks
- LODs and LOQs
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Duplicate sample

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.2.1 Method Blanks

Bis(2-ethylhexyl)phthalate (11.7 µg/L) was detected in method blank MB 280-421012/1-A above the LOQ (10 µg/L) and in method blank MB 280-421087/1-A (1.25 µg/L) below the LOQ (10 µg/L). Bis(2-ethylhexyl)phthalate was not detected in associated samples, therefore no qualification was necessary.

1.4.2.2 LCS/LCSD recoveries and RPDs

The RPD for 4-nitrophenol (21%) and benzoic acid (21%) for the LCS/LSCD sample was marginally above the QC limit (20%). However, the 4-nitrophenol and benzoic acid LCS and LCSD recoveries were within QC limits (59-129% and 41-120%, respectively), therefore no qualification is necessary.

1.4.2.3 MS/MSD recoveries and RPDs

An MS/MSD was performed on sample LL1mw-089-062718-GW in this SDG. Hexachlorocyclopentadiene recovered below (7%) the QC limits (10-120%) in the MS sample. Although the MSD recovery (15%) was within QC limits, the RPD (78%) was above the QC limit (20%). Assocated primary sample LL1mw-089-062718-GW is therefore qualified estimated (UJ M).

The MS/MSD RPD for 3-Nitroaniline (23%) exceeded the QC limit (20%). However, as the MS and MSD recoveries (59% and 68%, respectively) were within QC limits (41-128%), no qualification is necessary.

1.4.3 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Internal standards
- Endrin/DDT breakdown check
- Second column confirmation

All analytical or quality parameters requiring further discussion for Method 8081B are described in the sections below.

1.4.3.1 Sample Preparation

The laboratory noted in the case narrative that samples LL3mw-244-062618-GW and LL1mw-084-062718-GW required mercury clean up via EPA Method to reduce matrix interferences caused by

sulfur. No additional qualification was considered to be necessary with regards to the sample preparation.

1.4.3.2 Method Blanks

4,4'-DDT (0.0123 µg/L) was detected in method blank MB 280-421000/1-A below the LOQ (0.05 µg/L). 4,4'-DDT was not detected in associated samples, therefore no qualification was necessary.

1.4.3.3 LCS/LCSD Recoveries and RPDs

The toxaphene RPD (31%) exceeds the QC limit (30%) for the LCS/LCSD. However, the recoveries in the LCS (90%) and LCSD (81%) were within QC limits (33-134%), therefore no qualification was necessary.

Endosulfan I (58%), gamma-BHC (Lindane) (53%), and heptachlor (48%) recovered below QC limits (62-126%, 59-134% and 54-130%, respectively) in laboratory control sample LCSD 280-421030/3-A. The recoveries for endosulfan I (64%) and gamma-BHC (63%) were within control limits, therefore no qualification was necessary. The recovery for heptachlor in the LCS (61%) was within QC limits (54-130%), however, the RPD was above QC limits (22%). Therefore the associated sample, LL1mw-084-062718-GW is qualified estimated (UJ L).

1.4.3.4 Second Column Confirmation

The RPD between the primary and second column (189.8%) for beta-BHC associated with sample LL1mw-084-062718-GW was significantly above QC limits (40%). The higher of the two detections is therefore reported as the final result and is qualified estimated (J Q).

1.4.4 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- LCS recoveries
- MS/MSD recoveries and RPDs
- Initial calibration
- Initial calibration verification

- Continuing calibration verification
- Internal standards
- Second column confirmation
- Field duplicates

No analytical or quality parameters requiring further discussion for Method 8082A were identified.

1.4.5 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Method blanks
- Initial calibration
- Initial calibration verification
- Initial calibration verification
- Duplicate sample

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.5.1 LODs and LOQs

Sample LL1mw-084-062718-GW required dilution (10x) for HMX analysis due to significant matrix interferences. The laboratory adjusted all reporting limits accordingly, therefore no additional qualification is necessary.

Sample LL1mw-080-062718-GW required dilution (10x) prior to analysis. The laboratory adjusted all reporting limits accordingly, therefore no additional qualification is necessary.

1.4.5.2 Surrogate Recoveries

Surrogate 1,2-dinitrobenzene recovered above control limits (83-119%) in sample LL1mw-084-062718-GW (245%). The laboratory noted in the case narrative that the sample was re-extracted, however, the reported surrogates on the re-extracted result (141%) was similar to the first. All associated results are qualified estimated (J/UJ S).

1.4.5.3 LCS/LCSD Recoveries and RPDs

The LCS recovered above control limits (78-120% and 77-127%) for 2,4-dinitrotoluene (1040%) and 2,6-dinitrotoluene (979%) in laboratory control sample LCS 280-421008/2-A. An associated LCSD was not performed. 2,4-Dinitrotoluene was detected in associated samples LL1mw-089-062718-GW, LL12mw-245-062718-GW, LL1mw-084-062718-GW, and LL1mw-080-062718-GW and are therefore qualified estimated (J L). All other associated samples did not have detectable concentrations of this analyte, therefore no qualification is necessary.

The LCS recovered below control limits (79-120%) for 2-amino-4,6-dinitrotoluene (76%) in laboratory control sample LCS 280-421008/2-A. An associated LCSD was not performed. All associated samples are qualified estimated (UJ/J L).

1.4.5.4 MS/MSD recoveries and RPDs

An MS/MSD was performed on sample LL1mw-089-062718-GW in this SDG. 2,4-Dinitrotoluene recovered below (75%) the QC limits (78-120%) in the MS sample. Although the MSD recovery (79%) was within QC limits, the RPD (200%) was above the QC limit (20%). Assocated primary sample LL1mw-089-062718-GW is therefore qualified estimated (UJ M).

The MS/MSD RPDs for all Method 8330B compounds was 200%, which exceeds the QC limit (20%). However, with the exception of 2,4-dinitrotoluene noted above, all MS and MSD recoveries were within QC limits, therefore no qualification is necessary.

1.4.5.5 Second Column Confirmation

The RPD between the primary and second column for 1,3-dinitrobenzene (119.1%), 1,3,5-trinitrobenzene (51.5%), and 2,4-dinitrotoluene (89.1%) associated with sample LL1mw-084-062718-GW were above QC limits (40%). The higher detection was reported on the primary column for 1,3-dinitrobenzene and 1,3,5-trinitrobenzene and was reported by the laboratory as the final result. As the RPD QC limit is significantly exceeded, the higher of the two detections for 2,4-dinitrotoluene was on the second column and is therefore reported as the final result. All associated analytes are qualified estimated (J Q).

The RPD between the primary and second column for 2-amino-4,6-dinitrotoluene (50%) associated with sample LL1mw-081-062718-GW was above QC limits (40%). 2-Amino-4,6-dinitrotoluene is qualified estimated in this sample (J Q).

The RPD between the primary and second column for 1,3-dinitrobenzene (147.5%) associated with sample LL1mw-080-062718-GW was significantly above QC limits (40%). The higher detection was reported on the primary column and is qualified estimated in this sample (J Q).

1.4.5.6 Continuing Calibration Verification

The %D for 2-nitrotoluene (-28%) and 3-nitrotoluene (-31.40%) in continuing calibration verification CCV 280-424164/18 was outside the acceptable QC limit (±20%). Associated samples are qualified estimated (J/UJ CC).

1.4.6 Nitroguanidine by Method 8330

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Method blanks
- LCS recoveries
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- LODs and LOQs

All analytical or quality parameters requiring further discussion for Method 8330 are described in the sections below.

1.4.6.1 Sample Integrity

All samples shipped to Test America Sacremento for nitroguanidine analysis were received at the Sacrameto laboratory four days late due to a Fedex shipping delay. The laboratory noted in the sample login that evidence of ice (melted water) was present in the cooler and that the temperature of the coolers were at 17.8°C and 18.5°C. As all samples were received excessively above the required temperature criteria (<6°C), the associated sample results are rejected (R Q).

1.4.7 Perchlorate by Method 6860

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPD
- Method blank
- Initial calibration verification
- Initial calibration blank
- Continuing calibration verification
- Continuing calibration blank
- Detection limit check
- Interference check standards

No analytical or quality parameters required further discussion for Method 6860.

1.4.8 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- Method blanks
- LCS/LCSD recoveries and RPDs
- MS/MSD recoveries and RPDs
- Post digestion spike
- Serial dilution
- Contract required detection limit standard
- Instrument tuning
- Interference check solutions

All analytical or quality issues requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.8.1 Initial and Continuing Calibration Blanks

Beryllium (0.166 µg/L) was detected in continuing calibration blank CCB 280-421124/226 below the LOQ (1.0 µg/L). Berrylium was not detected in any associated sample, with the exception of LL1mw-084-062718-GW (0.45 µg/L), which is qualified non-detect at the LOQ (U B).

1.4.8.2 Initial/Continuing Calibrations Verifications

Berrylium recovered above control limits (80-120%) in the low-level initial calibration verification 280-421124/11 (126%) and low-level continuing calibration verification CCVL 280-421124/206

(125%) associated with multiple samples in this SDG. All associated samples are qualified estimated (UJ/J IC/CC).

Manganese recovered above control limits (80-120%) in the low level continiuing calibration verification CCVL 280-421124/227 (128%).All associated manganese results were qualified estimated (UJ/J CC).

1.4.9 Nitrocellulose by Method WS-WC-0050

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- Method blank
- MS/MSD recoveries and RPDs
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank

All analytical or quality parameters requiring further discussion for Method WS-WC-0050 are described in the sections below.

1.4.9.1 Sample Integrity

All samples shipped to Test America Sacremento for nitrocellulose analysis were received at the Sacrameto laboratory four days late due to a Fedex shipping delay. The laboratory noted in the sample login that evidence of ice (melted water) was present in the cooler and that the temperature of the coolers were at 17.8°C and 18.5°C. As all samples were received excessively above the required temperature criteria (<6°C), the associated sample results are rejected (R Q).

1.4.10 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LCS/LCSD recoveries and RPDs
- MS/MSD recoveries and RPDs
- LODs and LOQs
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank
- Low and high level control samples
- Field duplicate

All analytical or quality issues requiring further discussion for Method 9012B are described in the sections below.

1.4.10.1 Method Blank

Total cyanide was detected in method blank MB 280-420504/5-A (2.84 µg/L) below the LOQ (10 µg/L). Total cyanide was detected in all associated samples, which are threrefore qualified non-detect at the LOQ (U B).

1.4.11 Alkalinity by Method 2320B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recovery
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank

All analytical or quality issues requiring further discussion for Method 2320B are described in the sections below.

1.4.11.1 Method Blanks

Alkalinity was detected in method blank MB 280-421380/5 (1.53 mg/L) below the LOQ (5.0 µg/L). Alkalinity was detected at a concentration above the LOQ in associated sample LL1mw-084-062718-GW; therefore, no qualification was necessary.

1.4.11.2 Continuing Calibration Blanks

Alkalinity was detected in the continuing calibration blanks (1.35 mg/L and 1.54 mg/L) at concentrations below the LOQ (5.0 µg/L). Alkalinity was detected at a concentration above the LOQ in associated sample LL1mw-084-062718-GW; therefore, no qualification was necessary.

1.4.12 Sulfide by Method 9034

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs

- LCS recoveries
- MS/MSD recovery and RPD
- Method blanks

No analytical or quality issues required further discussion for Method 9034 were identified.

1.4.13 Anions by Method 9056A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS/LCSD recoveries and RPDs
- Initial calibration verification
- Continuing calibration verification
- Method reporting limit check

All analytical or quality issues requiring further discussion for Method 9034 are described in the sections below.

1.4.13.1 Method Blank

Chloride (461 µg/L) and sulfate (519 µg/L) were detected in method blank MB 280-423025/6 below their respective LOQs (3,000 µg/L and 5,000 µg/L). Sulfate was detected above the LOQ in associated sample LL1mw-084-062718-GW, therefore no qualification is necessary. Chloride was detected below the LOQ in associated sample LL1mw-084-062718-GW (1,300 µg/L) and is therefore qualified non-detect at the LOQ (U B).

1.4.13.2 Initial and Continuing Calibration Blanks

Chloride (0.459 mg/L) and sulfate (0.528 mg/L) were detected in the initial calibration blank below their respective LOQs (3 mg/L and 5 mg/L). In addition, chloride (0.460 mg/L and 0.460 mg/L) and sulfate (0.547 mg/L and 0.528 mg/L) below the LOQs (3 mg/L and 5 mg/L) were detected in the continuing calibration blanks bracketing associated sample LL1mw-084-062718-GW. Sulfate was detected above the LOQ in associated sample LL1mw-084-062718-GW, therefore no qualification is necessary. Chloride was detected below the LOQ in associated sample LL1mw-084-062718-GW (1,300 µg/L) and has been previously qualilfied as non-detect at the LOQ due to method balnk contamination; therefore no additional qualification is considered necessary.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	AnalyticMethod	Reason Code
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Nitroguanidine	556-88-7	µg/L	6.0	u	r	n	20	6.0	2.4	Nitroguanidine	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Nitrocellulose	9004-70-0	µg/L	1000	u	r	n	2000	1000	480	Nitrocellulose	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	1,1,1-Trichloroethane	71-55-6	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	1,1,2,2-Tetrachloroethane	79-34-5	µg/L	0.8	u	uj	n	1	0.8	0.20	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	1,1,2-Trichloroethane	79-00-5	µg/L	0.8	u	uj	n	1	0.8	0.32	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	1,1-Dichloroethane	75-34-3	µg/L	0.8	u	uj	n	1	0.8	0.16	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	1,1-Dichloroethene	75-35-4	µg/L	0.8	u	uj	n	1	0.8	0.14	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	1,2-Dibromoethane	106-93-4	µg/L	0.4	u	uj	n	1	0.4	0.18	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	1,2-Dichloroethane	107-06-2	µg/L	0.4	u	uj	n	1	0.4	0.13	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	1,2-Dichloroethene	540-59-0	µg/L	0.2	u	uj	n	1	0.2	0.15	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	1,2-Dichloropropane	78-87-5	µg/L	0.4	u	uj	n	1	0.4	0.13	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	2-Butanone	78-93-3	µg/L	4	u	uj	n	6	4	1.8	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	2-Hexanone	591-78-6	µg/L	4	u	uj	n	5	4	1.4	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	4-Methyl-2-pentanone	108-10-1	µg/L	3.2	u	uj	n	5	3.2	1	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Acetone	67-64-1	µg/L	6.4	u m	uj	n	10	6.4	1.9	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Benzene	71-43-2	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Bromochloromethane	74-97-5	µg/L	0.2	u	uj	n	1	0.2	0.1	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Bromodichloromethane	75-27-4	µg/L	0.4	u	uj	n	1	0.4	0.17	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Bromoform	75-25-2	µg/L	0.4	u	uj	n	1	0.4	0.19	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Bromomethane	74-83-9	µg/L	0.8	u	uj	n	2	0.8	0.21	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Carbon disulfide	75-15-0	µg/L	1.6	u	uj	n	2	1.6	0.45	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Carbon tetrachloride	56-23-5	µg/L	0.4	u	uj	n	2	0.4	0.19	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Chlorobenzene	108-90-7	µg/L	0.4	u	uj	n	1	0.4	0.17	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Chloroethane	75-00-3	µg/L	1.6	u	uj	n	2	1.6	0.41	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Chloroform	67-66-3	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Chloromethane	74-87-3	µg/L	0.8	u	uj	n	2	0.8	0.3	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	cis-1,3-Dichloropropene	10061-01-5	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Dibromochloromethane	124-48-1	µg/L	0.4	u	uj	n	1	0.4	0.17	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Ethylbenzene	100-41-4	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Methylene chloride	75-09-2	µg/L	0.41	j	u	n	5	0.8	0.32	VOCs	B
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Styrene	100-42-5	µg/L	0.4	u	uj	n	1	0.4	0.17	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Tetrachloroethene	127-18-4	µg/L	0.4	u	uj	n	1	0.4	0.2	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Toluene	108-88-3	µg/L	0.4	u	uj	n	1	0.4	0.17	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	trans-1,3-Dichloropropene	10061-02-6	µg/L	0.4	u	uj	n	1	0.4	0.19	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Trichloroethene	79-01-6	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Vinyl chloride	75-01-4	µg/L	0.2	u	uj	n	1.5	0.2	0.1	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Xylene (Total)	1330-20-7	µg/L	0.8	u	uj	n	2	0.8	0.19	VOCs	Q
280-111468-1	FWGmw-023-062618-GW	280-111468-1	Ground Water	Total Cyanide	57-12-5	µg/L	3.2	j q	u	n	10	5.0	2.0	Total Cyanide	B
280-111468-1	WBGmw-009-062618-GW	280-111468-2	Ground Water	Beryllium	7440-41-7	µg/L	0.30	u	uj	n	1.0	0.30	0.08	Metals	IC CC
280-111468-1	LL1mw-089-D-062718-GW	280-111468-4	Ground Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.13	u q	uj	n	0.21	0.13	0.053	Explosives	L
280-111468-1	LL1mw-089-D-062718-GW	280-111468-4	Ground Water	Total Cyanide	57-12-5	µg/L	2.8	j q	u	n	10	5.0	2.0	Total Cyanide	B

280-111468-1	LL1mw-089-D-062718-GW	280-111468-4	Ground Water	Nitroguanidine	556-88-7	µg/L	6.0	u	r	n	20	6.0	2.4	Nitroguanidine	Q
280-111468-1	LL1mw-089-D-062718-GW	280-111468-4	Ground Water	Nitrocellulose	9004-70-0	µg/L	1000	u	r	n	2000	1000	480	Nitrocellulose	Q
280-111468-1	LL1mw-089-062718-GW	280-111468-5	Ground Water	Nitroguanidine	556-88-7	µg/L	6.0	u	r	n	20	6.0	2.4	Nitroguanidine	Q
280-111468-1	LL1mw-089-062718-GW	280-111468-5	Ground Water	Nitrocellulose	9004-70-0	µg/L	1000	u	r	n	2000	1000	480	Nitrocellulose	Q
280-111468-1	LL1mw-089-062718-GW	280-111468-5	Ground Water	Hexachlorocyclopentadiene	77-47-4	µg/L	29	u j1	uj	n	49	29	9.7	SVOCs	M
280-111468-1	LL1mw-089-062718-GW	280-111468-5	Ground Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.48	q	j	y	0.42	0.21	0.088	Explosives	L M
280-111468-1	LL1mw-089-062718-GW	280-111468-5	Ground Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.13	u q	uj	n	0.21	0.13	0.053	Explosives	L
280-111468-1	LL1mw-089-062718-GW	280-111468-5	Ground Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u	uj	n	0.42	0.21	0.089	Explosives	CC
280-111468-1	LL1mw-089-062718-GW	280-111468-5	Ground Water	3-Nitrotoluene	99-08-1	µg/L	0.21	u m	uj	n	0.42	0.21	0.087	Explosives	CC
280-111468-1	LL1mw-089-062718-GW	280-111468-5	Ground Water	Total Cyanide	57-12-5	µg/L	2.6	j q	u	n	10	5.0	2.0	Total Cyanide	B
280-111468-1	LL2mw-059-062618-GW	280-111468-6	Ground Water	Beryllium	7440-41-7	µg/L	0.30	u	uj	n	1.0	0.30	0.08	Metals	IC CC
280-111468-1	LL3mw-244-062618-GW	280-111468-7	Ground Water	Beryllium	7440-41-7	µg/L	0.30	u	uj	n	1.0	0.30	0.08	Metals	IC CC
280-111468-1	LL3mw-234-062618-GW	280-111468-9	Ground Water	Total Cyanide	57-12-5	µg/L	3.7	j q	u	n	10	5.0	2.0	Total Cyanide	B
280-111468-1	FWGmw-013-062618-GW	280-111468-10	Ground Water	Total Cyanide	57-12-5	µg/L	3.4	j q	u	n	10	5.0	2.0	Total Cyanide	B
280-111468-1	LL12mw-245-062718-GW	280-111468-11	Ground Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.11	j m q	j	y	0.45	0.23	0.095	Explosives	L
280-111468-1	LL12mw-245-062718-GW	280-111468-11	Ground Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.14	u q	uj	n	0.23	0.14	0.057	Explosives	L
280-111468-1	LL12mw-245-062718-GW	280-111468-11	Ground Water	2-Nitrotoluene	88-72-2	µg/L	0.23	u	uj	n	0.45	0.23	0.097	Explosives	CC
280-111468-1	LL12mw-245-062718-GW	280-111468-11	Ground Water	3-Nitrotoluene	99-08-1	µg/L	0.23	u m	uj	n	0.45	0.23	0.095	Explosives	CC
280-111468-1	LL12mw-245-062718-GW	280-111468-11	Ground Water	Beryllium	7440-41-7	µg/L	0.30	u	uj	n	1.0	0.30	0.08	Metals	IC CC
280-111468-1	LL12mw-187-062718-GW	280-111468-12	Ground Water	Beryllium	7440-41-7	µg/L	0.30	u	uj	n	1.0	0.30	0.08	Metals	IC CC
280-111468-1	LL12mw-185-062718-GW	280-111468-13	Ground Water	Total Cyanide	57-12-5	µg/L	4.4	j q	u	n	10	5.0	2.0	Total Cyanide	B
280-111468-1	WBGmw-006-062618-GW	280-111468-14	Ground Water	Beryllium	7440-41-7	µg/L	0.09	j	j	y	1.0	0.30	0.08	Metals	IC CC
280-111468-1	WBGmw-021-062618-GW	280-111468-15	Ground Water	Beryllium	7440-41-7	µg/L	0.21	j	j	y	1.0	0.30	0.08	Metals	IC CC
280-111468-1	WBGmw-020-062618-GW	280-111468-16	Ground Water	Manganese	7439-96-5	µg/L	290		j	y	3.5	0.95	0.31	Metals	CC
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Nitroguanidine	556-88-7	µg/L	6.0	u	r	n	20	6.0	2.4	Nitroguanidine	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Nitrocellulose	9004-70-0	µg/L	1000	u	r	n	2000	1000	480	Nitrocellulose	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	1,1,1-Trichloroethane	71-55-6	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	1,1,2,2-Tetrachloroethane	79-34-5	µg/L	0.8	u	uj	n	1	0.8	0.20	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	1,1,2-Trichloroethane	79-00-5	µg/L	0.8	u	uj	n	1	0.8	0.32	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	1,1-Dichloroethane	75-34-3	µg/L	0.8	u	uj	n	1	0.8	0.16	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	1,1-Dichloroethene	75-35-4	µg/L	0.8	u	uj	n	1	0.8	0.14	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	1,2-Dibromoethane	106-93-4	µg/L	0.4	u	uj	n	1	0.4	0.18	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	1,2-Dichloroethane	107-06-2	µg/L	0.4	u	uj	n	1	0.4	0.13	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	1,2-Dichloroethene	540-59-0	µg/L	0.2	u	uj	n	1	0.2	0.15	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	1,2-Dichloropropane	78-87-5	µg/L	0.4	u	uj	n	1	0.4	0.13	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	2-Butanone	78-93-3	µg/L	4	u	uj	n	6	4	1.8	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	2-Hexanone	591-78-6	µg/L	4	u	uj	n	5	4	1.4	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	4-Methyl-2-pentanone	108-10-1	µg/L	3.2	u	uj	n	5	3.2	1	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Acetone	67-64-1	µg/L	6.4	u m	uj	n	10	6.4	1.9	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Benzene	71-43-2	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Bromochloromethane	74-97-5	µg/L	0.2	u	uj	n	1	0.2	0.1	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Bromodichloromethane	75-27-4	µg/L	0.4	u	uj	n	1	0.4	0.17	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Bromoform	75-25-2	µg/L	0.4	u	uj	n	1	0.4	0.19	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Bromomethane	74-83-9	µg/L	0.8	u	uj	n	2	0.8	0.21	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Carbon disulfide	75-15-0	µg/L	1.6	u	uj	n	2	1.6	0.45	VOCs	Q

280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Carbon tetrachloride	56-23-5	µg/L	0.4	u	uj	n	2	0.4	0.19	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Chlorobenzene	108-90-7	µg/L	0.4	u	uj	n	1	0.4	0.17	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Chloroethane	75-00-3	µg/L	1.6	u	uj	n	2	1.6	0.41	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Chloroform	67-66-3	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Chloromethane	74-87-3	µg/L	0.8	u	uj	n	2	0.8	0.3	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	cis-1,3-Dichloropropene	10061-01-5	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Dibromochloromethane	124-48-1	µg/L	0.4	u	uj	n	1	0.4	0.17	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Ethylbenzene	100-41-4	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Methylene chloride	75-09-2	µg/L	0.53	j	u	n	5	0.8	0.32	VOCs	B
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Styrene	100-42-5	µg/L	0.4	u	uj	n	1	0.4	0.17	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Tetrachloroethene	127-18-4	µg/L	0.4	u	uj	n	1	0.4	0.2	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Toluene	108-88-3	µg/L	0.4	u	uj	n	1	0.4	0.17	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	trans-1,3-Dichloropropene	10061-02-6	µg/L	0.4	u	uj	n	1	0.4	0.19	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Trichloroethene	79-01-6	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Vinyl chloride	75-01-4	µg/L	0.2	u	uj	n	1.5	0.2	0.1	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Xylene (Total)	1330-20-7	µg/L	0.8	u	uj	n	2	0.8	0.19	VOCs	Q
280-111468-1	FWGmw-019-062618-GW	280-111468-17	Ground Water	Total Cyanide	57-12-5	µg/L	3.9	j q	u	n	10	5.0	2.0	Total Cyanide	B
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Nitroguanidine	556-88-7	µg/L	6.0	u	r	n	20	6.0	2.4	Nitroguanidine	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Nitrocellulose	9004-70-0	µg/L	1000	u	r	n	2000	1000	480	Nitrocellulose	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	1,1,1-Trichloroethane	71-55-6	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	1,1,2,2-Tetrachloroethane	79-34-5	µg/L	0.8	u	uj	n	1	0.8	0.20	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	1,1,2-Trichloroethane	79-00-5	µg/L	0.8	u	uj	n	1	0.8	0.32	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	1,1-Dichloroethane	75-34-3	µg/L	0.8	u	uj	n	1	0.8	0.16	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	1,1-Dichloroethene	75-35-4	µg/L	0.8	u	uj	n	1	0.8	0.14	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	1,2-Dibromoethane	106-93-4	µg/L	0.4	u	uj	n	1	0.4	0.18	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	1,2-Dichloroethane	107-06-2	µg/L	0.4	u	uj	n	1	0.4	0.13	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	1,2-Dichloroethene	540-59-0	µg/L	0.2	u	uj	n	1	0.2	0.15	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	1,2-Dichloropropane	78-87-5	µg/L	0.4	u	uj	n	1	0.4	0.13	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	2-Butanone	78-93-3	µg/L	4	u	uj	n	6	4	1.8	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	2-Hexanone	591-78-6	µg/L	4	u	uj	n	5	4	1.4	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	4-Methyl-2-pentanone	108-10-1	µg/L	3.2	u	uj	n	5	3.2	1	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Acetone	67-64-1	µg/L	6.4	u m	uj	n	10	6.4	1.9	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Benzene	71-43-2	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Bromochloromethane	74-97-5	µg/L	0.2	u	uj	n	1	0.2	0.1	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Bromodichloromethane	75-27-4	µg/L	0.4	u	uj	n	1	0.4	0.17	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Bromoform	75-25-2	µg/L	0.4	u	uj	n	1	0.4	0.19	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Bromomethane	74-83-9	µg/L	0.8	u	uj	n	2	0.8	0.21	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Carbon disulfide	75-15-0	µg/L	1.6	u	uj	n	2	1.6	0.45	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Carbon tetrachloride	56-23-5	µg/L	0.4	u	uj	n	2	0.4	0.19	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Chlorobenzene	108-90-7	µg/L	0.4	u	uj	n	1	0.4	0.17	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Chloroethane	75-00-3	µg/L	1.6	u	uj	n	2	1.6	0.41	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Chloroform	67-66-3	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Chloromethane	74-87-3	µg/L	0.8	u	uj	n	2	0.8	0.3	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	cis-1,3-Dichloropropene	10061-01-5	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Dibromochloromethane	124-48-1	µg/L	0.4	u	uj	n	1	0.4	0.17	VOCs	Q

280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Ethylbenzene	100-41-4	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Methylene chloride	75-09-2	µg/L	0.76	j	u	n	5	0.8	0.32	VOCs	B
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Styrene	100-42-5	µg/L	0.4	u	uj	n	1	0.4	0.17	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Tetrachloroethene	127-18-4	µg/L	0.4	u	uj	n	1	0.4	0.2	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Toluene	108-88-3	µg/L	0.4	u	uj	n	1	0.4	0.17	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	trans-1,3-Dichloropropene	10061-02-6	µg/L	0.4	u	uj	n	1	0.4	0.19	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Trichloroethene	79-01-6	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Vinyl chloride	75-01-4	µg/L	0.2	u	uj	n	1.5	0.2	0.1	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Xylene (Total)	1330-20-7	µg/L	0.8	u	uj	n	2	0.8	0.19	VOCs	Q
280-111468-1	FWGmw-022-062618-GW	280-111468-19	Ground Water	Total Cyanide	57-12-5	µg/L	5.6	j q	u	n	10	5.0	2.0	Total Cyanide	B
280-111468-1	CBLmw-002-062618-GW	280-111468-20	Ground Water	Total Cyanide	57-12-5	µg/L	3.7	j q	u	n	10	5.0	2.0	Total Cyanide	B
280-111468-1	CBLmw-001-062618-GW	280-111468-21	Ground Water	Total Cyanide	57-12-5	µg/L	2.4	j q	u	n	10	5.0	2.0	Total Cyanide	B
280-111468-1	CBLmw-001-D-062618-GW	280-111468-22	Ground Water	Total Cyanide	57-12-5	µg/L	5.4	j q	u	n	10	5.0	2.0	Total Cyanide	B
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	beta-BHC	319-85-7	µg/L	0.99	j j1	j	y	0.048	0.038	0.0087	OCPs	Q
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	Heptachlor	76-44-8	µg/L	0.048	u q	uj	n	0.048	0.048	0.0095	OCPs	L
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	3.8	j1 q	j	y	1.1	0.43	0.21	Explosives	S Q
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	1,3-Dinitrobenzene	99-65-0	µg/L	1.5	j1 q	j	y	0.43	0.21	0.095	Explosives	S Q
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	2,4,6-Trinitrotoluene	118-96-7	µg/L	4.4	q	j	y	0.43	0.21	0.078	Explosives	S
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	2,4-Dinitrotoluene	121-14-2	µg/L	3.3	j1 q	j	y	0.43	0.21	0.090	Explosives	S L Q
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	0.21	0.069	Explosives	S
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	8.8	q	j	y	0.21	0.13	0.054	Explosives	S L
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u q	uj	n	0.43	0.21	0.092	Explosives	S
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	3-Nitrotoluene	99-08-1	µg/L	0.21	u q	uj	n	0.43	0.21	0.090	Explosives	S
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	19	q	j	y	0.21	0.13	0.062	Explosives	S
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u q	uj	n	0.43	0.21	0.092	Explosives	CC
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	3-Nitrotoluene	99-08-1	µg/L	0.21	u q	uj	n	0.43	0.21	0.090	Explosives	CC
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	Nitrobenzene	98-95-3	µg/L	0.21	u q	uj	n	0.43	0.21	0.098	Explosives	S
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	Nitroglycerin	55-63-0	µg/L	2.1	u q	uj	n	3.2	2.1	0.99	Explosives	S
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	PETN	78-11-5	µg/L	1.3	u q	uj	n	2.1	1.3	0.45	Explosives	S
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	RDX	121-82-4	µg/L	0.13	u m q	uj	n	0.21	0.13	0.056	Explosives	S
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	Tetryl	479-45-8	µg/L	0.13	u m q	uj	n	0.26	0.21	0.085	Explosives	S
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	Beryllium	7440-41-7	µg/L	0.45	j	u	n	1.0	0.30	0.08	Metals	B
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	Manganese	7439-96-5	µg/L	180		j	y	3.5	0.95	0.31	Metals	CC
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	Total Cyanide	57-12-5	µg/L	3.8	j q	u	n	10	5.0	2.0	Total Cyanide	B
280-111468-1	LL1mw-084-062718-GW	280-111468-24	Ground Water	Chloride	16887-00-6	µg/L	1300	j	u	n	3000	500	250	Anions	B
280-111468-1	LL1mw-081-062718-GW	280-111468-25	Ground Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.35	j1 q	j	y	0.20	0.12	0.052	Explosives	L Q
280-111468-1	LL1mw-081-062718-GW	280-111468-25	Ground Water	2-Nitrotoluene	88-72-2	µg/L	0.20	u	uj	n	0.41	0.20	0.088	Explosives	CC
280-111468-1	LL1mw-081-062718-GW	280-111468-25	Ground Water	3-Nitrotoluene	99-08-1	µg/L	0.20	u	uj	n	0.41	0.20	0.085	Explosives	CC
280-111468-1	LL1mw-081-062718-GW	280-111468-25	Ground Water	Total Cyanide	57-12-5	µg/L	5.3	j q	u	n	10	5.0	2.0	Total Cyanide	B
280-111468-1	LL1mw-080-062718-GW	280-111468-26	Ground Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.36	j q	j	y	0.42	0.21	0.088	Explosives	L
280-111468-1	LL1mw-080-062718-GW	280-111468-26	Ground Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	2.3	q	j	y	0.21	0.13	0.053	Explosives	L
280-111468-1	LL1mw-080-062718-GW	280-111468-26	Ground Water	1,3-Dinitrobenzene	99-65-0	µg/L	2.4	j1	j	y	0.42	0.21	0.093	Explosives	Q
280-111468-1	LL1mw-080-062718-GW	280-111468-26	Ground Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u	uj	n	0.42	0.21	0.090	Explosives	CC
280-111468-1	LL1mw-080-062718-GW	280-111468-26	Ground Water	3-Nitrotoluene	99-08-1	µg/L	0.21	u m	uj	n	0.42	0.21	0.088	Explosives	CC

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual & Quarterly Sampling Event for June 2018

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008
Task Order Number: 0003

Laboratory SDG 280-111468-2

Prepared For:

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by the Validator. Signatures indicate the report is approved for release.

Erica Fisher, Validator, TEC-WESTON JV	Date
Peter Chapman, Senior Chemist, TEC-WESTON JV	Date

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INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-111468-2**.

TestAmerica, Inc., Canton, Ohio performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Nitrate/Nitrite	SW-846 Method 9056A	Arvada, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*); and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*), the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	NO3/NO2
LL1mw-084-062718-GW	280-111468-24	06/27/2018	Groundwater		✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 SAMPLE RECEIPT

The sample was received by the laboratory on June 28, 2018; the sample was received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.3 TECHNICAL DATA VALIDATION

1.3.1 Nitrate/Nitrite by Method 9056A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- LODs and LOQs
- LCS recoveries
- Method blank
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank
- Field duplicate

The nitrate/nitrate analysis was conducted past the 48 hour holding time as required by the method. Therefore, the non-detect and detected nitrate/nitrite results for this sample was qualified as estimated values (UJ/J H).

No analytical or quality parameters requiring further discussion were identified for Method 9056A.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	Units	Result	Lab Flag	DV Flag	Detect	LOQ	LOD	MDL	Method	Reason Code
280-111468-2	LL1mw-084-062718-GW	280-111421-1	Ground Water	Nitrate	µg/L	310	h	j	y	500	100	42	9056A	H
280-111468-2	LL1mw-084-062718-GW	280-111421-1	Ground Water	Nitrite	µg/L	100	u h	uj	n	500	100	49	9056A	H

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater Semi-Annual & Quarterly Sampling Event for June 2018

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-111519-1

Prepared For:

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validator and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.



Erica Fisher, Validator, TEC-WESTON JV — 9/10/2018 Date

Peter Chapman, Senior Chemist, TEC-WESTON JV — 9/10/18 Date

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INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-111519-1**.

TestAmerica, Inc., Denver, Colorado/Sacramento, California performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Nitroguanidine	8330 Modified	Sacramento, CA
Metals	6010C/6020A/7470A	Denver, CO
Perchlorate	6860	Denver, CO
Alkalinity	2320B	Denver, CO
Total Cyanide	9012B	Denver, CO
Nitrocellulose	WS-WC-0050	Sacramento, CA
Sulfide	9034	Denver, CO
Chloride, Sulfate	9056A	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*); and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*), the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R)

should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*) and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*). Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates)	SVOCs (nitroaromatics & phthalates)	SVOCs (full list)	PAHs	Pesticides	Explosives	Nitroguanidine	Perchlorate	Metals	Total Cyanide	Sulfide	Alkalinity	Nitrocellulose	Anions (Nitrate)	Anions (Sulfate & Chloride)
LL2mw-267-062818-GW	280-111519-1	06/28/2018	Groundwater			✓								✓						
LL10mw-005-062818-GW	280-111519-2	06/28/2018	Groundwater		✓		✓		✓					✓						
TB-062818-01	280-111519-3	06/28/2018	Groundwater	Trip Blank	✓															
LL2mw-272-062718-GW	280-111519-4	06/27/2018	Groundwater					✓			✓	✓	✓		✓			✓		
LL1mw-065-062718-GW	280-111519-5	06/28/2018	Groundwater			✓					✓			✓						
LL1mw-064-062718-GW	280-111519-6	06/28/2018	Groundwater								✓			✓						
LL1mw-086-062718-GW	280-111519-7	06/28/2018	Groundwater			✓					✓			✓			✓			
EBGmw-125-062818-GW	280-111519-8	06/28/2018	Groundwater												✓					
EBGmw-131-062818-GW	280-111519-9	06/28/2018	Groundwater												✓					
CBPmw-009-062818-GW	280-111519-10	06/28/2018	Groundwater												✓					
CBPmw-008-062818-GW	280-111519-11	06/28/2018	Groundwater												✓					
LL12mw-183-062718-GW	280-111519-12	06/27/2018	Groundwater						✓						✓					
LL4mw-200-062718-GW	280-111519-13	06/27/2018	Groundwater												✓					
LL1mw-083-062718-GW	280-111519-14	06/27/2018	Groundwater			✓				✓	✓					✓	✓			✓
LL2mw-264-062718-GW	280-111519-15	06/27/2018	Groundwater												✓					
RQLmw-011-062818-GW	280-111519-16	06/28/2018	Groundwater	MS/MSD			✓		✓							✓	✓			✓
LL1mw-087-062818-GW	280-111519-17	06/28/2018	Groundwater			✓					✓			✓						
SCFmw-004-062818-GW	280-111519-18	06/28/2018	Groundwater			✓				✓	✓			✓						
LL12mw-242-D-062718-GW	280-111519-19	06/27/2018	Groundwater	Duplicate		✓					✓			✓					✓	
LL12mw-242-062718-GW	280-111519-20	06/27/2018	Groundwater			✓					✓			✓					✓	

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 SAMPLE RECEIPT

The samples were received by the laboratory on June 29, 2018; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

Nitroguanidine and nitrocellulose analyses were performed by TestAmerica Sacramento. Test America Sacramento reported that the samples were received at their facility on July 5, 2018, two days after they were due to receive the samples. At the time of logging, the ice in the cooler had melted and the cooler temperature was reported to be 9.8°C. This is further discussed in Section 1.4.6 and 1.4.9.

The HCl preserve vials for the requested VOC analysis for sample TB-062818-01 was received with a headspace bubble greater than 6 mm diameter. The laboratory noted this in the sample receipt, proceeded with the analysis and notes in the case narrative that the analytical results may be biased low. This is further discussed in Section 1.4.1.

One of the three 1 liter amber glass bottles continaing unpreserved sample volume received for sample LL1mw-083-062718-GW was received broken and had to be disposed by the laboratory. Sufficient in tact sample volume remained to facilitate SVOC analysis.

The laboratory received unfilitered and unpreserved (nitric acid) sample volume for dissolved metals analysis for samples LL1mw-086-062718-GW, LL12mw-242-062718-GW and LL12mw-242-D-062718-GW, although the Chain of Custody (COC) indicated that the sample was field filtered and field preserved. The laboratory logged the sample for lab filtered and preserved dissolved metals analysis.

Sample IDs on container labels for samples LL1mw-087-062818-GW and SCFmw-004-062818-GW were not consistent with the COC. Both samples were listed on the COC without the "-GW" appended to the end of the sample name. In view of remaining consistent with the sample name format for all other samples collected, the laboratory logged the samples in per the sample container labels, which included "-GW" at the end.

1.3 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
U	B	Non-detection; blank detection.
J	S	Estimated detection; surrogate outlier.
UJ	S	Estimated non-detection; surrogate outlier.
UJ	IC	Estimated non-detection; initial calibration criteria not met.
J	IC	Estimated detection; initial calibration criteria not met.
UJ	CC	Estimated non-detection; continuing calibration criteria not met.
J	CC	Estimated detection; continuing calibration criteria not met.
UJ	L	Estimated non-detection; LCS/LCSD percent recovery or RPD exceedance.
J	L	Estimated detection; LCS/LCSD percent recovery or RPD exceedance.
UJ	Q	Estimated non-detection; based on professional judgement, results are qualified.
J	Q	Estimated detection; based on professional judgement, results are qualified.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LCS recoveries
- Surrogate Recoveries
- LODs and LOQs
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Closing calibration verification

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Method Blanks

Acetone (3.65 µg/L) was detected the method blank at a concentration below the LOQ (10 µg/L). was not detected in the associated samples, therefore no qualification is necessary.

1.4.1.2 Trip Blanks

Methylene chloride (0.5 µg/L) was detected in trip blank TB-062818 at a concentration below the LOQ (5 µg/L). Methylene chloride was detected (0.5 µg/L) below the LOQ (5 µg/L) in associated sample LL10mw-005-062818-GW and is therefore qualified non-detect at the LOQ due to blank contamination (U B).

1.4.1.3 Sample Integrity and Preservation

The VOA vials for sample TB-062818 were received with headspace greater than 6 mm in diameter. The laboratory proceeded with the analysis. All VOC sample results associated with these samples were qualified as estimated (J/UJ Q).

1.4.1.4 Continuing Calibration Verification

The percent difference (%D) for 4-Methyl-2-pentanone (MIBK) (20.2%) in continuing calibration verification CCV 280-422040/2 was marginally outside the laboratory control limits (±20%D). MIBK was not detected in the associated samples and is qualified estimated (UJ CC).

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Method blanks
- MS/MSD recoveries and RPDs
- LODs and LOQs
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Duplicate sample

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.2.1 Sample Preparation

The laboratory noted in the case narrative that an incorrect volume of spiking solution was accidentally added to the LCS, MS and MSD associated with batch 280-421087. The percent recoveries are based on the spike amounts and no additional qualification has been assigned.

1.4.2.2 Method Blanks

Bis(2-ethylhexyl) phthalate (1.25 µg/L) was detected in method blank MB 280-421087/1-A below the LOQ (10 µg/L). Bis(2-ethylhexyl) phthalate was not detected in associated sample LL2mw-272-062718-GW, therefore no qualification is necessary.

1.4.2.3 Surrogate Recoveries

Surrogate 2-Fluorobiphenyl recovered below the QC limits (44-119%) in sample SCFmw-004-062818-GW (41%). All associated results are qualified estimated (UJ S).

Surrogate Terphenyl-d14 recovered below the laboratory QC limits (50-134%) in sample LL12mw-242-D-062718-GW (46%). The laboratory noted in the case narrative that sample LL12mw-242-D-062718-GW was re-extracted and analyzed outside of holding time and that the re-extracted sample was within control. Both sets of data are provided, however, as the original sample results are not significantly impacted by the poor surrogate recovery, and the re-extraction was outside holding time, only the original data set have been considered for validation purposes. All associated results are qualified estimated (UJ S).

1.4.3 Polycyclic Aromatic Hydrocarbons by Method 8270D SIM

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- MS/MSD recoveries and RPDs
- LODs and LOQs
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Closing calibration verification

All analytical or quality parameters requiring further discussion for Method 8270D SIM are described in the sections below.

1.4.3.1 Method Blanks

Anthracene (0.00951 µg.L), benzo(a)anthracene (0.0250 µg/L), benzo(b)fluoranthene (0.282 µg/L), benzo(k)fluoranthene (0.0285 µg/L), chrysene (0.0320 µg/L), fluoranthene (0.0166 µg/L), naphthalene (0.0170 µg/L), phenanthrene (0.0246 µg/L), and pyrene (0.0122 µg/L) were detected in method blank MB 280-420946/1-A at concentrations below the LOQ (0.10 µg/L). Fluoranthene, naphthalene, phenanthrene, and pyrene were detected in associated sample LL12mw-183-062718-GW at concentrations below the LOQ (0.093 µg/L). These sample results were qualified as non-detect at the LOQ (U B).

Benzo(a)anthracene (0.0344 µg/L), benzo(b)fluoranthene (0.0737 µg/L), benzo(k)fluoranthene (0.0288 µg/L), benzo(g,h,i)perylene (0.0392 µg/L), benzo(a)pyrene (0.0488 µg/L), chrysene (0.0528 µg/L), dibenz(a,h)anthracene (0.00706 µg/L), fluoranthene (0.0364 µg/L), indeno(1,2,3-cd)pyrene (0.0571 µg/L), phenanthrene (0.0245 µg/L), and pyrene (0.0277 µg/L) were detected in

method blank MB 280-422519/1-A at concentrations below the LOQ (0.10 µg/L). Benzo(a)anthracene, fluoranthene, phenanthrene, and pyrene were detected in associated samples LL10mw-005-062818-GW and RQLmw-011-062818-GW at concentrations below the LOQ (0.093 µg/L). These sample results were qualified as non-detect at the LOQ (U B).

1.4.3.2 Surrogate Recoveries

Surrogate Terphenyl-d14 recovered above the laboratory QC limits (50-134%) in sample LL10mw-005-062818-GW (140%). No associated analytes were detected in this sample requiring qualification, with the exception of benzo(a)anthracene, which is qualified non-detect at the LOQ due to blank contamination and therefore no additional qualification is necessary. Non-detect results do not require qualilfication.

1.4.3.3 Laboratory Control Sample

The RPD for benzo[k]fluoranthene (21%) exceeded the control limit (20%). All LCS and LCSD recoveries for these analytes were within control limits; therefore, no qualification was necessary.

1.4.3.4 Continuing Calibration Verification

The percent difference (%D) for dibenz(a,h)anthracene (20.4%) in continuing calibration verification CCV 280-423473/3 was marginally outside the laboratory control limits (±20%D). Dibenz(a,h)anthracene was not detected in the associated samples and are qualified estimated (UJ CC).

1.4.4 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blanks
- Initial calibration
- Initial calibration verification
- Internal standards
- Endrin/DDT breakdown check
- Second column confirmation

All analytical or quality parameters requiring further discussion for Method 8081B are described in the sections below.

1.4.4.1 Sample Preparation

The laboratory noted in the case narrative that samples LL1mw-083-062718-GW and SCFmw-004-062818-GW required mercury clean up via EPA Method to reduce matrix interferences caused by sulfur. No additional qualification was considered to be necessary with regards to the sample preparation.

1.4.4.2 LCS/LCSD Recoveries and RPDs

Endosulfan I (58%), gamma-BHC (Lindane) (53%) and heptachlor (48%) recovered below the laboratory QC limits (62-126%, 59-134% and 54-130%, respectively) in laboratory control sample duplicate LCSD 280-421030/3-A. All LCS recoveries and LCS/LCSD RPD's for these analytes were within control limits; therefore, no qualification was necessary.

1.4.4.3 Continuing Calibration Verification

The 4,4'-DDD %D (21.2%) in continuing calibration verification CCV 280-423027/26 exceeded the acceptable QC limit (20%). Associated sample SCFmw-004-062818-GW is therefore qualified estimated (UJ CC) for 4,4'-DDD.

The methoxychlor %D (20.2%) in continuing calibration verification CCV 280-423618/33 exceeded the acceptable QC limit (20%). Associated sample LL1mw-083-062718-GW is therefore qualified estimated (UJ CC) for methoxychlor.

1.4.5 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Method blanks
- Surrogate recoveries
- Initial calibration
- Initial calibration verification
- LODs and LOQs
- Initial calibration verification
- 2nd column confirmation
- Duplicate sample

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.5.1 Sample Preparation

Samples LL2mw-267-062818-GW, LL1mw-064-062718-GW, LL1mw-086-062718-GW, LL1mw-083-062718-GW, LL1mw-087-062818-GW, and LL12mw-242-D-062718-GW were filtered prior to analysis to reduce matrix interferences.

Only a portion of samples LL2mw-272-062718-GW and LL12mw-242-062718-GWwere used for analysis, rather than testing the entire sample amount in the original container, due to the sample container not being appropriate size. As such, the required solvent rinse of the original container could not be performed. The 500 mL bottles were mislabeled in their storage location. As the 500 mL containers could not be found, the laboratory decanted in to 500 mL bottles from the 1 L bottles. In addition, sample LL12mw-242-062718-GW had debris that would have lead to clogging. Based on professional judgement, no qualificaitons were necessary.

1.4.5.2 Laboratory Control Samples

The LCS recovered above control limits (78-120% and 77-127%) for 2,4-dinitrotoluene (1040%) and 2,6-dinitrotoluene (979%) in laboratory control sample LCS 280-421008/2-A. 2,4-Dinitrotoluene was detected in associated sample LL1mw-083-062718-GW and is therefore qualified estimated (J L). All other associated samples did not have detectable concentrations of these analytes, therefore no qualification is necessary.

The LCS recovered below control limits (79-120%) for 2-amino-4,6-dinitrotoluene (76%) in laboratory control sample LCS 280-421008/2-A. All associated samples are qualified estimated (UJ/J L).

1.4.5.3 Continuing Calibration Verification

The %D for 2-nitrotoluene (-38.8%), 3-nitrotoluene (-44.0%), and PETN (-29.1%) in continuing calibration verification CCV 280-424164/29 was outside the acceptable QC limit (±20%). Associated samples are qualified estimated (UJ CC).

1.4.6 Nitroguanidine by Method 8330

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Method blanks
- LCS recoveries
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- LODs and LOQs

All analytical or quality parameters requiring further discussion for Method 8330 are described in the sections below.

1.4.6.1 Sample Integrity

Sample LL2mw-272-062818-GW was received at the Sacrameto laboratory two days late due to a Fedex shipping delay. The laboratory noted in the sample login that evidence of ice (melted water) was present in the cooler and that the temperature of the cooler was measured at 9.8°C. Nitroguanidine was not detected in sample LL2mw-272-062818-GW and has been qualified estimated (UJ Q) due the temperature exceedance.

1.4.7 Perchlorate by Method 6860

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- Method blank
- Initial calibration verification
- Initial calibration blank
- Continuing calibration verification
- Continuing calibration blank
- Detection limit check
- Interference check standards

No analytical or quality parameters required further discussion for Method 6860.

1.4.8 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPDs
- Post digestion spike
- Serial dilution
- Contract required detection limit standard
- Instrument tuning
- Interference check solutions
- Field duplicates

All analytical or quality issues requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.8.1 Method Blanks

Iron (27.1 µg/L) was detected in method blank MB 280-420829/1-A at a concentration below the LOQ (100 µg/L). Iron was detected below the LOQ (100 µg/L) in sample SCFmw-004-062818-GW (50 µg/L), and is therefore qualified as non-detect at the LOQ (U B). All other associated sample results were either non-detect or at a concentration above the LOQ; therefore, no qualification was necessary.

Barium (0.794 µg/L), copper (0.659 µg/L) and silver (0.0940 µg/L) were detected in method blank 280-420830/1-A below their respective LOQs (3 µg/L, 2 µg/L and 5 µg/L). Copper was detected in associated sample LL10mw-005-062818-GW (0.74 ug/L), LL1mw-065-062718-GW (0.87 µg/L), LL1mw-064-062718-GW (0.57 µg/L), and LL1mw-087-062818-GW (1.6 µg/L) at concentrations below LOQ (2 ug/L). These samples are qualified non-detect at the LOQ (U B). All other associated sample results were either non-detect or at a concentration above the LOQ; therefore, no qualification was necessary.

1.4.8.2 Initial and Continuing Calibration Blanks

Several analytes were detected in the calibration blanks. The following table outlines these detections:

Calibration Blank	Associated Samples	Analyte	Blank Detection (µg/L)	LOQ (µg/L)	Assigned Flags	Samples Qualified
CCB 280-422085/154	LL2mw-267-062818-GW LL10mw-005-062818-GW LL1mw-065-062718-GW LL1mw-064-062718-GW LL1mw-086-062718-GW LL1mw-087-062818-GW SCFmw-004-062818-GW	Vanadium	0.969	6	U B	LL1mw-087-062818-GW
CCB 280-422085/167	LL2mw-267-062818-GW LL10mw-005-062818-GW	Vanadium	0.753	6	U B	LL1mw-087-062818-GW

	LL1mw-065-062718-GW LL1mw-064-062718-GW LL1mw-086-062718-GW LL1mw-087-062818-GW SCFmw-004-062818-GW LL12mw-242-D-062718-GW LL12mw-242-062718-GW					
CCB 280-422085/180	LL12mw-242-D-062718-GW LL12mw-242-062718-GW	Vanadium	0.684	6	None	None
CCB 280-421651/65	LL1mw-086-062718-GW LL12mw-242-D-062718-GW LL12mw-242-062718-GW	Vanadium	1.79	6	None	None
CCB 280-421651/57	LL1mw-086-062718-GW	Antimony	0.449	6	None	None
	LL12mw-242-D-062718-GW LL12mw-242-062718-GW	Vanadium	1.83	6		
ICB 280-421651/10	LL1mw-086-062718-GW LL12mw-242-D-062718-GW	Antimony	0.410	6	None	None
	LL12mw-242-062718-GW	Vanadium	0.690	6	None	None

All associated sample detections below the LOQ were qualified as non-detect at the LOQ (U B).

1.4.8.3 Initial/Continuing Calibrations Verifications

Manganese recovered below control limits (80-120%) in the low level initial calibration verifications ICVL 280-422081/13 (78%), and ICVL 280-422085/13 (78%). Manganese recovered below the laboratory control limits (80-120%) in the low level continiuing calibration verification CCVL 280-422085/181 (78%).All associated manganese results were qualified estimated (UJ/J IC/CC).

Copper recovered above the laboratory control limits (80-120%) in the low level intial calibration verifications ICVL 280-422085/12 (123%), and low level continuing calibration verificatons CCVL 280-422085/168 (126%), and CCVL 280-422085/181 (126%). All associated copper results are qualified estimated (UJ/J IC/CC), except where previously qualified non-detect at the LOQ due to blank contamination (U B).

Barium recovered above the laboratory control limits (80-120%) in the low level continuing calibration verifications CCVL 280-422085/168 (145%) and CCVL 280-422279/89 (121%). All associated barium results are qualified estimated (UJ/J CC).

Antimony recovered above the laboratory control limits (80-120%) in the low level intial calibration verification ICVL 280-421651/11 (124%) and the low level continuing calibration verification CCVL 280-421651/58 (124%). All associated antiminy results are qualified estimated (UJ/J IC/CC).

Vanadium recovered above the laboratory control limits (80-120%) in the low level continuing calibration verifications CCVL 280-421651/58 (132%) and CCVL 280-42165/66 (129%). All associated vanadium results are qualified estimated (UJ/J CC).

1.4.8.4 Field Duplicates

One field duplicate sample (LL12mw-242-D-062718-GW) was analyzed for metals as part of this SDG. For detections less than 5x the LOQ, the difference in values was compared to ± the LOQ. For detections greater that 5x the LOQ, the relative percent difference was calculated and compared to the RPD limit. The following table shows the detections in the parent and duplicate sample:

Primary/ Duplicate Sample ID	**Analyte**	**Primary Sample Result (µg/L)**	**Field Duplicate Result (µg/L)**	**LOQ (µg/L)**	**Absolute Diff. (µg/L)**	**RPD (%)**	**RPD Limit (%)[1]**
LL12mw-242-062718-GW/ LL12mw-242-D-062718-GW	Calcium	68000	69000	1000	N/A	1.5	40
	Iron	450	490	100	40	N/A	± LOQ
	Magnesium	42000	43000	500	N/A	2.4	40
	Potassium	1800 (J)	1800 (J)	3000	0	N/A	± LOQ
	Sodium	31000	30000	5000	1000	N/A	± LOQ
	Arsenic	9.7	10	5	0.3	NA	± LOQ
	Barium	28	28	3	N/A	0	40
	Cobalt	0.55 (J)	0.53 (J)	1	0.02	N/A	± LOQ
	Manganese	69	66	3.5	N/A	4.5	40
	Nickel	0.32 (J)	1.0 (U)	3	N/A	N/A	± LOQ

[1] The RPD limit is 40% for detections greater than 5x the LOQ; ± the LOQ for detections less than 5x the LOQ.

Bold values exceed the RPD limit.
J Laboratory flag indicating the result is less than the LOQ and is estimated.
N/A Not applicable

All duplicate pair results are within QC limits (40% or ± LOQ), therefore no qualification is necessary.

1.4.9 Nitrocellulose by Method 353.2

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- Method blank
- MS/MSD recoveries and RPDs
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank

All analytical or quality parameters requiring further discussion for Method 353.2 are described in the sections below.

1.4.9.1 Sample Integrity

Sample LL2mw-272-062818-GW was received at the Sacrameto laboratory two days late due to a Fedex shipping delay. The laboratory noted in the sample login that evidence of ice (melted water) was present in the cooler and that the temperature of the cooler was measured at 9.8°C. Nitrocellulose was not detected in sample LL2mw-272-062818-GW and has been qualified estimated (UJ Q) due the temperature exceedance.

1.4.10 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Method blanks
- LODs and LOQs
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank
- Low and high level control samples

All analytical or quality issues requiring further discussion for Method 9012B are described in the sections below.

1.4.10.1 LCS/LCSD Recoveries and RPDs

Total cyanide recovered above the QC limits (83-116%) in laboratory control sample LCS 280-421417/3-A (125%) and laboratory control duplicate sample LCSD 280-421417/4-A (127%), although the RPD (2%) was within QC limits (20%). Total cyanide was detected in all associated samples, which are threrefore qualified estimated (J L).

1.4.11 Alkalinity by Method 2320B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS/LCSD recovery and RPD
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank

All analytical or quality issues requiring further discussion for Method 2320B are described in the sections below.

1.4.11.1 Method Blanks

Alkalinity (1.25 mg/L) was detected in method blanks MB 280-421716/5 (1.53 mg/L) and MB 280-421776/6 (1.57 mg/L) concentrations below the LOQ (5.0 µg/L). Alkalinity was detected at a concentration above the LOQ, or was not detected in all associated samples; therefore, no qualification was necessary.

1.4.11.2 Continuing Calibration Blanks

Alkalinity (1.25 mg/L) was detected in the continuing calibration blank at a concentration below the LOQ (5.0 µg/L). Alkalinity was detected at a concentration above the LOQ, or was not detected in all associated samples; therefore, no qualification was necessary.

1.4.12 Sulfide by Method 9034

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- Method blanks

No analytical or quality issues required further discussion for Method 9034 were identified.

1.4.13 Anions by Method 9056A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- Method blanks
- LCS/LCSD recoveries and RPDs
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank

No analytical or quality issues required further discussion for Method 9034 were identified.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	AnalyticMethod	Reason Code
280-111519-1	LL2mw-267-062818-GW	280-111519-1	Ground Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u	uj	n	0.42	0.21	0.089	Explosives	CC
280-111519-1	LL2mw-267-062818-GW	280-111519-1	Ground Water	3-Nitrotoluene	99-08-1	µg/L	0.21	u	uj	n	0.42	0.21	0.087	Explosives	CC
280-111519-1	LL2mw-267-062818-GW	280-111519-1	Ground Water	PETN	78-11-5	µg/L	2.1	u	uj	n	2.1	1.3	0.083	Explosives	CC
280-111519-1	LL2mw-267-062818-GW	280-111519-1	Ground Water	Barium	7440-39-3	µg/L	7.3		j	y	3.0	0.95	0.29	Metals	CC
280-111519-1	LL2mw-267-062818-GW	280-111519-1	Ground Water	Copper	7440-50-8	µg/L	1.8	u	uj	n	2.0	1.8	0.56	Metals	IC CC
280-111519-1	LL2mw-267-062818-GW	280-111519-1	Ground Water	Manganese	7439-96-5	µg/L	770		j	y	3.5	0.95	0.31	Metals	IC
280-111519-1	LL10mw-005-062818-GW	280-111519-2	Ground Water	Methylene chloride	75-09-2	µg/L	0.5	j	u	n	5.0	0.80	0.32	VOCs	B
280-111519-1	LL10mw-005-062818-GW	280-111519-2	Ground Water	4-Methyl-2-pentanone	108-10-1	µg/L	3.2	u q	uj	n	5	3.2	1	VOCs	CC
280-111519-1	LL10mw-005-062818-GW	280-111519-2	Ground Water	Benz(a)anthracene	56-55-3	µg/L	0.013	j q	u	n	0.093	0.011	0.0039	PAHs	B
280-111519-1	LL10mw-005-062818-GW	280-111519-2	Ground Water	Dibenz(a,h)anthracene	53-70-3	µg/L	0.011	u q m	uj	n	0.093	0.011	0.0038	PAHs	CC
280-111519-1	LL10mw-005-062818-GW	280-111519-2	Ground Water	Fluoranthene	206-44-0	µg/L	0.019	j	u	n	0.093	0.011	0.0045	PAHs	B
280-111519-1	LL10mw-005-062818-GW	280-111519-2	Ground Water	Phenanthrene	85-01-8	µg/L	0.037	j	u	n	0.093	0.019	0.0086	PAHs	B
280-111519-1	LL10mw-005-062818-GW	280-111519-2	Ground Water	Pyrene	129-00-0	µg/L	0.010	j	u	n	0.093	0.019	0.0057	PAHs	B
280-111519-1	LL10mw-005-062818-GW	280-111519-2	Ground Water	Barium	7440-39-3	µg/L	19	q	j	y	3.0	0.95	0.29	Metals	CC
280-111519-1	LL10mw-005-062818-GW	280-111519-2	Ground Water	Copper	7440-50-8	µg/L	0.74	j	u	n	2.0	1.8	0.56	Metals	B
280-111519-1	LL10mw-005-062818-GW	280-111519-2	Ground Water	Manganese	7439-96-5	µg/L	870		j	y	3.5	0.95	0.31	Metals	IC
280-111519-1	TB-062818-01	280-111519-3	Ground Water	1,1,1-Trichloroethane	71-55-6	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	1,1,2,2-Tetrachloroethane	79-34-5	µg/L	0.8	u	uj	n	1	0.8	0.20	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	1,1,2-Trichloroethane	79-00-5	µg/L	0.8	u	uj	n	1	0.8	0.32	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	1,1-Dichloroethane	75-34-3	µg/L	0.8	u	uj	n	1	0.8	0.16	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	1,1-Dichloroethene	75-35-4	µg/L	0.8	u	uj	n	1	0.8	0.14	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	1,2-Dibromoethane	106-93-4	µg/L	0.4	u	uj	n	1	0.4	0.18	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	1,2-Dichloroethane	107-06-2	µg/L	0.4	u	uj	n	1	0.4	0.13	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	1,2-Dichloroethene	540-59-0	µg/L	0.2	u	uj	n	1	0.2	0.15	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	1,2-Dichloropropane	78-87-5	µg/L	0.4	u	uj	n	1	0.4	0.13	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	2-Butanone	78-93-3	µg/L	4	u	uj	n	6	4	1.8	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	2-Hexanone	591-78-6	µg/L	4	u	uj	n	5	4	1.4	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	4-Methyl-2-pentanone	108-10-1	µg/L	3.2	u q	uj	n	5	3.2	1	VOCs	Q CC
280-111519-1	TB-062818-01	280-111519-3	Ground Water	Acetone	67-64-1	µg/L	6.4	u	j	y	10	6.4	1.9	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	Benzene	71-43-2	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	Bromochloromethane	74-97-5	µg/L	0.2	u	uj	n	1	0.2	0.1	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	Bromodichloromethane	75-27-4	µg/L	0.4	u	uj	n	1	0.4	0.17	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	Bromoform	75-25-2	µg/L	0.4	u	uj	n	1	0.4	0.19	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	Bromomethane	74-83-9	µg/L	0.8	u	uj	n	2	0.8	0.21	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	Carbon disulfide	75-15-0	µg/L	1.6	u	uj	n	2	1.6	0.45	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	Carbon tetrachloride	56-23-5	µg/L	0.4	u	uj	n	2	0.4	0.19	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	Chlorobenzene	108-90-7	µg/L	0.4	u	uj	n	1	0.4	0.17	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	Chloroethane	75-00-3	µg/L	1.6	u	uj	n	2	1.6	0.41	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	Chloroform	67-66-3	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	Chloromethane	74-87-3	µg/L	0.8	u	uj	n	2	0.8	0.3	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	cis-1,3-Dichloropropene	10061-01-5	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q

280-111519-1	TB-062818-01	280-111519-3	Ground Water	Dibromochloromethane	124-48-1	µg/L	0.4	u	uj	n	1	0.4	0.17	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	Ethylbenzene	100-41-4	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	Methylene chloride	75-09-2	µg/L	0.5	j	uj	y	5	0.8	0.32	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	Styrene	100-42-5	µg/L	0.4	u	uj	n	1	0.4	0.17	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	Tetrachloroethene	127-18-4	µg/L	0.4	u	uj	n	1	0.4	0.2	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	Toluene	108-88-3	µg/L	0.4	u	uj	n	1	0.4	0.17	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	trans-1,3-Dichloropropene	10061-02-6	µg/L	0.4	u	uj	n	1	0.4	0.19	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	Trichloroethene	79-01-6	µg/L	0.4	u	uj	n	1	0.4	0.16	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	Vinyl chloride	75-01-4	µg/L	0.2	u	uj	n	1.5	0.2	0.1	VOCs	Q
280-111519-1	TB-062818-01	280-111519-3	Ground Water	Xylene (Total)	1330-20-7	µg/L	0.8	u	uj	n	2	0.8	0.19	VOCs	Q
280-111519-1	LL2mw-272-062718-GW	280-111519-4	Ground Water	Nitroguanidine	556-88-7	µg/L	6.0	u	uj	n	20	6.0	2.4	Nitroguanidine	Q
280-111519-1	LL2mw-272-062718-GW	280-111519-4	Ground Water	Nitrocellulose	9004-70-0	µg/L	1000	u	uj	n	2000	1000	480	Nitrocellulose	Q
280-111519-1	LL2mw-272-062718-GW	280-111519-4	Ground Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.13	u q	uj	n	0.22	0.13	0.055	Explosives	L
280-111519-1	LL2mw-272-062718-GW	280-111519-4	Ground Water	Total Cyanide	57-12-5	µg/L	3.3	j q	j	y	10	5.0	2.0	Total Cyanide	L
280-111519-1	LL1mw-065-062718-GW	280-111519-5	Ground Water	2-Nitrotoluene	88-72-2	µg/L	0.25	u	uj	n	0.49	0.25	0.11	Explosives	CC
280-111519-1	LL1mw-065-062718-GW	280-111519-5	Ground Water	3-Nitrotoluene	99-08-1	µg/L	0.25	u	uj	n	0.49	0.25	0.10	Explosives	CC
280-111519-1	LL1mw-065-062718-GW	280-111519-5	Ground Water	PETN	78-11-5	µg/L	1.5	u	uj	n	2.5	1.5	0.51	Explosives	CC
280-111519-1	LL1mw-065-062718-GW	280-111519-5	Ground Water	Barium	7440-39-3	µg/L	43	q	j	y	3.0	0.95	0.29	Metals	CC
280-111519-1	LL1mw-065-062718-GW	280-111519-5	Ground Water	Copper	7440-50-8	µg/L	0.87	j	u	n	2.0	1.8	0.56	Metals	B
280-111519-1	LL1mw-065-062718-GW	280-111519-5	Ground Water	Manganese	7439-96-5	µg/L	52		j	y	3.5	0.95	0.31	Metals	IC
280-111519-1	LL1mw-064-062718-GW	280-111519-6	Ground Water	Barium	7440-39-3	µg/L	47	q	j	y	3.0	0.95	0.29	Metals	CC
280-111519-1	LL1mw-064-062718-GW	280-111519-6	Ground Water	Copper	7440-50-8	µg/L	0.57	j	u	n	2.0	1.8	0.56	Metals	B
280-111519-1	LL1mw-064-062718-GW	280-111519-6	Ground Water	Manganese	7439-96-5	µg/L	140		j	y	3.5	0.95	0.31	Metals	IC
280-111519-1	LL1mw-086-062718-GW	280-111519-7	Ground Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u	uj	n	0.41	0.21	0.088	Explosives	CC
280-111519-1	LL1mw-086-062718-GW	280-111519-7	Ground Water	3-Nitrotoluene	99-08-1	µg/L	0.21	u	uj	n	0.41	0.21	0.086	Explosives	CC
280-111519-1	LL1mw-086-062718-GW	280-111519-7	Ground Water	PETN	78-11-5	µg/L	1.2	u	uj	n	2.1	1.2	0.43	Explosives	CC
280-111519-1	LL1mw-086-062718-GW	280-111519-7	Ground Water	Antimony	7440-36-0	µg/L	1.0	u	uj	n	6.0	1.0	0.40	Metals	IC CC
280-111519-1	LL1mw-086-062718-GW	280-111519-7	Ground Water	Barium	7440-39-3	µg/L	49	q	j	y	3.0	0.95	0.29	Metals	CC
280-111519-1	LL1mw-086-062718-GW	280-111519-7	Ground Water	Cadmium	7440-43-9	µg/L	1.0	u	uj	n	1.0	1.0	0.27	Metals	CC
280-111519-1	LL1mw-086-062718-GW	280-111519-7	Ground Water	Copper	7440-50-8	µg/L	1.8	u	uj	n	2.0	1.8	0.56	Metals	IC CC
280-111519-1	LL1mw-086-062718-GW	280-111519-7	Ground Water	Manganese	7439-96-5	µg/L	64		j	y	3.5	0.95	0.31	Metals	IC
280-111519-1	LL1mw-086-062718-GW	280-111519-7	Ground Water	Vanadium	7440-62-2	µg/L	2.0	u q	uj	n	6.0	2.0	0.50	Metals	CC
280-111519-1	LL1mw-086-062718-GW	280-111519-7	Ground Water	Total Cyanide	57-12-5	µg/L	4.3	j q	j	y	10	5.0	2.0	Total Cyanide	L
280-111519-1	EBGmw-131-062818-GW	280-111519-9	Ground Water	Total Cyanide	57-12-5	µg/L	4.0	j q	j	y	10	5.0	2.0	Total Cyanide	L
280-111519-1	CBPmw-009-062818-GW	280-111519-10	Ground Water	Total Cyanide	57-12-5	µg/L	4.6	j q	j	y	10	5.0	2.0	Total Cyanide	L
280-111519-1	CBPmw-008-062818-GW	280-111519-11	Ground Water	Total Cyanide	57-12-5	µg/L	4.5	j q	j	y	10	5.0	2.0	Total Cyanide	L
280-111519-1	LL12mw-183-062718-GW	280-111519-12	Ground Water	Fluoranthene	206-44-0	µg/L	0.012	j	u	n	0.098	0.012	0.0032	PAHs	B
280-111519-1	LL12mw-183-062718-GW	280-111519-12	Ground Water	Naphthalene	91-20-3	µg/L	0.057	j	u	n	0.098	0.012	0.0079	PAHs	B
280-111519-1	LL12mw-183-062718-GW	280-111519-12	Ground Water	Phenanthrene	85-01-8	µg/L	0.018	j	u	n	0.098	0.020	0.0092	PAHs	B
280-111519-1	LL12mw-183-062718-GW	280-111519-12	Ground Water	Pyrene	129-00-0	µg/L	0.0070	j	u	n	0.098	0.020	0.0060	PAHs	B
280-111519-1	LL12mw-183-062718-GW	280-111519-12	Ground Water	Total Cyanide	57-12-5	µg/L	4.8	j q	j	y	10	5.0	2.0	Total Cyanide	L
280-111519-1	LL4mw-200-062718-GW	280-111519-13	Ground Water	Total Cyanide	57-12-5	µg/L	6.3	j q	j	y	10	5.0	2.0	Total Cyanide	L
280-111519-1	LL1mw-083-062718-GW	280-111519-14	Ground Water	Methoxychlor	72-43-5	µg/L	0.035	u	uj	n	0.096	0.035	0.013	OCPs	CC
280-111519-1	LL1mw-083-062718-GW	280-111519-14	Ground Water	2,4-Dinitrotoluene	121-14-2	µg/L	4.2	q	j	y	0.43	0.21	0.090	Explosives	L
280-111519-1	LL1mw-083-062718-GW	280-111519-14	Ground Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	16		j	y	0.21	0.13	0.062	Explosives	L

280-111519-1	LL2mw-264-062718-GW	280-111519-15	Ground Water	Total Cyanide	57-12-5	µg/L	3.3	j q	j	y	10	5.0	2.0	Total Cyanide	L
280-111519-1	RQLmw-011-062818-GW	280-111519-16	Ground Water	Benz(a)anthracene	56-55-3	µg/L	0.012	j	u	n	0.096	0.012	0.0040	PAHs	B
280-111519-1	RQLmw-011-062818-GW	280-111519-16	Ground Water	Dibenz(a,h)anthracene	53-70-3	µg/L	0.012	u m	uj	n	0.096	0.012	0.0046	PAHs	CC
280-111519-1	RQLmw-011-062818-GW	280-111519-16	Ground Water	Fluoranthene	206-44-0	µg/L	0.016	j	u	n	0.096	0.012	0.0046	PAHs	B
280-111519-1	RQLmw-011-062818-GW	280-111519-16	Ground Water	Phenanthrene	85-01-8	µg/L	0.027	j	u	n	0.096	0.019	0.0089	PAHs	B
280-111519-1	RQLmw-011-062818-GW	280-111519-16	Ground Water	Pyrene	129-00-0	µg/L	0.0095	j	u	n	0.096	0.019	0.0059	PAHs	B
280-111519-1	LL1mw-087-062818-GW	280-111519-17	Ground Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u	uj	n	0.43	0.21	0.091	Explosives	CC
280-111519-1	LL1mw-087-062818-GW	280-111519-17	Ground Water	3-Nitrotoluene	99-08-1	µg/L	0.21	u	uj	n	0.43	0.21	0.089	Explosives	CC
280-111519-1	LL1mw-087-062818-GW	280-111519-17	Ground Water	PETN	78-11-5	µg/L	1.3	u	uj	n	2.1	1.3	0.44	Explosives	CC
280-111519-1	LL1mw-087-062818-GW	280-111519-17	Ground Water	Barium	7440-39-3	µg/L	24	q	j	y	3.0	0.95	0.29	Metals	CC
280-111519-1	LL1mw-087-062818-GW	280-111519-17	Ground Water	Copper	7440-50-8	µg/L	1.6	j	u	n	2.0	1.8	0.56	Metals	B
280-111519-1	LL1mw-087-062818-GW	280-111519-17	Ground Water	Vanadium	7440-62-2	µg/L	0.58	j	u	n	6.0	2.0	0.50	Metals	B
280-111519-1	LL1mw-087-062818-GW	280-111519-17	Ground Water	Manganese	7439-96-5	µg/L	200		j	y	3.5	0.95	0.31	Metals	IC
280-111519-1	SCFmw-004-062818-GW	280-111519-18	Ground Water	Bis(2-ethylhexyl) phthalate	117-81-7	µg/L	2.0	u m q	uj	n	9.8	2.0	0.55	SVOCs	S
280-111519-1	SCFmw-004-062818-GW	280-111519-18	Ground Water	Butyl benzyl phthalate	85-68-7	µg/L	2.0	u q	uj	n	20	2.0	0.98	SVOCs	S
280-111519-1	SCFmw-004-062818-GW	280-111519-18	Ground Water	Diethyl phthalate	84-66-2	µg/L	0.98	u q	uj	n	20	0.98	0.37	SVOCs	S
280-111519-1	SCFmw-004-062818-GW	280-111519-18	Ground Water	Dimethyl phthalate	131-11-3	µg/L	0.49	u q	uj	n	20	0.49	0.21	SVOCs	S
280-111519-1	SCFmw-004-062818-GW	280-111519-18	Ground Water	Di-n-butyl phthalate	84-74-2	µg/L	4.3	u q	uj	n	20	4.3	1.1	SVOCs	S
280-111519-1	SCFmw-004-062818-GW	280-111519-18	Ground Water	Di-n-octyl phthalate	117-84-0	µg/L	0.98	u q	uj	n	20	0.98	0.34	SVOCs	S
280-111519-1	SCFmw-004-062818-GW	280-111519-18	Ground Water	4,4'-DDD	72-54-8	µg/L	0.052	u	uj	n	0.052	0.052	0.0044	OCPs	CC
280-111519-1	SCFmw-004-062818-GW	280-111519-18	Ground Water	2-Nitrotoluene	88-72-2	µg/L	0.23	u	uj	n	0.46	0.23	0.098	Explosives	CC
280-111519-1	SCFmw-004-062818-GW	280-111519-18	Ground Water	3-Nitrotoluene	99-08-1	µg/L	0.23	u	uj	n	0.46	0.23	0.096	Explosives	CC
280-111519-1	SCFmw-004-062818-GW	280-111519-18	Ground Water	PETN	78-11-5	µg/L	1.4	u	uj	n	2.3	1.4	0.48	Explosives	CC
280-111519-1	SCFmw-004-062818-GW	280-111519-18	Ground Water	Barium	7440-39-3	µg/L	54	q	j	y	3.0	0.95	0.29	Metals	CC
280-111519-1	SCFmw-004-062818-GW	280-111519-18	Ground Water	Copper	7440-50-8	µg/L	32		j	y	2.0	1.8	0.56	Metals	IC CC
280-111519-1	SCFmw-004-062818-GW	280-111519-18	Ground Water	Iron	7439-89-6	µg/L	50	j	u	n	100	85	22	Metals	B
280-111519-1	SCFmw-004-062818-GW	280-111519-18	Ground Water	Manganese	7439-96-5	µg/L	750		j	y	3.5	0.95	0.31	Metals	IC
280-111519-1	LL12mw-242-D-062718-GW	280-111519-19	Ground Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.13	u q	uj	n	0.21	0.13	0.054	Explosives	L
280-111519-1	LL12mw-242-D-062718-GW	280-111519-19	Ground Water	Antimony	7440-36-0	µg/L	1.0	u	uj	n	6.0	1.0	0.40	Metals	IC CC
280-111519-1	LL12mw-242-D-062718-GW	280-111519-19	Ground Water	Barium	7440-39-3	µg/L	28	q	j	y	3.0	0.95	0.29	Metals	CC
280-111519-1	LL12mw-242-D-062718-GW	280-111519-19	Ground Water	Cadmium	7440-43-9	µg/L	1.0	u	uj	n	1.0	1.0	0.27	Metals	CC
280-111519-1	LL12mw-242-D-062718-GW	280-111519-19	Ground Water	Copper	7440-50-8	µg/L	1.8	u	uj	n	2.0	1.8	0.56	Metals	IC CC
280-111519-1	LL12mw-242-D-062718-GW	280-111519-19	Ground Water	Manganese	7439-96-5	µg/L	66		j	y	3.5	0.95	0.31	Metals	IC CC
280-111519-1	LL12mw-242-D-062718-GW	280-111519-19	Ground Water	Vanadium	7440-62-2	µg/L	2.0	u	uj	n	6.0	2.0	0.50	Metals	CC
280-111519-1	LL12mw-242-062718-GW	280-111519-20	Ground Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.14	u q	uj	n	0.23	0.14	0.057	Explosives	L
280-111519-1	LL12mw-242-062718-GW	280-111519-20	Ground Water	Antimony	7440-36-0	µg/L	1.0	u	uj	n	6.0	1.0	0.40	Metals	IC CC
280-111519-1	LL12mw-242-062718-GW	280-111519-20	Ground Water	Barium	7440-39-3	µg/L	28	q	j	y	3.0	0.95	0.29	Metals	CC
280-111519-1	LL12mw-242-062718-GW	280-111519-20	Ground Water	Cadmium	7440-43-9	µg/L	1.0	u	uj	n	1.0	1.0	0.27	Metals	CC
280-111519-1	LL12mw-242-062718-GW	280-111519-20	Ground Water	Copper	7440-50-8	µg/L	1.8	u	uj	n	2.0	1.8	0.56	Metals	IC CC
280-111519-1	LL12mw-242-062718-GW	280-111519-20	Ground Water	Manganese	7439-96-5	µg/L	69		j	y	3.5	0.95	0.31	Metals	IC CC
280-111519-1	LL12mw-242-D-062718-GW	280-111519-19	Ground Water	Vanadium	7440-62-2	µg/L	2.0	u	uj	n	6.0	2.0	0.50	Metals	CC

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual & Quarterly Sampling Event for June 2018

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008
Task Order Number: 0003

Laboratory SDG 280-111519-2

Prepared For:

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by the Validator. Signatures indicate the report is approved for release.

Erica Fisher, Validator, TEC-WESTON JV	Date
Peter Chapman, Senior Chemist, TEC-WESTON JV	Date

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INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-111519-2**.

TestAmerica, Inc., Canton, Ohio performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Nitrate/Nitrite	SW-846 Method 9056A	Arvada, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*); and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*), the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	NO3/NO2
LL1mw-083-062718-GW	280-111519-14	06/27/2018	Groundwater		✓
RLQmw-011-062818-GW	280-111519-16	06/28/2018	Groundwater		✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 SAMPLE RECEIPT

The samples were received by the laboratory on 29, 2018; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.3 TECHNICAL DATA VALIDATION

1.3.1 Nitrate/Nitrite by Method 9056A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- LODs and LOQs
- LCS recoveries
- Method blank
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank
- Field duplicate

The nitrate/nitrate analyses were conducted past the 48 hour holding time as required by the method. Therefore, the non-detect and detected nitrate/nitrite results for these two samples were qualified as estimated values (UJ/J H).

No analytical or quality parameters requiring further discussion were identified for Method 9056A.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	Units	Result	Lab Flag	DV Flag	Detect	LOQ	LOD	MDL	Method	Reason Code
280-111519-2	LL1mw-083-062718-GW	280-111519-14	Ground Water	Nitrate	µg/L	310	h	j	y	500	100	42	9056A	H
280-111519-2	LL1mw-083-062718-GW	280-111519-14	Ground Water	Nitrite	µg/L	100	u h	uj	n	500	100	49	9056A	H
280-111519-2	RQLmw-011-062818-GW	280-111519-15	Ground Water	Nitrate	µg/L	100	u h	uj	n	500	100	42	9056A	H
280-111519-2	RQLmw-011-062818-GW	280-111519-15	Ground Water	Nitrite	µg/L	100	u h	uj	n	500	100	49	9056A	H

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual & Quarterly Sampling Event for June 2018

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-111554-1

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.

Travis Withers
2018.08.29 18:44:38 -05'00'

Travis Withers, Validator, TEC-WESTON JV — Date

Peter Chapman, Senior Chemist, TEC-WESTON JV — 8/29/18 Date

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INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-111554-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semi-Volatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Alkalinity	2320B	Denver, CO
Total Cyanide	9012B	Denver, CO
Sulfide	9034	Denver, CO
Chloride, Sulfate	9056A	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*); and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*), the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*) and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*). Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs	PAHs	Pesticides	PCBs	Explosives	Metals	Total Cyanide	Alkalinity	Sulfide	Anions
RQLmw-007-062818-GW	280-111554-1	06/28/18	Groundwater		✓	✓	✓	✓	✓	✓	✓	✓			
FWGmw-012-062818	280-111554-2	06/28/18	Groundwater			✓				✓	✓				
FWGmw-011-062818	280-111554-3	06/28/18	Groundwater			✓				✓	✓				
RQLmw-012-062818-GW	280-111554-4	06/28/18	Groundwater									✓	✓	✓	✓
TB-062818-05	280-111554-5	06/28/18	Groundwater	Trip Blank	✓										
RQLmw-016-062818-GW	280-111554-6	06/28/18	Groundwater									✓			
RQLmw-008-062818-GW	280-111554-7	06/28/18	Groundwater			✓	✓	✓	✓	✓	✓	✓			
TB-062818-03	280-111554-8	06/28/18	Groundwater	Trip Blank	✓										
RQLmw-009-062818-GW	280-111554-9	06/28/18	Groundwater		✓	✓	✓	✓	✓	✓	✓	✓			
RQLmw-014-062818-GW	280-111554-10	06/28/18	Groundwater							✓			✓	✓	✓
RQLmw-013-062818-GW	280-111554-11	06/28/18	Groundwater										✓	✓	✓
TB-062818-02	280-111554-12	06/28/18	Groundwater	Trip Blank	✓										
RQLmw-007-D-062818-GW	280-111554-13	06/28/18	Groundwater	Field Duplicate	✓	✓	✓	✓	✓	✓	✓	✓			
TB-062818-04	280-111554-14	06/28/18	Groundwater	Trip Blank	✓										

Some samples were analyzed for natural attenuation parameters. Natural attenuation parameters are reported, but not validated in accordance with the QAPP.

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 SAMPLE RECEIPT

The samples were received by the laboratory on June 30 2018; the samples were received in good condition, under chain-of-custody, properly preserved and cooler temperatures were less than 6°C.

Two of three HCL preserved VOA vials for VOCs analysis for sample RQLmw-008-062818-GW were received with a headspace bubble greater than 6 mm in diameter. Sufficient sample volume without headspace was received to perform the requested analysis.

One of one HCL preserved VOA vials for VOCs analysis for sample TB-062818-05 was received with a headspace bubble greater than 6 mm in diameter. Analytical results may be biased low due to headspace.

Sample volume for the requested PAH and pesticide analysis were not received by the laboratory in the method required unpreserved 250mL amber glass containers for the following samples: RQLmw-007-062818-GW, RQLmw-008-062818-GW, RQLmw-009-062818-GW, and RQLmw-007-D-062818-GW. The laboratory was instructed to proceed with the analyses by aliquoting volume from 500mL amber glass bottles.

1.3 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate

is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
U	B	Non-detection; blank criteria not met.
UJ	S	Estimated non-detection; surrogate recovery exceedance.
UJ	M	Estimated non-detection; MS/MSD recovery or RPD exceedance.
J	CC	Estimated detection; continuing calibration criteria not met.
J	Q	Estimated detection; professional judgement.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS/LCSD recoveries and RPDs
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Trip blank

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Method Blank

Acetone (2.50 µg/L) was detected in the method blank at a concentration below the LOQ (10 µg/L). Acetone was also detected in samples RQLmw-007-062818-GW (5.8 µg/L), RQLmw-008-062818-GW (4.1 µg/L), RQLmw-009-062818-GW (6.4 µg/L), and RQLmw-007-D-062818-GW (6.1 µg/L)

at a concentration below the LOQ. These sample results were qualified as non-detect at the LOQ (U B). All other samples were non-detect for acetone; therefore, no qualification was necessary.

Methylene chloride (1.04 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Methylene chloride was also detected in samples TB-062818-05 (0.49 µg/L), RQLmw-008-062818-GW (0.47 µg/L), TB-062818-03 (0.71 µg/L), and TB-062818-04 (0.88 µg/L) at a concentration below the LOQ. These sample results were qualified as non-detect at the LOQ (U B).

Toluene (0.209 µg/L) was detected in the method blank at a concentration below the LOQ (1.0 µg/L). All associated samples were non-detect for toluene; therefore, no qualification was necessary.

1.4.1.2 MS/MSD Recoveries and RPDs

An MS/MSD was performed on sample RQLmw-007-062818-GW. Ethylbenzene recovered below the control limits (79-121%) in the MSD (78%). The MS recovery (80%) and RPD (2%) were within control limits for ethylbenzene; therefore, no qualification was necessary.

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Method blanks
- LODs and LOQs
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Field duplicates

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.2.1 Surrogate Recoveries

Surrogate terphenyl-d14 recovered below control limits (50-134%) in samples RQLmw-007-062818-GW (26%) and RQLmw-007-D-062818-GW (24%). All associated sample results were qualified as estimated (UJ S).

Surrogate 2-fluorobiphenyl recovered below control limits (44-149%) in samples FWGmw-012-062818 (37%) and FWGmw-011-062818 (35%). All associated sample results were qualified as estimated (UJ S).

Surrogate 2-fluorobiphenyl recovered below control limits (44-149%) in the method blank (43%). All associated sample results were qualified as estimated (UJ S).

1.4.2.2 LCS/LCSD Recoveries and RPDs

Analytes 1,2,4-trichlorobenzene (27%), 1,2-dhlorobenzene (23%), 1,3-dichlorobenzene (25%), 1,4-dichlorobenzene (25%), 2-chloronaphthalene (23%), 2-methylnaphthalene (26%), benzoic acid (21%), hexachlorobutadiene (28%), hexachlorocyclopentadiene (27%), and hexachloroethane (27%) exceeded the RPD limit (20%) for the LCS/LCSD. All LCS and LCSD recoveries were within control limits; therefore, no qualification was necessary.

1.4.3 Polycyclic Aromatic Hydrocarbons (PAHs) by Method 8270D SIM

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Surrogate recoveries
- LCS/LCSD recoveries and RPDs
- LODs and LOQs
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Field duplicates

All analytical or quality parameters requiring further discussion for Method 8270D SIM are described in the sections below.

1.4.3.1 Method Blank

Several analytes were detected in the method blank at a concentration below the LOQ. These analytes are outlined in the table below, along with the associated sample qualifications.

Analyte	Detection (µg/L)	LOQ (µg/L)	Sample	Flag
Benz[a]anthracene	0.0344	0.10	RQLmw-008-062818-GW	U B
Benzo[b]fluoranthene	0.0737	0.10	N/A	N/A

Benzo[k]fluoranthene	0.0288	0.10	N/A	N/A
Benzo[g,h,i]perylene	0.0392	0.10	N/A	N/A
Benzo[a]pyrene	0.0488	0.10	N/A	N/A
Chrysene	0.0528	0.10	N/A	N/A
Dibenz(a,h)anthracene	0.00706	0.10	N/A	N/A
Fluoranthene	0.0364	0.10	RQLmw-007-062818-GW RQLmw-008-062818-GW RQLmw-009-062818-GW RQLmw-007-D-062818-GW	U B
Indeno(1,2,3-cd)pyrene	0.0571	0.10	N/A	N/A
Phenanthrene	0.0245	0.10	RQLmw-007-062818-GW RQLmw-009-062818-GW RQLmw-007-D-062818-GW	U B
Pyrene	0.0277	0.10	RQLmw-007-062818-GW RQLmw-008-062818-GW RQLmw-009-062818-GW RQLmw-007-D-062818-GW	U B

1.4.4 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Method blank
- Surrogate recoveries
- LCS/LCSD recoveries and RPDs
- MS/MSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- LODs and LOQs

All analytical or quality parameters requiring further discussion for Method 8081B are described in the sections below.

1.4.4.1 Sample Preparation

Samples RQLmw-007-062818-GW, RQLmw-008-062818-GW, RQLmw-009-062818-GW, and RQLmw-007-D-062818 required a mercury clean-up, via EPA Method 3660A, to reduce matrix interferences caused by sulfur.

1.4.4.2 Continuing Calibration Verifications

4,4-DDD (121%) recovered above the control limits (80-120%) in the continuing calibration verification. All associated samples were non-detect for 4,4-DDD; therefore, no qualification was necessary.

1.4.5 Polychlorinated Biphenyls (PCBs) by Method 8082A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Method blank
- Surrogate recoveries
- LCS/LCSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- LODs and LOQs

All analytical or quality parameters requiring further discussion for Method 8082A are described in the sections below.

1.4.5.1 Sample Preparation

Samples RQLmw-007-062818-GW, RQLmw-008-062818-GW, RQLmw-009-062818-GW, and RQLmw-007-D-062818 required a sulfuric acid clean-up, via EPA Method 3665A, to reduce matrix interferences.

1.4.5.2 MS/MSD Recoveries and RPDs

An MS/MSD was performed on sample RQLmw-007-062818-GW. PCB-1016 recovered above the control limits (46-129%) in the MSD (231%) and the RPD (78%) was above the limit (30%) as well. The associated parent sample was non-detect for PCB-1016; therefore, no qualification was necessary.

1.4.6 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- Initial calibration
- Initial calibration verification

- LODs and LOQs

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.6.1 Method Blank

2-Amino-4,6-dinitrotoluene was detected in the method blank on the secondary confirmation column. This analyte was not detected on the primary column; therefore, no qualification was necessary.

1.4.6.2 LCS/LCSD Recoveries and RPDs

m-Nitrotoluene (50%), o-nitrotoluene (69%), and 2-amino-4,6-dinitrotoluene (127%) recovered outside of their respective control limits (73-125%, 70-127%, & 79-120%) in the LCS on the secondary confirmation column. All LCS recoveries were within the control limits on the primary column; therefore, no qualification was necessary.

1.4.6.3 MS/MSD Recoveries and RPDs

An MS/MSD was performed on sample RQLMw-007-062818-GW. Several analytes exceeded the control limits for the MS/MSD. The following table outlines the exceedances:

Analyte	MS %R	MSD %R	%R Limits	RPD	RPD Limit
2,4,6-Trinitrotoluene	99	122	71-123	**22**	20
2,4-Dinitrotoluene	106	**826**	78-120	**155**	20
2,6-Dinitrotoluene	99	**759**	77-127	**154**	20
2-Nitrotoluene	**138**	88	70-127	**42**	20
4-Nitrotoluene	102	74	71-127	**26**	20

%R = percent recovery
Bolded values are outside control limits.

The RPD for 2,4,6-trinitrotoluene and 4-nitrotoluene were above the control limit. The MS and MSD recoveries are within the control limits for these analytes; therefore, no qualification was necessary.

The MS or MSD recovery and RPD were above the control limits for 2,4-dinitrotoluene, 2,6-dinitrotoluene, and 2-nitrotoluene. The associated parent sample results were qualified as estimated (UJ M).

1.4.6.4 Continuing Calibration Verification

m-Nitrotoluene, o-nitrotoluene, and PETN recovered outside of the control limits in a continuing calibration verification on the secondary confirmation column. All of these analytes were within the control limits on the primary column; therefore, no qualification was necessary.

1.4.6.5 Sample Preparation

Samples FWGmw-011-062818, FWGmw-011-062818, RQLmw-008-062818-GW, RQLmw-009-062818-GW, and RQLmw-014-062818-GW were filtered prior to analysis to reduce matrix interferences.

1.4.6.6 Confirmation Column

The RPD between the primary and confirmation column results for RDX in sample RQLmw-014-062818-GW (125%) exceeded 40%. The higher of the two results will be reported and qualified as estimated (J Q).

1.4.7 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS/LCSD recoveries and RPDs
- Post digestion spike
- Serial dilution
- Initial and continuing calibration blanks
- Contract required detection limit standard
- Instrument tuning
- Interference check solutions
- Field duplicate

All analytical or quality issues requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.7.1 Method Blank

Calcium (55.3 µg/L), iron (31.7 µg/L), sodium (203 µg/L), and beryllium (0.160 µg/L) were detected in the method blank at a concentration above their respective LOQs (1000 µg/L, 100 µg/L, 5000 µg/L, & 1.0 µg/L).

Calcium and iron were detected at concentrations above the LOQ in all associated samples; therefore, no qualification was necessary.

Sodium was detected at a concentration below the LOQ in samples RQLmw-007-062818-GW (3600 µg/L), RQLmw-008-062818-GW (2800 µg/L), RQLmw-009-062818-GW (1700 µg/L), and RQLmw-007-D-062818-GW (3700 µg/L). These results were qualified as non-detect at the LOQ (U B). All other associated sample results were at concentrations above the LOQ; therefore, no qualification was necessary.

Beryllium was detected at a concentration below the LOQ in samples RQLmw-007-062818-GW (0.15 µg/L) and RQLmw-009-062818-GW (0.14 µg/L). These results were qualified as non-detect at the LOQ (U B). All other associated samples were non-detect for beryllium; therefore, no qualification was necessary.

1.4.7.2 Initial/Continuing Calibrations Verifications

Calcium recovered above control limits (80-120%) in the low-level continuing calibration verification CCVL 280-421601/132 (127%). All associated sample results were qualified as estimated (J CC).

Sodium recovered above control limits (80-120%) in the low-level continuing calibration verification CCVL 280-421601/132 (124%). All associated detected sample results were qualified as estimated (J CC).

Barium recovered above control limits (80-120%) in the low-level continuing calibration verification CCVL 280-421631-133 (127%). All associated detected sample results were qualified as estimated (J CC).

Beryllium recovered above control limits (80-120%) in the low-level continuing calibration verification CCVL 280-421770/110 (124%) and CCVL 280-421770/118 (126%). All associated were either non-detect or qualified as non-detect; therefore, no qualification was necessary.

1.4.8 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- MS/MSD recoveries and RPDs
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank
- Low and high level control sample recoveries
- Field duplicate

No analytical or quality issues required further discussion for Methods 9012B.

1.4.9 Alkalinity by Method 2320B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Field duplicate

All analytical or quality issues requiring further discussion for Methods 2320B are described in the sections below.

1.4.9.1 Method Blanks

Alkalinity was detected in the method blanks MB 280-422017/5 (1.37 mg/L) and MB280-422017/31 (1.10 mg/L) at a concentration below the LOQ (5.0 mg/L). All associated sample were either non-detect or had alkalinity concentrations above the LOQ; therefore, no qualification was necessary.

1.4.9.2 Continuing Calibration Blanks

Alkalinity was detected in continuing calibration blanks CCB 280-422017-17 (1.27 mg/L), CCB 280-422017-29 (1.34 mg/L), and CCB 280-422017-43 (1.13 mg/L) at a concentration below the LOQ (5 mg/L). All associated sample were either non-detect or had alkalinity concentrations above the LOQ; therefore, no qualification was necessary.

1.4.10 Sulfide by Method 9034

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- MS/MSD recoveries and RPDs

No analytical or quality issues required further discussion for Methods 9034.

1.4.11 Anions by Method 9056A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- MS/MSD recoveries and RPDs
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank

No analytical or quality issues required further discussion for Methods 9056A.

	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL
GW	280-111554-1	Ground Water	Calcium	7440-70-2	µg/L	110000	v	j	y	1000	140	35
GW	280-111554-1	Ground Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	120
GW	280-111554-1	Ground Water	Barium	7440-39-3	µg/L	35	v	j	y	3	0.95	0.29
GW	280-111554-1	Ground Water	Beryllium	7440-41-7	µg/L	1	j	u	n	1	0.3	0.08
GW	280-111554-1	Ground Water	Acetone	67-64-1	µg/L	10	j	u	n	10	6.4	1.9
GW	280-111554-1	Ground Water	1,2,4-Trichlorobenzene	120-82-1	µg/L	0.97	u q	uj	n	9.7	0.97	0.27
GW	280-111554-1	Ground Water	1,2-Dichlorobenzene	95-50-1	µg/L	0.49	u q	uj	n	9.7	0.49	0.22
GW	280-111554-1	Ground Water	1,3-Dichlorobenzene	541-73-1	µg/L	0.97	u q	uj	n	9.7	0.97	0.29
GW	280-111554-1	Ground Water	1,4-Dichlorobenzene	106-46-7	µg/L	0.97	u q	uj	n	9.7	0.97	0.31
GW	280-111554-1	Ground Water	2-Chloronaphthalene	91-58-7	µg/L	0.97	u q	uj	n	9.7	0.97	0.25
GW	280-111554-1	Ground Water	2-Methylnaphthalene	91-57-6	µg/L	0.97	u q	uj	n	9.7	0.97	0.28
GW	280-111554-1	Ground Water	Benzoic acid	65-85-0	µg/L	29	u q	uj	n	78	29	9.7
GW	280-111554-1	Ground Water	Hexachlorobutadiene	87-68-3	µg/L	9.7	u q	uj	n	29	9.7	3.2
GW	280-111554-1	Ground Water	Hexachlorocyclopentadiene	77-47-4	µg/L	29	u q	uj	n	49	29	9.7
GW	280-111554-1	Ground Water	Hexachloroethane	67-72-1	µg/L	4.3	u q	uj	n	9.7	4.3	2
GW	280-111554-1	Ground Water	Fluoranthene	206-44-0	µg/L	0.097	j	u	n	0.097	0.012	0.0046
GW	280-111554-1	Ground Water	Phenanthrene	85-01-8	µg/L	0.097	j	u	n	0.097	0.019	0.009
GW	280-111554-1	Ground Water	Pyrene	129-00-0	µg/L	0.097	j	u	n	0.097	0.019	0.0059
GW	280-111554-1	Ground Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.21	u j1	uj	n	0.42	0.21	0.089
GW	280-111554-1	Ground Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u j1	uj	n	0.21	0.21	0.068
GW	280-111554-1	Ground Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u j1	uj	n	0.42	0.21	0.09
GW	280-111554-10	Ground Water	RDX	121-82-4	µg/L	0.82	j1	j	y	0.21	0.12	0.054
8-GW	280-111554-13	Ground Water	Calcium	7440-70-2	µg/L	110000	v	j	y	1000	140	35
8-GW	280-111554-13	Ground Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	120
8-GW	280-111554-13	Ground Water	Barium	7440-39-3	µg/L	33	v	j	y	3	0.95	0.29
8-GW	280-111554-13	Ground Water	Acetone	67-64-1	µg/L	10	j	u	n	10	6.4	1.9
8-GW	280-111554-13	Ground Water	1,2,4-Trichlorobenzene	120-82-1	µg/L	0.95	u q	uj	n	9.5	0.95	0.27
8-GW	280-111554-13	Ground Water	1,2-Dichlorobenzene	95-50-1	µg/L	0.48	u q	uj	n	9.5	0.48	0.22
8-GW	280-111554-13	Ground Water	1,3-Dichlorobenzene	541-73-1	µg/L	0.95	u q	uj	n	9.5	0.95	0.29
8-GW	280-111554-13	Ground Water	1,4-Dichlorobenzene	106-46-7	µg/L	0.95	u q	uj	n	9.5	0.95	0.3
8-GW	280-111554-13	Ground Water	2-Chloronaphthalene	91-58-7	µg/L	0.95	u q	uj	n	9.5	0.95	0.25
8-GW	280-111554-13	Ground Water	2-Methylnaphthalene	91-57-6	µg/L	0.95	u q	uj	n	9.5	0.95	0.28
8-GW	280-111554-13	Ground Water	Benzoic acid	65-85-0	µg/L	29	u q	uj	n	76	29	9.5
8-GW	280-111554-13	Ground Water	Hexachlorobutadiene	87-68-3	µg/L	9.5	u q	uj	n	29	9.5	3.1
8-GW	280-111554-13	Ground Water	Hexachlorocyclopentadiene	77-47-4	µg/L	29	u q	uj	n	48	29	9.5
8-GW	280-111554-13	Ground Water	Hexachloroethane	67-72-1	µg/L	4.2	u m q	uj	n	9.5	4.2	2
8-GW	280-111554-13	Ground Water	Fluoranthene	206-44-0	µg/L	0.089	j	u	n	0.089	0.011	0.0043
8-GW	280-111554-13	Ground Water	Phenanthrene	85-01-8	µg/L	0.089	j	u	n	0.089	0.018	0.0082
8-GW	280-111554-13	Ground Water	Pyrene	129-00-0	µg/L	0.089	j	u	n	0.089	0.018	0.0054
	280-111554-14	Ground Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32
	280-111554-2	Ground Water	Calcium	7440-70-2	µg/L	24000	v	j	y	1000	140	35
	280-111554-2	Ground Water	Sodium	7440-23-5	µg/L	6700	v	j	y	5000	350	120
	280-111554-2	Ground Water	Barium	7440-39-3	µg/L	27	v	j	y	3	0.95	0.29

	280-111554-2	Ground Water	bis(2-Ethylhexyl)phthalate	117-81-7	µg/L	2.1	u q	uj	n	11	2.1	0.59
	280-111554-2	Ground Water	Butyl benzyl phthalate	85-68-7	µg/L	2.1	u q	uj	n	21	2.1	1.1
	280-111554-2	Ground Water	Diethylphthalate	84-66-2	µg/L	1.1	u q	uj	n	21	1.1	0.4
	280-111554-2	Ground Water	Dimethyl phthalate	131-11-3	µg/L	0.53	u q	uj	n	21	0.53	0.22
	280-111554-2	Ground Water	Di-N-Butyl phthalate	84-74-2	µg/L	4.6	u m q	uj	n	21	4.6	1.2
	280-111554-2	Ground Water	Di-N-Octyl phthalate	117-84-0	µg/L	1.1	u q	uj	n	21	1.1	0.37
	280-111554-3	Ground Water	Calcium	7440-70-2	µg/L	45000	v	j	y	1000	140	35
	280-111554-3	Ground Water	Sodium	7440-23-5	µg/L	5500	v	j	y	5000	350	120
	280-111554-3	Ground Water	Barium	7440-39-3	µg/L	30	v	j	y	3	0.95	0.29
	280-111554-3	Ground Water	bis(2-Ethylhexyl)phthalate	117-81-7	µg/L	1.9	u q	uj	n	9.7	1.9	0.54
	280-111554-3	Ground Water	Butyl benzyl phthalate	85-68-7	µg/L	1.9	u q	uj	n	19	1.9	0.97
	280-111554-3	Ground Water	Diethylphthalate	84-66-2	µg/L	0.97	u q	uj	n	19	0.97	0.37
	280-111554-3	Ground Water	Dimethyl phthalate	131-11-3	µg/L	0.48	u q	uj	n	19	0.48	0.2
	280-111554-3	Ground Water	Di-N-Butyl phthalate	84-74-2	µg/L	4.3	u m q	uj	n	19	4.3	1.1
	280-111554-3	Ground Water	Di-N-Octyl phthalate	117-84-0	µg/L	0.97	u q	uj	n	19	0.97	0.34
	280-111554-5	Ground Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32
GW	280-111554-7	Ground Water	Calcium	7440-70-2	µg/L	43000	v	j	y	1000	140	35
GW	280-111554-7	Ground Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	120
GW	280-111554-7	Ground Water	Barium	7440-39-3	µg/L	54	v	j	y	3	0.95	0.29
GW	280-111554-7	Ground Water	Acetone	67-64-1	µg/L	10	j	u	n	10	6.4	1.9
GW	280-111554-7	Ground Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32
GW	280-111554-7	Ground Water	1,2,4-Trichlorobenzene	120-82-1	µg/L	0.96	u q	uj	n	9.6	0.96	0.27
GW	280-111554-7	Ground Water	1,2-Dichlorobenzene	95-50-1	µg/L	0.48	u q	uj	n	9.6	0.48	0.22
GW	280-111554-7	Ground Water	1,3-Dichlorobenzene	541-73-1	µg/L	0.96	u q	uj	n	9.6	0.96	0.29
GW	280-111554-7	Ground Water	1,4-Dichlorobenzene	106-46-7	µg/L	0.96	u q	uj	n	9.6	0.96	0.31
GW	280-111554-7	Ground Water	2-Chloronaphthalene	91-58-7	µg/L	0.96	u q	uj	n	9.6	0.96	0.25
GW	280-111554-7	Ground Water	2-Methylnaphthalene	91-57-6	µg/L	0.96	u q	uj	n	9.6	0.96	0.28
GW	280-111554-7	Ground Water	Benzoic acid	65-85-0	µg/L	29	u q	uj	n	76	29	9.6
GW	280-111554-7	Ground Water	Hexachlorobutadiene	87-68-3	µg/L	9.6	u q	uj	n	29	9.6	3.2
GW	280-111554-7	Ground Water	Hexachlorocyclopentadiene	77-47-4	µg/L	29	u q	uj	n	48	29	9.6
GW	280-111554-7	Ground Water	Hexachloroethane	67-72-1	µg/L	4.2	u q	uj	n	9.6	4.2	2
GW	280-111554-7	Ground Water	Benz(a)anthracene	56-55-3	µg/L	0.095	j	u	n	0.095	0.011	0.004
GW	280-111554-7	Ground Water	Fluoranthene	206-44-0	µg/L	0.095	j	u	n	0.095	0.011	0.0046
GW	280-111554-7	Ground Water	Pyrene	129-00-0	µg/L	0.095	j	u	n	0.095	0.019	0.0058
	280-111554-8	Ground Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32
GW	280-111554-9	Ground Water	Calcium	7440-70-2	µg/L	18000	v	j	y	1000	140	35
GW	280-111554-9	Ground Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	120
GW	280-111554-9	Ground Water	Barium	7440-39-3	µg/L	24	v	j	y	3	0.95	0.29
GW	280-111554-9	Ground Water	Beryllium	7440-41-7	µg/L	1	j	u	n	1	0.3	0.08
GW	280-111554-9	Ground Water	Acetone	67-64-1	µg/L	10	j	u	n	10	6.4	1.9
GW	280-111554-9	Ground Water	1,2,4-Trichlorobenzene	120-82-1	µg/L	0.95	u q	uj	n	9.5	0.95	0.27
GW	280-111554-9	Ground Water	1,2-Dichlorobenzene	95-50-1	µg/L	0.48	u q	uj	n	9.5	0.48	0.22
GW	280-111554-9	Ground Water	1,3-Dichlorobenzene	541-73-1	µg/L	0.95	u q	uj	n	9.5	0.95	0.29
GW	280-111554-9	Ground Water	1,4-Dichlorobenzene	106-46-7	µg/L	0.95	u q	uj	n	9.5	0.95	0.3
GW	280-111554-9	Ground Water	2-Chloronaphthalene	91-58-7	µg/L	0.95	u q	uj	n	9.5	0.95	0.25

GW	280-111554-9	Ground Water	Benzoic acid	65-85-0	µg/L	29	u q	uj	n	76	29	9.3
GW	280-111554-9	Ground Water	Hexachlorobutadiene	87-68-3	µg/L	9.5	u q	uj	n	29	9.5	3.1
GW	280-111554-9	Ground Water	Hexachlorocyclopentadiene	77-47-4	µg/L	29	u q	uj	n	48	29	9.5
GW	280-111554-9	Ground Water	Hexachloroethane	67-72-1	µg/L	4.2	u q	uj	n	9.5	4.2	2
GW	280-111554-9	Ground Water	Fluoranthene	206-44-0	µg/L	0.095	j	u	n	0.095	0.011	0.0045
GW	280-111554-9	Ground Water	Phenanthrene	85-01-8	µg/L	0.095	j	u	n	0.095	0.019	0.0088
GW	280-111554-9	Ground Water	Pyrene	129-00-0	µg/L	0.095	j	u	n	0.095	0.019	0.0058

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual & Quarterly Sampling Event for June 2018

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008
Task Order Number: 0003

Laboratory SDG 280-111554-2

Prepared For:

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.

PC for Erica Fisher — 10/15/18

Erica Fisher, Validation Chemist, TEC-WESTON JV — Date

Peter Chapman — 10/15/18

Peter Chapman, Senior Chemist, TEC-WESTON JV — Date

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INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-111554-2**.

TestAmerica, Inc., Canton, Ohio performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Nitrate/Nitrite	SW-846 Method 9056A	Arvada, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review* (*EPA 2014*); and *USEPA National Functional Guidelines for Inorganic Data Review* (*EPA 2014*), the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	NO3/NO2
RQLmw-012-062818-GW	280-111554-4	06/28/2018	Groundwater		✓
RQLmw-013-062818-GW	280-111554-11	06/28/2018	Groundwater		✓
RQLmw-014-062818-GW	280-111554-10	06/28/2018	Groundwater		✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 SAMPLE RECEIPT

The samples were received by the laboratory on June 30, 2018; the sample was received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.3 TECHNICAL DATA VALIDATION

1.3.1 Nitrate/Nitrite by Method 9056A

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- LODs and LOQs
- LCS recoveries
- Method blank
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank
- Field duplicate

The nitrate/nitrate analyses were conducted past the 48 hour holding time as required by the method. Therefore, the non-detect and detected nitrate/nitrite results for these sample were qualified as estimated values (UJ/J H).

No analytical or quality parameters requiring further discussion were identified for Method 9056A.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	Units	Result	Lab Flag	DV Flag	Detect	LOQ	LOD	MDL	Method	Reason Code
280-111554-2	RQLmw-012-062818-GW	280-111554-4	Ground Water	Nitrate	µg/L	1200	h	j	y	500	100	42	9056A	H
280-111554-2	RQLmw-012-062818-GW	280-111554-4	Ground Water	Nitrite	µg/L	100	u h	uj	n	500	100	49	9056A	H
280-111554-2	RQLmw-013-062818-GW	280-111554-11	Ground Water	Nitrate	µg/L	100	u h	uj	n	500	100	42	9056A	H
280-111554-2	RQLmw-013-062818-GW	280-111554-11	Ground Water	Nitrite	µg/L	100	u h	uj	n	500	100	49	9056A	H
280-111554-2	RQLmw-014-062818-GW	280-111554-10	Ground Water	Nitrate	µg/L	100	u h	uj	n	500	100	42	9056A	H
280-111554-2	RQLmw-014-062818-GW	280-111554-10	Ground Water	Nitrite	µg/L	100	u h	uj	n	500	100	49	9056A	H

ATTACHMENT C
FIELD NOTES – JUNE 2018 SAMPLING EVENT

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LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

* Page 1/

Date: 6-27-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL12mw-242
Sample ID: LL12mw-242-062718-GW
Well Head Condition: Locked: Y ✓ N __
Pooled water at head: Y __ N ✓ Inner Casing Clean: Y ✓ N __
Exterior Seal Good: Y ✓ N __ Inner Casing Straight and Clear: Y ✓ N __

PID Borehole Reading: N/A
LNAPL: Y __ N ✓ DNAPL: Y __ N ✓ Product Depth ~~___~~
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) dep & JC
QC Sample (Y) / N Type: duplicate
Parameter(s) Collected: See below

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
0940			11.00							
0945	150	0.150	11.05	16.1	7.36	0.714	155.5	3.85	78.8	
0950		0.90	11.20	12.8	7.18	0.751	137.6	3.44	43.6	
0955		1.65	11.25	11.6	7.10	0.751	176.9	1.47	14.5	
1000	↓	2.40	11.25	11.5	7.13	0.751	213.4	1.17	8.3	
3.03 1005	125	~~3.15~~	11.15	11.7	7.09	0.749	350.3	0.80	-6.6	emptied out 45T
3.65 1010		~~3.90~~	11.40	11.7	7.09	0.754	460.4	1.18	-9.5	
4.29 1015		~~4.65~~	11:45	12.2	7.09	0.754	440.1	0.94	-13.9	
4.90 1020		~~5.40~~	11.50	12.1	7.10	0.754	357.2	0.90	-12.3	
1025		5.53	11.60	12.0	7.10	0.754	305.6	0.86	-17.5	
1030	↓	6.15	11.70	12.1	7.10	0.754	295.1	0.81	-20.5	
1035	125	6.78	11.70	12.3	7.11	0.754	272.1	0.79	-22.2	emptied out 45T
1040		7.40	11.85	13.3	7.14	0.753	267.2	3.66	0.00	
1045		8.03	11.90	13.70	7.12	0.755	244.6	2.37	-2.0	
1050		8.65	11.90	13.90	7.12	0.756	258.1	2.27	-1.9	
1055		9.275	11.90	13.70	7.13	0.754	228.0	2.18	-3.3	
1100	↓	9.90	11.90	13.8	7.13	0.756	223.8	2.15	-5.3	
1105		10.53	11.90	13.90	7.14	0.755	224.9	2.02	-9.6	
Final Parameter Readings for Sample.										

Comments:

10.53
6.25
1.5

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06.27.18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL12mw-242
Sample ID: LL12mw-242-062718
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth N/A
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) DP & EC
QC Sample (Y)/ N Type: Duplicate
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
N/A			N/A							
11:10	125	11.155	12.01	14.1	7.14	0.755	208.2	1.92	-13.8	
11:15	↓	11.78	12.09	14.2	7.14	0.755	201.2	1.88	-15.4	
11:20	↓	12.405	12.10	14.3	7.14	0.755	193.5	1.82	-18.5	
11:25	↓	13.03	12.1	14.4	7.14	0.755	198.2	1.78	-19.9	Emptied YSI
11:30	↓	13.66	11.90	13.5	7.14	0.748	223.0	2.30	-21.5	
11:35	↓	14.28	11.90	13.7	7.12	0.756	240.1	2.10	-25.2	
11:40	↓	14.91	11.90	13.7	7.13	0.756	201.7	1.86	-26.5	
11:43	125	15.29	12.00	13.70	7.14	0.756	189.9	1.80	-27.2	
11:46	125	15.66	12.00	13.7	7.14	0.756	187.6	1.74	-27.2	
Final Parameter Readings for Sample.										
			1							

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/20/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: CBLmw-001
Sample ID: CBLmw-001-062018-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y __ N X DNAPL: Y __ N X Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) Danyelle Phillips & Kathryn Bryant
QC Sample: Y / N Type: Duplicate - CBLmw-001-D-062018-GW
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
15:45			42.99							began drawing water at 1550
1553	145	0.44	43.00	15.9	8.20	0.077	-0.8	9.35	140.7	
1558	145	1.16	43.10	12.7	5.41	0.056	9.5	9.73	192.9	
1603	145	1.89	43.12	12.1	5.04	0.052	11.2	9.75	212.9	
1608	250	3.14	43.22	11.3	4.97	0.050	54.9	9.80	223.0	
1613	250	4.39	43.28	11.4	4.94	0.053	-12265.1*	9.79	236.1	air bubble on turbidity sensor
1618	250	5.64	43.30	11.3	4.94	0.050	18.0	9.79	243.1	
3min 1621	250	6.39	43.32	11.6	4.94	0.050	15.4	9.76	248.0	
1624	250	7.14	43.35	11.5	4.94	0.050	12.1	9.76	250.5	
1627	250	7.89	43.36	11.6	4.94	0.050	9.8	9.78	252.5	
Final Parameter Readings for Sample.										
1627		see	above							

Comments: ants nest in well

* Air bubble on sensor for Turbitity reading at 1613
Sampled at 1628

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6-20-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: CBLmw-002
Sample ID: CBLmw-002-062018-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ✓
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) Dep & KB
QC Sample: Y / N Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1710			37.60							
1715	45	0.23	37.63	15.3	5.16	0.1049	-0.7	8.01	183.9	NTU is probably 0
1720	425	2.35	37.78	10.6	4.92	0.0964	-0.4	7.69	214.1	since meter is read
1723	425	3.63	37.81	10.5	4.89	0.0965	0.2	7.61	222.9	negative
1726	425	4.9	37.85	10.6	4.88	0.0968	-1.5	7.50	229.1	
1729	425	6.18	37.86	10.6	4.86	0.0970	-1.5	7.41	236.1	
1732	425	7.45		10.6	4.86	0.0972	-1.5	7.37	241.2	
Final Parameter Readings for Sample.										
1732		see	above							

Comments: sampled at 1733

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6/21/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FWGMW-024
Sample ID: FWGMW-024-062218-GW
Well Head Condition: Locked: Y✓N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓N__
Exterior Seal Good: Y✓N__ Inner Casing Straight and Clear: Y✓N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) Dep
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
0900			14.84							
0905	155	0.78	14.86	16.0	7.76	0.456	4.5	860	80.8	clear
0910	155	1.55	14.88	11.8	7.14	0.473	434.6	4.32	71.6	bright orange
0915	350	3.30	14.89	11.3	6.95	0.474	470.6	3.08	64.4	less orange
0920	350	5.05	14.90	11.2	6.86	0.475	332.5	2.01	55.7	clearer
0925	↓	6.8	14.90	11.2	6.83	0.475	354.3	2.11	1205 0820 44.4	
0930		8.55	14.90	11.2	6.82	0.477	65.2	1.87	32.5	
0935		10.3	14.90	11.3	6.83	0.478	39.5	1.66	20.1	
0940		12.05	14.90	11.3	6.83	0.483	14.7	1.08	9.4	
0945	↓	13.8	14.90	11.3	6.83	0.485	13.8	0.87	0.9	
0950		15.55	14.90	11.2	6.83	0.486	11.9	0.80	-4.1	
0955	↓	16.83	14.90	11.2	6.84	0.486	8.4	0.79	-7.6	
Final Parameter Readings for Sample.										
0955		see above								

Comments:
turbidity is bouncing all over the place even though water has cleared up.

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6-21-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FWGMW-021
Sample ID: FWGMW-021-062118-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ~~~~
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) Dep
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1105			21.88							
1110	55	0.28	21.95	19.8	8.16	0.1935	5.4	9.18	22.9	
1115	55	0.55	22.05	17.4	7.54	0.1693	5.9	9.24	42.9	
1120	425	2.68	22.40	11.3	7.94	0.1959	-33800	7.53	100.9	NTU off scale,
1125	150	3.43	22.20	12.1	5.92	0.1933	85.0	4.99	70.8	orange water
1130	↓	4.18	22.21	12.0	5.86	0.1937	32.3	4.64	57.7	clearing up
1135	↓	4.93	22.19	11.9	5.81	0.1930	19.9	4.30	57.6	
1140	↓	5.68	22.19	11.9	5.76	0.1925	26.6	4.16	60.6	
1145	↓	6.43	22.20	11.8	5.77	0.1925	25.6 28.0	4.06	61.3	
1150	↓	7.18	22.20	11.9	5.77	0.1923	26.8	3.98	62.5	
1155	↓	7.93	22.20	12.0	5.77	0.1920	26.0	3.93	63.9	
Final Parameter Readings for Sample.										
1155		see	above							

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6-21-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FWGmw-020
Sample ID: FWGmw-020-062118
Well Head Condition: Locked: Y ✓ N __
Pooled water at head: Y __ N ✓ Inner Casing Clean: Y ✓ N __
Exterior Seal Good: Y ✓ N __ Inner Casing Straight and Clear: Y ✓ N __

PID Borehole Reading: N/A
LNAPL: Y __ N ✓ DNAPL: Y __ N ✓ Product Depth ~~~
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) Dep
QC Sample: Y / N Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1340			23.27							
1345	150	0.75	23.61	13.8	6.96	0.0776	9.0	8.35	34.1	clear
1350		1.5	23.63	13.4	6.88	0.0785	28.0	3.90	-21.9	
1355		2.25	23.65	13.1	6.88	0.0784	28.9	2.70	-30.5	
1400		3.0	23.65	13.1	6.88	0.0783	18.3	2.41	-33.7	
1403 (3 mins)		3.45	23.65	13.1	6.88	0.0783	13.4	2.25	-35.8	
1406	↓	3.9	23.65	13.2	6.88	0.0783	12.6	2.19	-36.6	
1409	↓	4.35	23.65	13.0	6.88	0.0783	12.2	2.07	-37.7	
1412		4.8	23.65	13.0	6.88	0.0784	12.0	1.96	-38.8	
1415	↓	5.25	23.65	13.0	6.89	0.0789	12.1	1.90	-39.9	

Final Parameter Readings for Sample.

1415		see above								

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6-21-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: CBLmw-003
Sample ID: CBLmw-003-062118-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y __ N ✓ DNAPL: Y __ N ✓ Product Depth ~~~~
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) Dep
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1607		dep	35.33							
1612	75	~~DEOM~~	35.35	14.7	6.73	0.1143	0.5	9.36	140.2	clear
3mins 1615	160	0.58 0.86	35.37	12.8	5.80	0.1231	0.9	9.01	167.9	
1618	↓	1.34	35.40	11.2	5.62	0.1290	0.8	9.26	181.8	
1621	↓	1.82	35.45	11.0	5.53	0.1305	0.5	9.43	192.7	
1624	↓	2.3	35.43	10.9	5.50	0.1310	0.3	9.51	198.4	
1627	↓	2.78	35.45	10.8	5.48	0.1311	0.5	9.54	203.7	
1630	↓	3.26	35.45	10.8	5.47	0.1309	0.3	9.57	207.3	
Final Parameter Readings for Sample.										
1630		See	above							

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6-25-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: NTAmw-118
Sample ID: NTAmw-118-062518-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ~~~
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) DP
QC Sample: Y✓N Type: ~~~
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
1525			9.95							
1530	115	0.58	10.38	20.2	8.34	0.4705	18.2	7.50	71.3	fine black sediment in tube
1535	115	1.15	10.85	13.8	7.21	0.4694	60.8	3.50	101.2	
1540	115	1.73	10.94	13.6	7.14	0.4652	48.1	2.33	104.4	
1543 (3 mins)	↓	2.07	11.02	13.4	7.13	0.4638	37.2	1.94	105.4	
1546	↓	2.42	11.13	13.4	7.13	0.4630	28.1	1.63	105.9	
1549	↓	2.76	11.12	13.5	7.13	0.4624	26.6	1.46	106.0	
1552	↓	3.11	11.15	13.5	7.13	0.4628	25.7	1.40	105.9	
1555	↓	3.45	11.20	13.6	7.13	0.4622	25.5	1.23	105.6	
Final Parameter Readings for Sample.										
1555		see above								

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6-26-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL10mw-003
Sample ID: LL10mw-003-062618-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y __ N ✓ DNAPL: Y __ N ✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) DP, CJ, & AR
QC Sample: Y / N Type: ms/msd
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
0947			21.46							
0952	210	1.05	21.73	11.4	~~6.52~~	0.4238	5.7	8.36	107.1	
0957	210	2.10	21.72	11.1	6.45 6.55	0.4139	4.5	6.50	121.1	
1000	↓	2.73	21.71	11.0	6.45	0.4045	4.6	6.13	127.4	3 min
1003		3.36	21.75	11.1	6.43	0.4045	4.6	6.02	130.2	
1006		3.99	21.75	11.1	6.40	0.4054	4.8	5.85	134.0	
1009	↓	4.62	21.76	11.1	6.39	0.4069	4.6	5.81	136.3	
Final Parameter Readings for Sample.										
1009		see above								

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6-26-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: CBLmw-002
Sample ID: CBLmw-002-062618-GW
Well Head Condition: Locked: Y ✓ N
Pooled water at head: Y N ✓ Inner Casing Clean: Y ✓ N
Exterior Seal Good: Y ✓ N Inner Casing Straight and Clear: Y ✓ N

PID Borehole Reading: N/A
LNAPL: Y N ✓ DNAPL: Y N ✓ Product Depth —
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) dep
QC Sample: Y / (N) Type: —
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1455			37.94							
1500	70	0.35	38.00	15.6	5.67	0.1409	-2.1	9.13	194.3	negative NTU probably = 0 NTU
1505	225	1.48	38.04	13.8	5.25	0.1154	-1.9	8.37	208.9	
1508 (3 mins)	↓	2.15	38.07	11.3	5.04	0.1103	-2.4	7.92	219.4	
1511		2.83	38.07	11.2	5.00	0.1095	-2.4	7.83	224.2	
1514		3.5	38.07	11.3	4.99	0.1092	-2.4	7.78	226.6	
1517	↓	4.18	38.07	11.5	4.97	0.1087	-2.2	7.74	229.9	
Final Parameter Readings for Sample.										
1517		see above								

Comments: resampling for Cyanide

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6-26-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: CBLmw-001
Sample ID: CBLmw-001-062618-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y __ N ✓ DNAPL: Y __ N ✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) dep
QC Sample: (Y) / N Type: duplicate
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1530			43.24							
1535	90	0.45	43.32	13.9	5.12	0.0666	46.4	10.43	220.1	
1540	90	0.90	43.35	15.2	5.10	0.0627	60.2	10.53	222.5	
1545	175	1.78	43.47	11.4	5.06	0.0584	14.5	10.63	230.0	
3 mins 1548	↓	2.3	43.50	11.3	5.02	0.0579	4.8	10.61	235.2	
1551	↓	2.83	43.52	11.3	5.00	0.0576	2.2	10.62	238.6	
1554	↓	3.35	43.53	11.3	5.01	0.0575	1.2	10.61	241.6	
Final Parameter Readings for Sample.										
1554		see	above							

Comments: resampling for Cyanide

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/26/19
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: WBGmw-021
Sample ID: WBGmw-021-062619-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) CMJ / ANR
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1115			10.55							
1125	140 mL	1.40	10.60	13.9	9.13	0.364	547.4	4.5	-62.8	SEDIMENT VISIBLE
1130		2.1	10.62	17.5	8.91	0.361	362.0	2.61	-58.7	
1135		2.8	10.60	13.4	8.90	0.361	174.5	2.48	-58.9	CLEARING up Some
1140		3.5	10.61	13.5	8.90	0.361	101.1	2.28	-58.1	
1145		4.2	10.61	13.9	8.89	0.366	108.9	2.11	-58.5	
1150		4.9	10.60	14.0	8.88	0.367	84.3	1.81	-60.1	
1155		5.6	10.60	14.2	8.88	0.370	137.1	1.80	-59.5	
1200		6.3	10.61	14.4	8.88	0.373	76.6	16.5	-60.7	
1205		7	10.61	14.4	8.88	0.373	70.1	16.3	-61.2	
1210		7.7	10.60	14.0	8.88	0.370	55.0	16.0	-62.9	
1215		8.4	10.61	12.4	8.87	0.357	64.8	15.4	-59.7	
1220		9.1	10.62	12.3	8.88	0.366	41.6	15.7	-60.4	
1225		9.8	10.61	13.3	8.89	0.370	22.3	15.4	-61.6	
1230		10.5	10.61	11.9	8.89	0.353	19.1	15.7	-65.8	
1235		11.2	10.60	11.6	8.90	0.350	15.9	13.8	-67.5	
1240		11.9	10.60	11.2	8.91	0.350	11.6	13.5	-73.4	
1245	↓	12.6	10.61		8.91		5.8	13.3		
Final Parameter Readings for Sample.										
1245		See above								

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6/26/2018
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: WBGmw-020
Sample ID: WBGmw-020-062618-GW
Well Head Condition: Locked: Y ✓ N
Pooled water at head: Y N ✓ Inner Casing Clean: Y ✓ N
Exterior Seal Good: Y ✓ N Inner Casing Straight and Clear: Y ✓ N

PID Borehole Reading: N/A
LNAPL: Y N ✓ DNAPL: Y N ✓ Product Depth —
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) ANR, [illegible]
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
1350			14.55							
~~1355~~	~~330~~			~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~			YSI not full
dep ~~1400~~										
1405	330	4.95	14.51	12.1	6.85	0.188	1.6	1.05	-117.3	
1410	340	6.65	14.49	12.1	6.84	0.188	1.1	0.93	-120.7	
1415	330	8.3	14.50	12.1	6.85	0.188	0.7	0.88	-121.7	
1420	↓	9.95	14.50	12.0	6.85	0.188	0.7	0.85	-122.4	
1425		11.6	14.52	12.0	6.85	0.188	0.7	0.81	-123.1	
1430		13.25	14.49	12.1	6.85	0.188	0.5	0.79	-123.1	
1435	↓	14.9		12.1	6.85	0.188	0.4	0.77	-122.9	
Final Parameter Readings for Sample.										
1435		See above								

Comments: Conductivity recorded for C-$\frac{mS}{cm}$, revised

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 062816
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: EBGmw-131-~~0628~~ GW
Sample ID: EBGmw-131-062818-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) CMJ / ANR
QC Sample: Y / N Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
0905			10.34							
0910	100	0.5	10.35	12.9	6.72	433.7	2.6	5.60	118.5	
0915	100	10	10.37	11.7	6.57	397.8	4.4	3.16	-21.6	
0920	210	2.05	10.37	11.6	6.55	394.3	4.7	2.49	-40.6	
0925	210	3.1	10.38	11.7	6.54	395.3	4.9	1.86	-51.3	
0930	↓	4.15	10.36	11.6	6.54	394.2	5.2	1.56	-55.5	
0935		5.2	10.36	11.7	6.54	395.4	4.9	1.52	-57.4	
0940	↓	6.25	10.36	11.8	6.54	395.7	5.1	1.49	-58.0	
Final Parameter Readings for Sample.										
0940		See above								

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6/28/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: CBPMW-009
Sample ID: CBPMW-009-062818-GW
Well Head Condition: Locked: Y ✓ N__
Pooled water at head: Y__ N ✓ Inner Casing Clean: Y__ N ✓
Exterior Seal Good: Y ✓ N__ Inner Casing Straight and Clear: Y ✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N ✓ DNAPL: Y__ N ✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) CMJ
QC Sample: Y / N Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1100			12.15							
1105	~~275~~	1.38	12.11	11.6	6.79	422.5	6.2	2.23	-69.1	
1110	275	2.75	12.10	11.6	6.77	422.1	5.9	1.37	-82.7	
1115	115	3.33	12.01	11.9	6.77	423.0	6.2	1.18	-87.1	
1120	115	3.9	11.99	12.4	6.78	431.5	6.7	1.09	-88.7	
1125	115	4.48	12.01	12.4	6.78	431.2	6.9	1.05	-92.5	
1130 ~~1000~~	200	5.48	12.00	12.3	6.78	430.7	7.4	1.10	-93.6	
1135 ~~1005~~	200	6.48	11.97	12.3	6.78	430.4	7.8	1.15	-93.5	
Final Parameter Readings for Sample.										
1135		SEE ABOVE								

Comments:

PANTS all over CAP and INSIDE

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6/28/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: RQLmw-007
Sample ID: RQLmw-007-062818-gw
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y__ N✓ mts
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) CMS
QC Sample (Y) N Type: field dup & ms/msd
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1335			7.59							
1340	210	1.05	7.97	13.8	6.25	7008.0	69.9	3.30	58.1	
1345	210	2.1	7.98	15.1	6.05	648	2.1	1.33	18.2	
1350	200	3.1	7.95	15.9	6.05	692	2.4	1.19	14.1	
1355	200	4.1	7.88	16.0	6.05	698	2.6	1.16	13.3	
1400	200	5.1	7.88	16.0	6.05	705	2.7	1.13	12.9	
1405	↓	6.1	7.83	16.1	6.06	729	2.2	1.00	10.8	
1410	↓	7.1		16.0	6.06	736	2.4	0.94	9.9	
Final Parameter Readings for Sample.										
1410		See above								

Comments: INCLUDES FIELD DUP (sample ID RQLmw-007-D-062818-gw) and MS/MSD

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/21/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LLimw-088
Sample ID: LLimw-088-062118-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth —
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB & DEP
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
07:20			KMB: 3.50 ~~3.50~~							
07:25	155	0.78	KMB: 3.80 ~~3.80~~	11.1	8.33	0.0728	45.8	5.24	37.2	
07:30	155	1.55	KMB: 4.20 ~~4.20~~	11.5	7.70	0.0725	31.3	3.63	33.5	
07:35	100	2.05	7.30	11.4	7.50	0.0723	23.5	2.51	21.7	
07:40	100	2.55	7.35	11.3	7.35	0.0721	18.0	1.47	10.9	
07:45	100	3.05	7.39	11.2	7.30	0.0722	22.3	1.21	1.2	
07:50	100	3.55	7.41	11.0	7.22	0.0723	26.2	1.00	-22.4	
07.55	100	4.05	7.44	11.0	7.19	0.0722	28.9	0.91	-36.7	
08:00	100	4.55	7.41	11.1	7.17	0.0722	30.3	0.85	-44.0	
0803	100	4.85	7.38	11.1	7.16	0.0722	32.8	0.84	-46.6	
0806	100	5.15	7.36	11.0	7.15	0.0722	33.2	0.83	-47.8	
0809	100	5.45	7.37	11.0	7.15	0.0722	32.9	0.83	-49.9	
Final Parameter Readings for Sample.										
0809		see above								

3 mins

Comments:
Pump on at 07:20
Sampled at 0810

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/21/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FWGmw-017
Sample ID: FWGmw-017-062118-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y__ N__
Exterior Seal Good: Y__ N__ Inner Casing Straight and Clear: Y__ N__

PID Borehole Reading: N/A
LNAPL: Y__ N__ DNAPL: Y__ N__ Product Depth —
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
0915			13.12							adjusting pump from 1915-1920
0920	175	0.88	13.33	12.2	7.27	0.559	21.8	5.91	-99.0	
0925	175	1.75	13.35	11.9	7.01	0.556	22.5	4.70	-109.5	
0930	175	2.63	13.36	11.9	6.96	0.552	22.1	3.46	-98.6	
0935	175	3.5	13.38	11.9	6.94	0.553	21.3	3.04	-88.3	
0940	175	4.38	13.39	11.9	6.94	0.553	21.5	2.64	-85.3	
0945	175	5.25	13.39	11.9	6.94	0.553	21.6	2.50	-85.5	
0950	175	6.13	13.40	11.9	6.94	0.552	27.8	2.37	-83.2	
0953	175	6.65	13.40	12.0	6.94	0.552	31.4	2.29	-83.3	
0956	175	7.18	13.41	12.0	6.94	0.552	34.6	2.17	-82.0	
0959	175	7.7	13.41	12.0	6.94	0.552	34.4	2.13	-81.9	
~~0959~~ KMB										
Final Parameter Readings for Sample.										
0959		see above								

Comments:

0915 pump on - begin purge
ants nest in well head
1000 sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/21/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL3mw-246
Sample ID: LL3mw-246-062118-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N__ DNAPL: Y__ N__ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB
QC Sample: (Y) N Type: Dup/MS/MSD (LL3mw-246-D-062118-GW)
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
1110			21.46							no water in flowcell until 1120; adjusting flow rate
1120	160	1.60	21.606	12.0	6.61	0.183	130.0	6.29	116.7	
1125	160	2.4	21.69	12.0	6.28	0.180	108.3	5.81	121.7	
1130	~~160~~ 110 KMB	2.95	21.69	12.0	6.10	0.178	111.5	5.57	126.0	
1135	~~160~~ 110 KMB	3.5	21.70	12.3	6.00	0.177	105.5	5.40	129.9	
1140	110	4.05	21.70	12.3	5.96	0.177	122.3	5.29	133.4	
1145	110	4.60	21.70	12.0	5.94	0.177	130.1	5.26	137.0	
1155	150	5.35	21.73	12.4	5.90	0.177	67.5	5.05	142.6	battery died, switch batteries, readjust pump
1200	150	6.10	21.73	12.3	5.89	0.176	71.6	5.01	143.7	
1205	150	6.85	21.73	12.2	5.88	0.176	67.3	4.96	146.6	
1210	150	7.6	21.74	12.0	5.87	0.176	65	4.93	148.8	
1215	150	8.35	21.74	12.0	5.87	0.176	67.9	4.92	150.5	
1220	150	9.10	21.75	11.9	5.87	0.176	69.0	4.92	151.5	
1225	150	9.85	21.75	11.9	5.85	0.176	44.3	4.93	151.7	
1228	150	10.3	21.76	12.0	5.84	0.177	10.5*	4.97	152.4	* possible air bubble on turbidity probe prior to 1228 - waterappears clear & free of sediment
1231	150	10.75	21.76	11.8	5.84	0.177	11.2	4.93	153.0	
1234	150	11.20	21.77	11.7	5.84	0.176	11.4	4.95	153.6	
Final Parameter Readings for Sample.										
1234		See above								

Comments:

1110 - begin purge
battery died mid-purge (@ ~1150)
1235 - sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/21/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FWGmw-018
Sample ID: FWGmw-018-062118-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth ____
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB & DEP
QC Sample: Y (N) Type: ____
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
1342 ~~2.4~~ 3 min			22.43							
1347	140	0.7	22.70	16.0	7.34	0.625	0.8	9.39	137.3	
1352	140	1.4	22.80	12.6	7.15	0.640	2.9	4.42	-20.7	
1357	140	2.1	22.88	12.3	7.09	0.639	1.4	3.45	-64.3	
1402	140	2.8	22.95	12.3	7.06	0.640	1.4	3.37	-65.0	
1405	140	3.22	22.96	12.3	7.03	0.640	4.8	2.68	-59.5	
1408	140	3.64	22.96	12.1	7.03	0.640	1.8	2.24	-53.2	
1411	140	4.06	22.97	12.1	7.00	0.640	1.4	2.00	-47.4	
1414	140	4.48	22.97	12.1	7.02	0.639	2.0	1.97	-45.0	
1417	140	5.65	22.98	12.1	7.02	0.639	3.4	1.93	-44.8	
Final Parameter Readings for Sample.										
1417		See above								

Comments:

1342 - begin purge
1417 - sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/21/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: CBLmw-004
Sample ID: CBLmw-004-062118-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth ~
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
1607			35.63							
1612	175	0.88	35.70	11.6	6.64	0.072	34.6	7.97	99.0	
1617	175	1.75	35.72	11.3	5.88	0.070	22.1	7.81	106.4	
1622	175	2.63	35.70	11.3	5.58	0.069	10.9	7.81	112.3	
1627	175	3.5	35.71	11.3	5.54	0.068	6.1	7.80	113.2	
3 mins 1630	175	4.03	35.70	11.3	5.57	0.068	4.1	7.78	109.9	
1633	175	4.55	35.71	11.3	5.51	0.068	3.3	7.76	108.7	
1636	175	5.08	35.70	11.2	5.48	0.068	3.0	7.75	103.9	
Final Parameter Readings for Sample.										
1636		see above								

Comments:

1607-begin purge
1640-sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/25/2018
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FWGmw-007
Sample ID: FWGmw-007-062518-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) ANR, CMJ
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
0950			25.2							
0955	120	0.6	25.32	13.4	7.01	0.908	291.0	2.04	96.2	
1000	120	1.2	25.34	13.1	7.02	0.89	256.0	1.89	89.8	
1005	130	1.85	25.35	13.1	7.02	0.875	183.0	1.78	80.1	
1010	130	2.5	25.35	13.2	7.0	0.855	121.0	1.70	74.1	
1015	120	3.1	25.40	13.1	7.04	0.841	106.8	1.62	67.7	
1020	120	3.7	25.38	13.1	7.05	0.831	78.1	1.56	62.1	
1025	120	4.3	25.36	13.3	7.05	0.830	56.0	1.52	56.8	
1030	|	4.9	25.37	13.2	7.05	0.815	39.6	1.44	50.7	
1035	|	5.5	25.36	13.4	7.06	0.814	33.5	1.41	48.5	
1040	|	6.1	25.36	13.4	7.06	0.809	33.0	1.38	48.1	
1045	|	6.7	25.37	13.2	7.06	0.799	26.5	1.36	46.9	
1050	|	7.3	25.36	13.0	7.06	0.792	27.8	1.33	45.1	
~~1100~~ 1055	|	7.9	25.38	12.9	7.07	0.787	~~20.7~~ 23.0	1.32	43.9	
1100	|	8.5	25.39	13.0	7.07	0.788	17.9	1.29	42.5	
1105	|	9.1	25.38	13.0	7.07	0.784	17.5	1.28	42.5	
1110	↓	9.7	25.38	12.9	7.07	0.78	~~17.8~~ 16.8	1.26	41.7	
Final Parameter Readings for Sample.										
1110			25.38	12.9	7.07	0.78	16.8	1.26	41.7	

Comments: *SAMPLED THRU YSI ON ACCIDENT.

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6/25/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: NTAmw-119
Sample ID: NTAmw-119-062518-GW
Well Head Condition: Locked: Y✓ N__ NTAmw-119D-062518-GW
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) ANR CMJ
QC Sample: (Y) N Type: duplicate
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
1215			13.60							
1235	125	+ 2.5	13.61	13.0	7.38	0.422	6.9	5.64	53.9	
1240	125	3.13	13.63	12.4	7.36	0.416	10.0	4.88	-58.5	
1245	120	3.78	13.62	12.3	7.35	0.418	14.3	3.94	-72.5	
1250	~~130~~ 120	4.33	13.63	12.1	7.34	0.416	21.6	3.38	-79.2	
1255	120	4.93	13.62	12.0	7.34	0.414	21.9	3.01	-83.2	
1300	105	5.45	13.62	12.4	7.34	0.417	21.9	2.75	-85.4	
1305	105	5.98	13.62	12.7	7.34	0.423	~~21.9~~ 22.1	2.53	-86.7	
1310	105	6.5	13.62	13.2	7.34	0.428	23.1	2.37	-88.5	
Final Parameter Readings for Sample.										
1310		see	above							

Comments: SAMPLED THRU YSI on accident

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6/25/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: NTAmw-117
Sample ID: NTAmw-117-062518-GW
Well Head Condition: Locked: Y ✓ N
Pooled water at head: Y N ✓ Inner Casing Clean: Y ✓ N
Exterior Seal Good: Y ✓ N Inner Casing Straight and Clear: Y ✓ N

PID Borehole Reading: N/A
LNAPL: Y N ✓ DNAPL: Y N ✓ Product Depth
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) ANR / CMJ
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1534			16.78							
1539	300	1.5	16.90	10.3	7.4	0.416	8.9	3.82	45.4	
1544	300	3.0	17.04	10.2	7.39	0.400	5.8	3.34	38.7	
1549	300	4.5	16.18	11.5	7.39	0.412	3.9	3.02	34.2	
1554	200	5.5	15.98	13.4	7.40	0.426	4.3	2.85	33.8	
1559	200	6.5	16.21	11.6	7.4	0.413	3.8	2.86	36.4	
1604	200	7.5	16.36	11.0	7.4	0.394	3.8	2.75	36.7	
Final Parameter Readings for Sample.										
1604		see	above							

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6/26/2018
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: NTAmw-120
Sample ID: NTAmw-120-062618-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) ANR/CMS
QC Sample: Y/(N) Type: —— duplicate
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
0800			34.01							
~~0817~~ 0855	100	1.7	34.01	13.8	9.33	0.585	4.2	9.44	180.1	
0822	150	2.2	34.04	11.6	8.92	0.564	8.3	5.66	-69.4	
0827	150	2.7	34.05	11.6	8.92	0.566	10.6	4.48	-70.8	
0832	↓	3.2	34.04	11.6	8.93	0.567	8.7	3.72	-77.2	
0837	↓	3.7	34.05	11.7	8.94	0.566	7.7	3.16	-80.4	
0842	↓	4.2	34.02	12.3	8.98	0.265	6.6	3.30	-78.4	
0847	↓	4.7	34.04	12.0	8.97	0.574	7.9	3.07	-82.0	
Final Parameter Readings for Sample.										
0847		see above								

Comments:
Complete @ 0950

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/26/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: ~~LL18MW-003~~ WBGMW-009
Sample ID: ~~LL18MW-003 062618 DW~~ WBGMW-009-062618-DW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y__ N✓
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) AN (RJ CM)
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1330			15.82							
1335	215	1.08	15.78	12.7	8.3	0.389	79.3	~~2.75~~	84.3	
1340	↓	2.15	15.80	12.9	8.23	0.367	45.9	~~2.67~~	96.7	
1345		3.23	15.80	12.8	8.12	0.339	37.5	2.57	96.8	
1350		4.13	15.80	12.9	8.08	0.340	20.4	2.47	97.7	
1355	↓	5.38	15.81	14.8	8.08	0.351	16.4	2.27	99.5	
~~1220~~ 1420	300	6.88	15.80	12.0	8.03	0.311	6.5	2.16	115.4	battery died
1425	↓	8.38	15.78	12.4	8.07	0.337	20.9	2.20	121.2	
1430		9.88	15.78	12.7	8.11	0.351	16.6	1.79	119.4	
1435		11.38	15.80	12.7	8.12	0.352	12.4	1.74	119.0	
1440		12.88	15.81	12.8	8.12	0.351	12.7	1.69	118.7	
1445	↓	14.38	15.81	12.9	8.12	0.351	12.5	1.68	118.6	
Final Parameter Readings for Sample.										
1445		see above								

Comments: Battery died ants on inner casing cap

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6/26/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: WBGmw-006
Sample ID: WBGmw-006-062618-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) ANR / CMJ
QC Sample: Y (N) Type: —
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
1007			8.82							
1010	~~500~~	1.5	9.12	11.2	7.38	0.379	17.4	3.77	56.2	
1015	500	4.0	9.27	11.3	7.17	0.376	35.9	1.68	66.2	
1020	500	6.5	9.3	11.2	7.14	0.379	34.3	1.38	69.6	
1025	500	9.0	9.18	11.3	7.15	0.378	87.4	1.19	72.9	
1030	230	10.15	8.95	13.6	7.13	0.396	98.8	1.03	75.2	
1035	230	11.3	~~8~~ 9.07	12.2	7.12	0.382	103.4	1.02	103.1	
1040	↓	12.45	9.11	12.5	7.12	0.386	49.0	0.92	79.8	
1045	↓	13.6	9.08	12.4	7.12	0.384	-4444.0	0.86	82.2	A.R Bubble/Sediment
1052	↓	14.75	9.08	12.5	7.11	0.385	21.7	0.84	82.5	
1057	↓	15.9	9.07	12.6	7.12	0.586	27.2	0.82	82.9	
1102	↓	17.05	9.08	12.4	7.12	0.384	36.4	0.80	83.4	
1107	↓	18.2	9.10	12.4	7.11	0.383	44.6	0.78	84.1	
Final Parameter Readings for Sample.										
1107		see	above							

Comments: Conductivity C – mS/cm

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/26/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FWGMW-013
Sample ID: FWGMW-013-062618-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) ANR, CMJ
QC Sample: Y / (N) Type: ——
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1535			22.19							
1540	400	2.0	22.19	12.1	8.67	0.303	57.9	6.27	133.3	
1545	400	4.0	24.10	12.4	8.51	0.304	45.1	5.17	132.8	
1550	400	6.0	24.70	12.2	8.47	0.304	44.3	4.34	131.1	
1555	300	7.5	25.22	12.3	8.44	0.306	3.9	3.15	128.6	
1600	300	9.0	25.30	12.6	8.44	0.313	5.2	2.43	127.4	
1605	300	10.5	25.40	12.5	8.44	0.312	6.0	2.16	126.1	
Final Parameter Readings for Sample.										
1605		See above								

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6/27/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: ~~LL1-08~~ LL1mw-089
Sample ID: LL1mw089-062718
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ~~~
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) ANR / CMJ
QC Sample: Y / (N) Type: duplicate and ms/msd
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
~~0900~~ 0945			26.42							
~~0925~~ 0950	~~300~~	1.5	26.5	11.2	4.21	64.5	----	2.58	282.8	
~~0955~~			~~26.5~~	~~11.2~~	~~4.88~~	~~63.4~~	~~3.14~~	~~2.39~~	~~263.3~~	~~3 dep~~
~~1000~~										
0955	300	8	26.5	11.1	4.64	63.0	5.0	1.92	282.8	
1000	↓	4.5	26.5	11.0	4.59	62.3	7.0	1.78	293.8	
1005		6	26.48	11.0	4.58	62.2	2.9	1.73	297.6	
1010		7.5	26.46	11.0	4.58	62.0	2.6	1.70	302.7	
1015		9	26.45	11.1	4.58	62.0	3.5	1.67	306.6	
1020	↓	10.5	26.45	11.1	4.57	61.9	4.1	1.65	309.0	
Final Parameter Readings for Sample.										
1020		see	above							

Comments: YSI needed to be recalibrated. Turbidity was reading "----".

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6/27/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL2 mw 272
Sample ID: LL2 mw-272-062718-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) ANR CMJ
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
1235			14.52							
1240	175	0.88	14.52	10.6	6.06	0.253	64.5	3.43	33.8	
1245	175	1.75	13.89	10.9	6.10	0.246	90.4	1.62	0.2	
1250	175	2.63	~~13.82~~	12.2	6.12	0.253	48.6	1.34	-11.8	
1255	175	3.5	13.82	12.1	6.13	0.254	77.6	1.19	-18.6	
1300	130	4.15	12.76	12.3	6.16	0.256	63.6	1.15	-22.6	
1305	130	4.8	12.69	13.3	6.18	0.264	147.5	1.17	-23.8	
1310	130	5.45	12.66	13.3	6.18	0.264	~~179.5~~ 131.8	1.17	-24.9	
1315	↓	6.1	~~13.9~~ 12.64	13.3	6.18	0.269	105.7	1.06	-29.1	
1320		6.75	12.66	13.7	6.19	0.268	152.6	1.10	-28.1	
1325		7.4	12.60	14.7	6.21	0.275	126.1	1.24	-25.3	
1330		8.05	12.58	15.4	6.21	0.289	54.5	1.13	-28.4	
1335		8.7	12.59	15.7	6.21	0.283	44.1	1.03	-30.9	
1340		9.35	12.57	15.5	6.21	0.281	37.8	0.98	-32.7	
1345		10	12.54	14.7	6.21	~~3.40~~ 0.277	32.5	0.95	-33.2	
1350	↓	10.65	12.57	14.3	6.21	0.274	36.3	0.93	-34.0	
Final Parameter Readings for Sample.										
1350		see above								

Comments: Conductivity recorded under C- $\frac{uS}{cm}$, revised

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6/28/2018
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: EBGmw-125 Ravenna, OH
Sample ID: EBGmw-125-062818-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ____
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) ANR, CJM
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
0902			12.68							
0907	500+	~~12.~~ 2.5	12.68	9.7	7.73	0.271	9.5	402	-56.1	
0912	175	3.38	12.69	10.5	7.82	0.276	3.6	3.43	-67.8	
0917	175	4.25	12.69	10.7	7.89	0.278	3.8	2.97	-76.8	
0922	245	5.48	12.68	10.4	7.98	0.277	2.8	2.41	-86.5	
0927	~~245~~ 245	6.7	12.69	10.4	8.01	0.277	2.0	2.27	-89.2	
0932	245	7.93	12.69	10.5	8.02	0.277	1.6	2.16	-91.5	
0										
Final Parameter Readings for Sample.										
0932			12.69	10.5	8.02	0.277	1.6	2.16	-91.5	

Comments: Used C. $\frac{mS}{cm}$ to Record conductivity.

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6/28/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: CBPMW-008
Sample ID: CBPMW-008-062818-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) ANR CMJ
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1030			17.63							
1035	550	2.75	18.92	9.8						YSI NOT FULL
1040	580	5.5	18.75	9.8	8.13	1.217	2.0	4.51	87.8	
1045	550	8.25	19.59	9.7	8.13	1.228	1.6	3.13	88.6	
1050	550	11.0	19.83	9.8	8.12	1.240	1.0	2.78	83.8	
1055	340	12.7	19.81	10.3	8.12	2.55	1.0	2.57	78.6	
1100	~~340~~ 345	14.43	20.38	10.1	8.12	1.275	1.0	2.30	52.4	
1105	225	15.55	20.78	10.3	8.13	1.289	1.0		42.3	
1110	240	16.75	~~24.00~~	10.3	8.13	1.294	1.0	2.10	40.7	
1115	240	17.95	21.31	10.3	8.15	1.319	1.1	1.93	20.1	
1120	240	19.15	21.16	13.5	8.16	1.461	0.8	1.64	15.0	Top of pump
1208	105	18.68	21.18	14.9	8.21	1.537	0.9	2.10	5.8	thought that well was dry
1213	~~135~~	20.30	21.16	12.0	8.17	1.444	0.7	2.06	-25.4	TOP OF PUMP
1218	75	20.68	21.27	11.8	8.18	1.433	0.9	1.81	-37.1	
1223	100	21.18	21.30	11.9	8.19	1.433	1.6	1.88	-33.3	
Final Parameter Readings for Sample.										
1223		See above								

Comments:
restarted at 1208

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6/28/2018
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: RQLmw-008
Sample ID: RQLmw-008-062818-GW
Well Head Condition: Locked: Y__ N__
Pooled water at head: Y__ N↘ Inner Casing Clean: Y↘ N__
Exterior Seal Good: Y↘ N__ Inner Casing Straight and Clear: Y↘ N__

PID Borehole Reading: N/A
LNAPL: Y__ N/ DNAPL: Y__ N/ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) ANR CMJ
QC Sample: Y (N) Type: ——
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1342			~~7.77~~							
~~1347~~	~~75~~ ~~140~~	0.38	7.81	18.0	7.75	0.~~54~~1	123.7	2.51	-54.3	
~~1352~~	~~140~~ 140	1.08	7.87	19.0	7.73	0.526	35.6	2.24	-55.~~5~~	
1357	80	1.48	7.95	~~19.0~~ 16.4	~~7.73~~ 7.72	0.490	48.1	1.88	-59.9	
1402	80	1.88	8.20	~~14.3~~ 14.3	7.74	0.464	12.4	1.78	-57.2	
1407	125	2.50	7.96	17.3	7.71	0.499	10.9	1.66	-59.3	
1412	80	2.90	7.93	17.4	7.71	0.504	6.7	1.57	-61.9	
1417	80	3.30	8.29	15.6	7.71	0.492	9.3	1.74	-61.7	
1422	150	4.05	8.05	15.1	7.71	0.490	7.9	1.74	-62.5	
1427	150	4.8	8.06	14.5	7.69	0.511	7.4	1.73	-66.8	
1432	150	5.55	8.09	14.9	7.70	0.510	8.2	1.64	-68.1	
Final Parameter Readings for Sample.										
1432			~~8.09~~	See above						

Comments: Recorded conductivity as C- $\frac{mS}{cm}$.

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6/28/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: RQLmw-016-062818-GW
Sample ID: RQLmw-016-062818-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) ANR/CMJ
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
1532			37.44							
1537	280	1.4	38.09	13.6	7.66	1.512	2.7	6.03	45.0	
1542	205	2.43	38.33	11.0	7.07	1.355	2.3	4.00	24.2	
1547	125	3.05	38.31	11.1	7.06	1.356	1.3	3.19	18.6	
1552	125	3.68	38.44	12.2	7.08	1.402	1.2	2.48	16.0	
1557	↓	4.13	38.55	11.9	7.09	1.394	1.2	2.20	14.2	
1602	↓	4.93	38.61	11.9	7.09	1.395	1.1	2.07	13.0	
~~1607~~	~~dup~~									
Final Parameter Readings for Sample.										
1602		See	above							

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/25/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FBQmw-171
Sample ID: FBQmw-171-062518-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y __ N X DNAPL: Y __ N X Product Depth —
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB & KF
QC Sample: Y / N Type: Dup - FBQmw-171-D-062518-GW
Parameter(s) Collected: See COC

	Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
5min	0845			19.08							
	0850	260	~~250~~ KMB 1.3	19.22	11.5	7.54	0.135	13.3	7.03	102.6	adjusting
	0855	245	2.53	19.39	11.6	6.16	0.131	5.9	6.67	107.0	pumping rate
	0900	180	3.43	19.42	11.5	5.72	0.130	5.0	6.50	109.1	
3min	0905	180	4.33	19.42	11.5	5.56	0.130	5.5	6.50	111.8	
	0908	180	4.87	19.43	11.5	5.50	0.131	6.2	6.50	114.3	
	0911	180	5.41	19.44	11.5	5.48	0.131	7.7	6.50	115.6	
	0914	180	5.95	19.45	11.5	5.46	0.132	8.4	6.48	117.4	
	0917	180	6.49	19.46	11.5	5.45	0.132	10.0	6.48	119.3	
Final Parameter Readings for Sample.											
	0917		see above								

Comments:

0845 - start pump / begin purge
0918 - sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6-25-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FBQ mw-172
Sample ID: FBQ mw-172-062518-[redacted] GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB & KF
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
10:05			26.59							
10:10	100	0.5	26.69	12.5	6.32	0.856	19.0	6.93	129.7	
10:15	100	1.0	26.72	12.2	6.36	0.906	11.0	6.19	130.6	
10:20	100	1.5	26.72	12.0	6.38	0.920	7.5	5.98	131.6	
10:25	100	2.0	26.77	11.9	6.40	0.924	5.0	5.84	132.8	
10:30	100	2.5	26.77	12.1	6.41	0.926	3.1	5.77	133.3	
10:35	100	3.0	26.76	11.8	6.42	0.928	2.9	5.74	134.0	
Final Parameter Readings for Sample.										
10:35		see above								

Comments: @10:05 – pump on; begin purge
10:40 - begin sampling

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6-25-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FBQmw-174-
Sample ID: FBQmw-174-062518-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB & KF
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1308			17.76							
1313	180	0.9	*	13.6	5.41	0.055	49.2	10.10	177.1	
1318	150	1.65	top of pump	15.0	5.29	0.055	11.2*	10.0	177.8	bubble dislodged
1323	100	2.15	top of pump	14.9	5.20	0.056	8.5	9.90	179.9	
1328	100	2.65	top of pump	14.7	5.16	0.057	8.2	9.86	181.6	
1333	100	3.15	top of pump	14.7	5.13	0.057	7.7	9.82	183.3	
1338	100	3.65	top of pump	14.7	5.12	0.058	7.3	9.80	185.1	
Final Parameter Readings for Sample.										

Comments: 15.51 - depth to top of pump 1340 - sample
17.76 - depth to water
* unable to measure water level - below pump

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06-25-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FBQmw-175
Sample ID: FBQmw-175-062518-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth —
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB & KF
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1130			18.23							adjusting pumping rate
1135	180	0.9	18.53	11.3	6.35	0.096	123.4	10.24	113.5	
1140	100	1.40	18.65	12.1	5.75	0.095	77.2	10.27	151.5	
1145	100	1.90	18.76	12.5	5.49	0.094	75.5	10.26	154.9	
1150	100	2.40	18.75	12.7	5.37	0.094	67.4	10.26	158.0	
1155	100	2.90	18.76	12.7	5.32	0.094	66.4	10.27	159.8	
1200	100	3.40	18.79	12.6	5.29	0.093	67.0	10.29	161.9	
1205	100	3.90	18.78	12.8	5.27	0.093	67.4	10.32	163.8	
1210	100	4.40	18.82	13.0	5.25	0093	54.7	10.25	165.4	
1215	100	4.90	18.83	12.8	5.21	0.093	46.6	10.29	168.3	
1220	100	5.40	18.85	12.8	5.21	0.093	41.0	10.28	169.6	
1225	100	5.90	18.88	12.8	5.20	0.093	35.7	10.31	171.4	
1230	100	6.40	18.89	12.9	5.19	0.093	38.4	10.29	172.8	
1235	100	6.90	18.90	12.7	5.18	0.093	35.7	10.32	174.6	
1240	100	7.40	18.91	12.9	5.17	0.093	36.1	10.33	176.2	
1245	100	7.90	18.92	12.9	5.17	0.093	34.7	10.34	177.7	
1250	100	8.40	18.93	12.9	5.16	0.093	36.0*	10.34	178.0	turbidity not dropping below 30's
Final Parameter Readings for Sample.										
1250		see above								

Comments:

1130 begin purging / pump on

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/25/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FBQmw-176
Sample ID: FBQmw-176-062518-GW
Well Head Condition: Locked: Y X N
Pooled water at head: Y N X Inner Casing Clean: Y X N
Exterior Seal Good: Y X N Inner Casing Straight and Clear: Y X N

PID Borehole Reading: N/A
LNAPL: Y N X DNAPL: Y N X Product Depth —
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB & KF
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1428			9.48							adjusting pumping rate
1433	260	1.3	9.56	11.1	5.88	0.125	754.2	2.11	102.2	
1438	220	2.4	9.54	11.5	5.86	0.126	530.0	1.37	69.2	
1443	220	3.5	9.56	11.4	5.87	0.125	365.2	1.10	51.2	
1448	220	4.6	9.56	11.4	5.84	0.125	242.6	1.0	42.9	
1453	220	5.7	9.56	11.3	5.86	0.125	137.2	0.88	35.7	
1458	220	6.8	9.56	11.3	5.87	0.125	130.1	0.84	31.4	
1503	220	7.9	9.56	11.4	5.87	0.125	104.3	1.23	33.1	
1508	220	9.0	9.56	11.3	5.87	0.125	77.8	0.82	28.0	
1513	220	10.1	9.56	11.1	5.87	0.125	64.7	0.78	24.9	
1518	220	11.2	9.57	11.1	5.88	0.125	57.2	0.75	22.2	
1523	220	12.3	9.57	11.2	5.89	0.125	55.3	0.73	20.1	
1528	220	13.4	9.57	11.1	5.89	0.125	59.6	0.72	18.5	
1533	220	14.5	9.58	11.1	5.89	0.125	34.0	0.70	16.6	
1538	220	15.6	9.58	11.2	5.89	0.125	31.7	0.69	15.1	
1543	220	16.7	9.58	11.3	5.89	0.125	29.8	0.68	13.7	
1548	220	17.8	9.59	11.0	5.90	0.126	25.0	0.99	19.7	
1553	220	18.9	9.59	11.0	5.89	0.126	23.6	0.84	18.1	
Final Parameter Readings for Sample.										

Comments: 1428 - begin purging / pump on

page 1 of 2

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/25/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FBQmw-176
Sample ID: FBQmw-176-062518-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB/KF
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1558	220	20.0	9.59	11.1	5.89	0.126	23.1	0.81	17.3	
1603	220	21.1	9.59	11.1	5.90	0.126	18.3	0.76	16.2	
1608	220	22.2	9.60	11.1	5.90	0.126	17.2	0.79	15.5	
1613	220	23.3	9.60	11.0	5.90	0.126	14.4	0.75	14.8	
1618	220	24.4	9.60	10.9	5.90	0.126	14.2	0.72	14.0	
1623	220	25.5	9.60	11.0	5.90	0.126	14.1	0.70	13.6	
1628 *	220	26.6	9.60	11.0	5.90	0.126	14.0	0.67	13.1	end of 2hr purge
Final Parameter Readings for Sample.										
1628		See above								

Comments: page 2 of 2
1628- sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/26/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL4mw-193
Sample ID: LL4mw-193-062618-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB & KF
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
800			7.26							
805	260	1.3	8.56	10.5	6.90	0.774	31.0	4.18	185.8	adjusting pumping rate
810	~~100~~ KMB 80	1.7	8.78	11.8	6.90	0.765	22.5	3.01	180.1	
815	145	2.43	9.12	11.4	6.92	0.766	5.9	1.70	176.0	
820	100	2.93	9.13	12.2	6.94	0.760	6.1	1.51	173.6	
823	100	3.23	9.14	12.4	6.96	0.768	0.9	1.41	172.0	
826	100	3.53	9.16	12.3	6.97	0.769	0.9	1.38	171.2	
829	100	3.83	9.16	12.5	6.99	0.769	0.4	1.35	170.5	
832	100	4.13	9.16	12.3	7.00	0.768	2.0	1.31	169.2	
Final Parameter Readings for Sample.										
832		See above								

5min
3min

Comments:

800 - begin purging / pumpon
833 - sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/26/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL12mw-247
Sample ID: LL12mw-247-062618-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KF EKMB
QC Sample: (Y) / N Type: Dup/MS/MSD - LL12mw-247-D062618-GW
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
900			6.07							
905	175	0.88	6.65	12.3	7.09	0.874	160.4	4.70	167.8	adjusting pumping rate
910	160	1.63	7.07	11.9	7.03	0.866	95.0	3.24	146.2	
915	140	2.33	7.18	12.5	7.0	0.868	80.0	2.86	126.1	
920	140	3.03	7.23	13.1	6.99	0.872	72.5	2.11	99.8	
925	100	3.53	7.27	13.3	6.99	0.876	68.0	2.03	88.7	
930	100	4.03	7.35	13.0	7.10	0.881	30.9*	5.02	75.3	bubble dislodged ↓
935	100	4.53	7.40	13.1	7.02	0.874	14.6*	2.25	64.3	
940	100	5.03	7.40	13.6	7.0	0.871	19.4	1.88	52.0	
945	100	5.53	7.41	13.5	7.01	0.873	14.1	1.76	46.6	
950	100	6.03	7.42	13.9	7.0	0.874	18.8	1.68	39.8	
953	100	6.33	7.40	14.1	7.0	0.876	23.7	1.62	34.3	
956	100	6.63	7.42	* ——					—— *	missed measurement
959	100	6.93	7.42	14.3	7.11	0.881	10.2	1.76	40.2	
1002	100	7.03	7.41	14.2	7.04	0.878	2.4	2.13	35.5	
1005	100	7.33	7.42	15.0	7.01	0.877	1.8	2.00	29.5	
1008	100	7.63	7.42	15.3	7.01	.878	0.8	1.95	27.2	
Final Parameter Readings for Sample.										
1008		see above								

Comments: 900 - pump on, begin purge
1010 - sample
1025 - turbidity increase during sampling - suspended sediment (tan/brown), no changes in pumping rate at time of increased turbidity - metals appear to have been collected

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/26/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL2mw-059
Sample ID: LL2 mw - 059 - 062618 - GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB & KF
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
11:56			14.82							
1201	125	0.63	15.22	12.5	6.66	0.234	1.9	3.60	154.3	
1206	125	1.25	15.43	12.3	6.30	0.228	1.2	1.80	155.6	
1211	125	1.88	15.46	12.3	6.15	0.224	4.4	1.43	156.2	
1216	125	2.50	15.47	12.3	6.10	0.223	4.6	1.34	156.7	
1221	125	3.13	~~16.54~~ 15:51	12.4	6.07	0.223	4.4	1.26	157.7	
1226	125	3.75	15.53	12.3	6.05	0.224	4.0	1.20	158.8	
Final Parameter Readings for Sample.										
1226		see above								

Comments: 1156 - start pumps, begin purge
1228 - sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/26/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL3mw-244
Sample ID: LL3mw-244-062618-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KF & KMB
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
1300			13.46							
1305	250	1.25	13.56	13.2	6.68	0.200	6.1	7.79	172.7	
1310	250	2.5	13.57	11.8	6.21	0.185	0.6	6.03	180.7	
1315	250	3.75	13.58	11.7	6.13	0.184	5.8	5.65	182.2	
1320	250	5.0	13.59	11.5	6.08	0.183	0.8	5.29	186.0	
1325	250	6.25	13.60	11.6	6.07	0.182	0.2	5.06	186.5	
1330	250	7.5	13.60	11.6	6.06	0.182	0.5	4.93	188.1	
Final Parameter Readings for Sample.										
1330		see above								

Comments: 1300 - pump on, begin purging
1331 - sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/26/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL3mw-237
Sample ID: LL3mw-237-062618-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KF & KMB
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
~~1400~~			16.86							
1405	160	KMB 160 0.8	17.11	13.4	6.59	0.304	7.6	7.75	180.8	
1410	160	1.6	17.33	12.2	6.61	0.304	3.1	6.27	183.8	
1415	160	2.4	17.57	12.5	6.62	0.302	3.7	6.02	184.3	
1420	160	3.2	17.76	12.6	6.63	0.302	5.6	5.98	184.3	
1425	160	4.0	17.82	12.7	6.63	0.302	6.6	5.94	184.0	
1430	160	4.8	17.88	12.7	6.63	0.302	5.9	5.92	184.2	
Final Parameter Readings for Sample.										
1430		see above								

Comments: 1400 - pump on, begin purge
1431 - Sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6/26/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL3 mw - 234
Sample ID: LL3 mw - 234 - 062618 - GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth —
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB & KF
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1447			10.82							
1452	160	0.80	11.64	13.2	6.73	0.392	1394.1	2.23	160.4	adjusting pumping rate
1457	125	1.43	11.81	13.7	6.67	0.391	1035.2	1.23	164.2	
1502	125	2.05	11.88	13.6	6.66	0.391	745.0	1.07	165.0	
1507	125	2.68	11.96	13.4	6.64	0.391	280.2	0.88	156.2	
1512	125	3.31	12.04	13.3	6.68	0.390	171.1	0.84	143.9	
1517	125	3.94	12.04	13.6	6.64	0.391	KMB 87.2	0.81	121.2	
1522	125	4.57	12.06	13.3	6.64	0.391	59.1	0.77	104.4	
1527	125	5.20	12.07	13.3	6.65	0.391	48.1	0.76	97.2	
1530	125	5.57	12.08	13.2	6.65	0.391	40.0	0.76	93.3	
1533	125	5.95	12.09	13.0	6.65	0.389	30.2	0.75	88.0	
1536	125	6.32	12.10	13.0	6.64	0.389	21.9	0.74	82.4	
1539	125	6.70	12.11	13.0	6.64	0.389	18.3	0.73	80.0	
1542	125	7.07	12.12	13.1	6.64	0.389	15.4	0.73	76.8	
Final Parameter Readings for Sample.										
1542		see above.								

5min
3min

Comments:

1447 - pump on) begin purge
*water dark orange w/ significant suspended sediment at start of purging
1542 - sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6/27/19
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL1mw-080
Sample ID: LL1mw-080-062718-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB | KF
QC Sample: Y / N Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
5min										
0737			14.21							
0742	140	0.7	14.63	13.4	7.44	0.683	6.5	4.75	129.7	adjusting pumping rate
0747	140	1.4	15.02	13.2	6.66	0.628	3.2	4.20	135.8	adjusting pumping rate
0752	130	2.05	15.24	13.8	6.40	0.611	2.3	4.14	139.5	adjusting pumping rate
0757	136	2.70	15.49	14.2	6.25	0.643	2.3	4.18	142.5	
3min 0802	130	3.35	15.67	14.1	6.15	0.722	1.9	3.91	146.6	
0805	130	3.74	15.79	14.0	6.13	0.748	1.9	3.80	147.9	
0808	130	4.13	15.96	14.0	6.11	0.761	1.6	3.65	149.6	
0811	130	4.52	15.99	13.9	6.10	0.774	1.7	3.58	151.1	
Final Parameter Readings for Sample.										
0811		see above								

Comments:

0737 - pump on / begin purge
0812 - sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/27/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LLmw-081
Sample ID: LLmw-081-062718-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KP & KM13
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
0832			31.44							drawing water / flow cell filling
0844	100	1.2	32.08	11.9	6.57	0.438	1578.4	3.94	53.2	
0849	100	1.7	32.22	11.9	6.50	0.434	710.5	2.41	42.4	
0854	100	2.2	32.32	11.9	6.46	0.432	491.3	1.92	33.8	
0859	100	2.7	32.39	11.8	6.45	0.431	243.6	1.69	17.4	
0904	100	3.2	32.43	11.7	6.45	0.436	185.4	1.49	9.3	
0909	100	3.7	32.43	11.7	6.45	0.436	240.2	1.36	5.4	
0914	100	4.2	32.48	11.6	6.48	0.440	101.4	1.18	5.1	
0919	100	4.7	32.50	11.4	6.46	0.446	75.1	1.03	-1.2	
0924	100	5.2	32.51	11.3	6.46	0.448	74.0	0.95	-3.8	
0929	100	5.7	32.54	11.4	6.47	0.449	54.0	0.91	-5.6	
0934	100	6.2	32.56	11.6	6.47	0.451	42.6	0.89	-7.3	
0939	100	6.7	32.56	11.6	6.48	0.452	55.4	0.86	-8.7	
0944	100	7.2	32.56	11.6	6.48	0.453	50.2	0.84	-10.0	
0949	100	7.7	32.56	11.5	6.49	0.455	42.1	0.80	-11.8	
0954	100	8.2	32.53	11.5	6.49	0.455	45.4	0.78	-12.8	
0959	100	8.7	32.55	11.6	6.47	0.456	100.5*	0.77	-13.5	*sudden turb. increase
1004	100	9.2	32.55	11.7	6.51	0.457	135.6	0	-	
Final Parameter Readings for Sample.										
1034		see page 2								

Comments: Page 1 of 2
0832 - pump on / beging purging
0832-0844 – flow cell filling - water dark orange/red

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/27/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LLMW-081
Sample ID: LLMW-081-062718-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KF & KMB
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
——			——							
1008	100	9.7	32.55	11.5	6.50	0.456	67.2	0.76	-13.6	
1014	100	10.2	32.56	11.5	6.50	0.456	36.9	0.75	-13.7	
1019	100	10.7	32.59	11.6	6.50	0.457	24.9	0.73	-14.7	
1024	100	11.2	32.58	11.6	6.50	0.457	24.9	0.71	-15.3	
1029	100	11.7	32.60	11.8	6.50	0.457	19.8	0.70	-16.2	
1034	100	12.2	32.61	11.8	6.50	0.457	15.4	0.70	-17.1	end 2hr max purge
Final Parameter Readings for Sample.										
1034		see above								

Comments:
page 2 of 2
1035 - sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/27/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL1mw-084
Sample ID: LL1mw-084-062718-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth —
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB / KF
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
1106			31.02							
1111	210	1.05	31.60	12.9	5.63	0.317	3.1	7.10	140.8	
1116	210	2.1	31.92	12.1	5.34	0.309	2.5	6.24	151.6	
1121	125	2.73	32.00	13.2	5.25	0.309	2.0	5.77	158.4	
1126	125	3.35	32.13	13.2	5.20	0.310	1.7	5.55	~~160~~ 165.0	
1131	125	3.98	32.23	13.1	5.18	0.313	1.8	5.45	170.5	
1136	125	4.60	32.33	13.0	5.18	0.314	1.7	5.40	174.9	
Final Parameter Readings for Sample.										
1136		see above								

Comments: 1106 - start pump, begin purge
1138 - sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/27/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: ~~LL2MW-264~~ LL2MW-264
Sample ID: LL2mw-264-062718-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KF & KMB
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) / 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
6min 1400			9.95							
1405	550	2.75	9.95	11.1	6.49	0.373	19.1	1.76	196.6	adjusting pumping rate
1410	~~275~~ 550 KMB	3.25	9.68	13.0	6.63	0.372	8.7	1.29	153.0	
1415	275	4.63	9.74	12.3	6.71	0.381	9.1	1.10	127.0	
1420	275	6.00	9.74	12.1	6.76	0.383	6.9	1.01	109.5	
3min 1425	275	7.38	9.72	12.4	6.80	0.383	6.3	0.96	96.1	
1428	275	8.20	9.72	12.4	6.82	0.384	5.9	0.94	87.3	
1431	275	9.03	9.72	12.6	6.83	0.385	6.0	0.92	79.6	
1434	275	9.85		12.8	6.83	0.385	6.8	0.90	74.4	
Final Parameter Readings for Sample.										
1434		see above								

Comments:

1400 - pump on / begin purging
1435 - sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/27/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LLimw-083
Sample ID: LLimw-083-062718-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB / KF
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
5min 12:13			35.39							
1221	150	1.20	35.65	12.7	4.48	0.305	15.3	8.37	228.3	
1226	150	1.95	35.81	12.2	4.37	0.306	11.1	8.15	233.0	
1231	150	2.70	35.85	12.0	4.31	0.309	15.3	8.10	241.3	
1236	150	3.45	35.90	11.8	4.26	0.310	30.0	8.08	247.0	
1241	150	4.20	35.91	11.9	4.25	0.310	50.0	8.09	251.1	
1246	150	4.95	35.91	11.9	4.25	0.311	48.3	8.09	255.2	
1251	150	5.70	35.93	11.8	4.25	0.310	44.6	8.13	260.3	
3min 1256	150	6.45	35.94	11.9	4.25	0.311	45.0	8.10	263.8	
1259	150	6.90	35.93	12.1	4.24	0.311	46.5	8.09	266.2	
1302	150	7.35	missed	—	—	—	—	—	—	
1305	150	7.80	35.96	12.1	4.26	0.311	54.5	8.16	269.5	
1308	150	8.25	35.96	11.9	4.23	0.311	27.0	8.24	273.4	
1311	150	9.15	35.96	11.7	4.23	0.311	19.4	8.20	275.4	
1314	150	9.90	35.96	11.8	4.23	0.311	16.0	8.19	276.8	
1317	150	10.05	35.96	12.0	4.23	0.312	10.0	8.20	279.2	
1320	150	10.50	35.96	12.0	4.23	0.312	7.7	8.20	280.7	
1323	150	10.95	35.96	12.2	4.23	0.312	6.1	8.20	282.8	
Final Parameter Readings for Sample.										
1323		see above								

Comments: 1213 - begin purge/pump on
1325 - sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/28/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL2mw-267
Sample ID: LL2 mw-267-062818-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth —
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB / KF
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
5min 738			11.12							
743	125	0.63	11.23	15.2	8.84	0.320	755.3	8.60	44.5	
748	125	1.25	11.27	12.4	7.46	0.315	2472.8	5.50	30.9	Fe bacteria colonies,
753	125	1.88	11.30	12.0	6.93	0.322	947.2	3.41	29.7	
758	125	2.5	11.31	11.7	6.74	0.329	512.0	3.00	19.9	
803	125	3.13	11.33	11.5	6.65	0.330	532.5	2.61	13.4	
808	125	3.75	11.36	11.4	6.97	0.335	607.3	2.61	4.9	
813	125	4.38	11.41	11.1	6.69	0.334	706.1*	1.26	1.2	*sediment dislodged
818	125	5.0	11.43	11.1	6.63	0.342	221.2*	1.06	-1.9	
823	125	5.63	11.45	11.0	6.59	0.360	189.9	0.97	-5.6	
828	125	6.25	11.46	11.1	6.74	0.375	80.3	1.79	-2.3	
833	125	6.88	11.46	11.1	6.61	0.389	39.0	1.18	-5.5	
838	125	7.5	11.47	11.0	6.57	0.395	27.9	1.04	-7.6	
843	125	8.13	11.48	10.9	6.55	0.401	27.8	1.24	-9.4	
848	125	8.75	11.48	10.9	6.52	0.409	14.3	1.07	-11.1	
853	125	9.38	11.49	11.0	6.52	0.411	13.7	0.94	-12.3	
3min 858	125	10.0	11.50	10.9	6.52	0.411	9.9	1.30	-12.9	
* Not Pol	125	10.38	11.50	11.0	6.52	0.416	9.8	1.24	-13.3	
Final Parameter Readings for Sample.										
		next	page							

Comments: 738- pumps on, begin purge
748- rust/carrot/blood colored water, strong odor

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/28/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL2mw-267
Sample ID: LL2mw-267-062818
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth —
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB IKF
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
—			—							
904	125	10.75	11.50	11.0	6.52	0.416	9.1	1.20	-14.0	
Final Parameter Readings for Sample.										
904		See above								

Comments: 905 - sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/28/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL10mw-005
Sample ID: LL10mw-005-062818-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth —
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB / KF
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) / 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
945			16.64							flow cell filling
~~952~~ 953	140	1.0	16.67	12.6	7.35	0.422	50.1	6.19	92.3	
958	140	1.7	16.69	11.7	7.03	0.417	63.5	2.81	94.7	very fine flakes in clear wate
1003	140	2.40	16.69	11.7	7.01	~~0.460~~ 0.416	29.9	2.64	95.3	
1008	140	3.10	16.69	11.7	6.93	0.415	14.7	2.01	95.6	
1013	140	3.80	16.70	11.6	6.91	0.416	8.1	1.86	95.8	
1016	140	4.22	16.70	11.7	6.90	0.416	5.4	1.80	95.8	
1019	140	4.64	16.70	11.7	6.90	0.415	3.8	1.80	95.7	
Final Parameter Readings for Sample.										
1019		See above								

5 min
3 min

Comments: 945 - pump on, begin purge
1020 - sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/28/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: RQLmw-011
Sample ID: RQLmw-011-062818-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth —
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB/KF
QC Sample: (Y) N Type: MS/MSD - RLQmw-011-062818-GW
Parameter(s) Collected: See COC

Time (3-5 min) / 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1121 (5 min)			23.06							
~~1126~~ KF 1130	120	1.08	23.22	13.7	5.08	0.213	6.5	3.94	187.4	
1135	120	1.68	23.25	13.9	4.82	0.215	6.8	3.31	196.2	
1140	120	2.28	23.26	14.0	4.76	0.219	13.0	3.11	199.9	
1145 (3 min)	120	2.88	23.28	14.3	4.73	0.231	14.0	2.82	203.4	
1148 ~~1150~~ KF	120	3.24	23.28	14.2	4.74	0.236	13.2	2.78	203.5	
1151	120	3.60	23.28	14.4	4.77	0.244	12.7	2.66	203.5	
Final Parameter Readings for Sample.										
1151		see above								

Comments: rusted cap/wasps
1121 - pump on, begin purge
1151 - sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/28/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: RALmw-012
Sample ID: RALmw-012-062818-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB / KF
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
1230			22.91							
1235	225	1.13	22.98	12.0	5.38	0.417	5.9	5.36	210.5	
1240	225	2.25	23.02	11.9	5.42	0.446	4.5	4.40	210.6	
1245	225	3.38	23.02	11.9	5.43	0.451	3.0	3.95	212.0	
1248	225	4.05	23.02	11.8	5.43	0.453	4.0	3.82	212.6	
1251	225	4.73	23.02	11.7	5.43	0.452	2.0	3.72	213.4	
1254	225	5.40	23.02	11.6	5.43	0.453	0.0	3.67	214.0	
Final Parameter Readings for Sample.										
1254		See	above							

1 min
3 min

Comments: ants!
1230 - pump on, begin purge
1255 - sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/28/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: RAL mw - 014
Sample ID: RAL mw - 014 - 062818-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth —
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB & KF
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) / 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1312			20.89							
1317	120	0.60	21.03	14.3	6.35	0.345	16.8	7.38	149.1	
1322	120	1.2	21.09	12.7	6.02	0.218	20.1	2.37	99.3	
1327	120	1.8	21.10	12.5	5.97	0.199	7.4	1.47	76.2	
1332	120	2.4	21.10	12.3	5.95	0.195	2.8	1.23	68.2	
1335	120	3.0	21.11	12.4	5.94	0.193	2.0	1.15	64.8	
1338	120	3.6	21.11	12.3	5.94	0.193	2.2	1.13	62.0	
Final Parameter Readings for Sample.										
1338		see above								

Comments: ants

1312 - pumps on, begin purge
1340 - sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/28/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: RQL mw-013
Sample ID: RQL mw-013-062818-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth —
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB | KF
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
~~1354~~ 1354			26.39							
1355	100	0.4	26.60	14.7	4.14	0.372	2.3	6.36	~~18~~ 192.1	
1400	200	~~0.9~~ 1.4	26.61	13.6	4.15	0.356	1.7	4.20	198.3	
1403	200	~~1.3~~ 2.0	26.62	13.1	4.15	0.338	1.2	3.51	204.3	
1406	200	~~1.7~~ 2.6	26.62	12.6	4.13	0.337	0.3	3.20	210.3	
1409	200	~~2.0~~ 3.2	26.63	12.5	4.12	0.334	0.1	2.99	216.8	
1412	200	3.8	26.63	12.4	4.12	0.329	0.9	2.69	221.5	
Final Parameter Readings for Sample.										
1412		see above								

5 min
3 min

Comments: ants
1354 - pump on, begin purge
1414 - sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06/28/18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: RQLmw-009
Sample ID: RQLmw-009-062818-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) KMB - KF
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) / 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1430			6.04			0.307				
1435	200	1.0	6.70	16.4	6.21	~~318.3~~	118.3	4.23	132.0	
1440	200	2.0	6.74	16.4	6.28	0.289	31.6	2.16	92.2	
1445	200	3.0	6.69	16.7	6.31	0.266	16.5	1.44	66.2	
1450	200	4.0	6.69	17.3	6.33	0.266	9.2	1.25	53.4	
1453	200	4.6	6.69	18.1	6.33	0.270	6.7	1.22	47.8	
1456	200	5.2	6.69	18.5	6.34	~~0.7~~ 0.272	3.7	1.21	45.0	
Final Parameter Readings for Sample.										
1456		see above								

5min
3min

Comments: ~~Purge~~
1435 - pump on, begin purge
1458 - sample

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06.25.18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL7-mw-001
Sample ID: LL7-mw-001-062518-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth N/A
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) Jessica Cain
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
11:00			23.0							
11:10	150 mL	150 mL	23.50	11.8	6.17	277.5	131.9	1.63	83.0	
11:15	150 mL	300 mL	23.50	10.9	6.13	277.8	119.6	~~12.8~~ 1.41	62.8	
11:20	150 mL	450 mL	23.50	10.8	6.15	288.9	118.0	1.24	57.0	
~~11:25~~	~~150 mL~~	~~600 mL~~								Battery for Compressor
~~11:30~~	~~150 mL~~	~~750 mL~~	?							Died.
11:35	100 mL	550 mL	23.00	16.1	6.27	289.1	100.3	1.23	0.3	
11:40	100 mL	650 mL	23.00	16.6	6.24	297.5	96.3	1.62	1.2	
11:45	100 mL	750 mL	23.00	15.5	6.22	298.3	63.5	1.68	1.9	
11:50	100 mL	850 mL	22.90	14.6	6.22	286.8	53.0	1.69	1.8	
11:55	100 mL	950 mL	22.95	14.4	6.21	282.0	45.5	1.55	0.60	
12:00	100 mL	1050 mL	22.95	14.1	6.21	283.9	47.0	1.39	0.90	
12:05	100 mL	1150 mL	22.95	13.6	6.19	281.4	67.5	1.21	-3.30	
12:10	100 mL	1250 mL	22.95	13.6	6.21	281.9	79.8	1.18	-4.00	
12:15	100 mL	1350 mL	22.95	13.5	6.20	284.3	17.0	1.12	-4.80	
12:20	100 mL	1450 mL	22.95	13.7	6.20	287.3	15.5	1.09	-6.0	
12:25	100 mL	1550 mL	22.95	13.7	6.23	290.6	~~15.2~~ 14.4	1.08	-8.0	
12:30	100 mL	1650 mL	22.95	13.5	6.23	289.6	14.3	1.04	-9.3	
Final Parameter Readings for Sample.										
12:30		1650 mL	22.95	13.5	6.23	289.6	14.3	1.04	-9.3	

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06.25.18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FWGmw-016-~~062518~~-GW-JC
Sample ID: FWGmw-016-062518-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__ Concentrated Cracked
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth N/A
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) JC
QC Sample: Y (N) Type: N/A
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
13:50			17.35							
13:55	100 mL	0.1	17.40	15.0°	7.09	665	3.2	3.28	10.0	
14:00	100 mL	~~0.2~~ 0.6	17.45	14.8°	7.10	667	1.2	2.83	41.0	
14:05	100 mL	~~0.3~~ 1.1	17.40	14.7°	7.10	669	0.9	2.12	1.2	
14:10	100 mL	~~0.4~~ 1.6	17.40	14.7°	7.12	666	1.2	1.74	-25.9	
14:15	100 mL	~~0.5~~ 2.1	17.40	14.9°	7.12	666	1.3	1.63	-40.0	
14:20	100 mL	~~0.6~~ 2.6	17.35	14.7°	7.13	664	2.0	1.56	-45.0	
14:23	100 mL	~~2.9~~ 2.9	17.40	14.8	7.13	666	2.3	1.49	-48.0	
Final Parameter Readings for Sample.										
14:23		2.9	17.40	14.8	7.13	665	2.3	1.49	-48	

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06-26-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: DET mw-003-062618-GW
Sample ID: DET mw-003
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth N/A
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) JC
QC Sample: (Y) N Type: FD
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
8:25			9.70							
8:30	~100	0.1	9.70	10.9	6.89	753	9.4	1.67	65	
8:35	~100	0.6	9.70	10.9	6.85	751	6.1	1.24	7.8	
8:40	~100	1.1	9.65	11.1	6.86	749	2.8	1.10	-21.5	
8:45	~100	1.6	9.65	11.2	6.87	750	0.6	1.01	-43.9	
8:50	~100	2.1	9.65	11.1	6.89	750	0.5	0.95	-54.0	
8:55	~100	2.6	9.65	11.1	6.90	751	1.6	0.90	-62.1	
8:58	~100	2.9	9.65	11.1	6.91	751	1.4	0.86	-67.4	
~~9~~ 9:01	~100	3.2	9.65	11.1	6.92	751	0.70	0.83	-72.0	
Final Parameter Readings for Sample.										
~~8:58~~ 9:01		3.2	9.65	11.1	6.92	751	0.70	0.83	-72.0	

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06 26.18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FWGmw 010
Sample ID: FWGmw-010-062618-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth N/A
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) JC & SG
QC Sample: Y / N Type: N/A
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
11:20			12.65					JC		
11:25	~100	0.10	13.65	12.5	5.25	54.6	29.1	~~88.~~ 10.2	289.0	
11:30	~100	0.60	13.70	12.6	5.19	52.9	36.1	9.40	296.9	
11:35	~100	1.10	13.90	12.5	5.19	52.8	26.1	9.32	305.7	
11:40	~100	1.60	13.94	12.3	5.19	53.5	24.9	9.24	311.3	
11:45	~100	2.10	14.00	12.3	5.18	54.1	22.4	9.18	315.7	
11:50	~100	3.60	13.98	12.5	5.18	55.5	18.1	9.06	317.9	
11:55	~100	4.10	14.01	12.7	5.19	56.7	14.6	8.94	320.0	
12:00	~100	5.60	13.97	12.6	5.19	58.3	10.0	8.88	323.2	
Final Parameter Readings for Sample.										
12:00		5.60	13.97	12.6	5.19	58.3	10.0	8.88	323.2	

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6-28-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: SCFmw-004
Sample ID: SCFmw-004-062818-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ~~~
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) dlp & JC
QC Sample: Y / (N) Type: N/A
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
7:44			0.5							
0749	250	0.25	0.5	14.0	6.92	1.113	1.9	1.95	-149.3	
0754		1.5	0.5	13.6	6.85	1.150	5.9	0.61	-172.7	
0759		2.75	0.5	13.5	6.85	1.153	8.1	0.53	-159.8	
0802		4.0	0.5	13.5	6.85	1.143	6.9	0.50	-156.9	
0805		5.25	0.5	13.6	6.85	1.143	7.3	0.50	-157.2	
0808		6.~~7.75~~	0.5	13.3	6.85	1.140	6.0	0.99	-157.0	
0811	250	7.75	0.5	13.4	6.85	1.134	7.9	0.98	-157.1	
0814	250	9.0	0.5	13.3	6.85	1.136	9.0	0.97	-159.4	
Final Parameter Readings for Sample.										
		see above								

Comments:
artesian well, but not overflowing

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06.28.18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: ~~FB0~~ LLmw-065
Sample ID: LLmw-065-062818-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth N/A
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) JC
QC Sample: Y / (N) Type: N/A
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
9:25			12.7							
9:30	0.201	0.20	12.8	10.7	7.11	0.580	17.3	1.29	113	
9:36	200	0.7 ~~1.20~~ 2.0	12.8	10.8	7.11	0.574	3.8	1.20	100	
9:40	100	1.2	12.8	10.7	7.11	0.563	3.9	1.09	87.5	
9:45	100	1.7	12.8	10.7	7.11	0.564	3.8	1.04	85.3	
9:50	100	2.2	12.8	11.0	7.12	0.554	4.8	1.02	85.6	
9:55	100	2.7	12.8	11.0	7.12	0.540	5.4	1.04	86.4	
Final Parameter Readings for Sample.										
09:55		2.7	12.8	11.0	7.12	0.540	5.4	1.04	86.4	

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06.28.18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: ~~LLmw-064-062818-GW~~ FC
Sample ID: LLdup-064-062818-GW
Well Head Condition: Locked: Y N
Pooled water at head: Y N Inner Casing Clean: Y N
Exterior Seal Good: Y N Inner Casing Straight and Clear: Y N

PID Borehole Reading: N/A
LNAPL: Y N DNAPL: Y N Product Depth N/A
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) JC
QC Sample: Y (N) Type: N/A
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
11:20			2.9							
11:25	300 ~~250~~ ~~300~~	~~0.15~~	2.8	13.0	7.48	0.3596	396.0	1.04	-101.4	
11:30	~~450~~ 300	1.80	2.9	13.0	7.49	0.3594	344.5	0.92	-103.2	
11:35	300	3.30	2.9	13.0	7.49	0.3586	233.0	0.68	-108.9	
11:40	300	4.80	2.9	12.7	7.50	0.3586	79.7	0.62	-120.3	Empty air flow through Cell
11:45	300	6.30	2.85	12.7	7.51	0.3578	25.8	0.90	-115.4	
11:50	300	7.80	2.90	12.5	7.49	0.3586	17.4	0.70	-129.6	
11:55	300	9.30	2.90	12.4	7.50	0.3585	9.3	0.58	-134.6	
12:00	300	10.80	2.90	12.4	7.50	0.3588	8.1	0.56	-135.8	
Final Parameter Readings for Sample.										
12:00		10.80	2.90	12.4	7.50	0.3588	8.1	0.56	-135.8	

Comments:

1504

2:150

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06.28.18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: ~~[illegible]~~ FWGmw-012
Sample ID: FWGmw-012-062818-GW
Well Head Condition: Locked: Y ✓ N__
Pooled water at head: Y__ N ✓ Inner Casing Clean: Y ✓ N__
Exterior Seal Good: Y ✓ N__ Inner Casing Straight and Clear: Y ✓ N__

PID Borehole Reading: N/A
LNAPL: Y __ N ✓ DNAPL: Y __ N ✓ Product Depth N/A
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) JC & SC
QC Sample: Y (N) Type: N/A
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
13:20 ~~14:20~~			2.95							
1325 ~~14:25~~	100	0.1	1.95	17.0	6.58	0.1979	13.8	3.18	130.5	
1330 ~~14:30~~	100	0.6	2.10	14.1	5.92	0.1985	138.2	2.47	78.2	
~~1335~~ 13:35	300	2.1	2.30	12.1	6.01	0.2092	111.7	1.32	64.4	
13:40	300	3.6	2.40	11.90	6.08	0.2172	49.7	0.85	54.70	
13:45	300	5.1	2.40	11.90	6.04	0.2142	27.9	0.70	54.00	
13:50	300	6.60	2.40	11.60	6.00	0.2113	17.7	0.63	54.8	Emptied out flow thru
13:55	300	8.1	2.50	11.70	6.00	0.2091	14.1	0.95	62.9	Cell
1500 ~~13~~ 14:00	300	9.6	2.50	11.50	5.95	0.2083	11.20	0.67	63.8	
14:05	300	11.1	2.45	11.3	5.91	0.2052	10.0	0.58	65.7	

Final Parameter Readings for Sample.

1405		11.1	2.45	11.3	5.91	0.2052	10.1	0.58	65.7	

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6-25-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL11-MW-005
Sample ID: LL11-MW-005-GW
Well Head Condition: Locked: Y__ N✓ (Flush mount)
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) Jessica Cain / Scott Carmichael
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC Cyanide

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
9:14			9.25							
9:20	100	0.6	9.23	12.6	5.63	97.6	19.7	7.36	188.9	
9:25	100	1.1	9.22	12.5	5.51	96.7	12.6	7.16	239.8	
9:30	100	1.6	9.21	12.4	5.50	94.2	4.8	7.11	252.1	
9:35	100	2.1	9.20	12.4	5.52	96.6	3.9	6.95	259.5	
9:40	100	2.6	9.20	12.4	5.51	95.3	4.8	6.96	267.2	
9:45	100	3.1	9.20	12.4	5.51	96.2	4.7	7.01	272.5	
Final Parameter Readings for Sample.										
9:45			9.20	12.4	5.51	96.2	4.7	7.01	272.5	

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6-25-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL7 MW-006
Sample ID: LL7-MW-006-62518-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) SC
QC Sample: Y / (N) Type: ~~Explosives~~ ~~Propellants~~ dup
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
10:45			13.40							
11:21	60	~~375~~ 3.78	13.74	11.4	5.61	133.5	500	3.43	189.5	
11:26	375	5.66	14.05	10.5	5.59	136.1	110	3.12	217	
11:32	375	7.53	14.00	10.9	5.60	139.7	15.1	1.57	233.9	
11:37	375	9.41	14.18	10.5	5.61	139.4	13.4	1.23	231.1	
11:40	375	11.28	14.15	10.4	5.62	139.0	13.4	1.17	229.1	
11:43	375	13.16	14.28	10.5	5.62	138.8	13.0	1.14	227.4	
Final Parameter Readings for Sample.										
11:43			14.28	10.5	5.62	138.8	13.0	1.14	227.4	

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6-25-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FWGMW-015
Sample ID: FWGMW-015-062518-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) SC
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
# 1355			6.96							
1359	500	2	11.50	12.3	6.92	238.1	11.6	20.0	120.5	
1404	350	3.75	12.35	12.6	6.91	238.8	10.4	2.01	130.2	
1409	300	5.25	13.05	12.3	6.91	239.5	8.7	17.8	143.8	
1414	125	5.88	13.75	14.0	6.92	238.8	171.5	0.88	151.3	
1419	125	6.50	13.65	14.2	6.93	241.8	4.1	0.86	158.2	
1422	125	~~6.88~~ 6.88	13.80	13.5	6.93	243.6	4.5	0.83	159.7	
1425	125	7.25	14.01	13.1	6.93	243.1	4.9	0.77	160.7	
1428	125	7.63	14.40	12.6	6.93	243.8	4.7	0.80	162.0	
1431	125	8.00	14.78	12.8	6.93	243.5	4.8	0.77	162.0	
1436										Pump stopped due to loose electrical connection on compressor.
1439	125	8.38	13.60	17.4	6.94	242.9	4.8	0.81	170.0	
1442	125	8.75	13.70	14.7	6.94	245.0	5.8	0.87	170.9	
1445	125	9.13	~~14.~~ 13.70	14.2	6.94	243.9	5.9	0.85	170.1	
Final Parameter Readings for Sample.										
1445			13.70	14.2	6.94	243.9	5.9	0.85	170.1	

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6-25-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FWGMW-004
Sample ID: FWGMW-004-062518-GW
Well Head Condition: Locked: Y ✓ N __
Pooled water at head: Y __ N ✓ Inner Casing Clean: Y ✓ N __
Exterior Seal Good: Y ✓ N __ Inner Casing Straight and Clear: Y ✓ N __

PID Borehole Reading: N/A
LNAPL: Y __ N ✓ DNAPL: Y __ N ✓ Product Depth ~~~
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) JC SC
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1515			14.35							
1520	100	0.5	14.47	14.5	7.04	6.46 646	51.1	4.64	132.7	
1525	100	1.0	14.50	14.0	7.02	638	45	2.93	131.7	
1530	100	1.5	14.60	12.5	6.99	644	42.8	2.21	129.5	
1535	100	2.0	14.70	12.5	6.99	627	26.0	1.72	125.9	
1540	100	2.5	14.68	13.3	6.95	648	11.7	1.50	122.5	
1545	100	3.0	14.70	12.7	6.95	658	10.0	1.39	120.5	
1548	100	3.3	14.70	12.2	6.95	654	10.0	1.36	118.7	
Final Parameter Readings for Sample.										
1548			14.70	12.2	6.95	654	10.0	1.36	118.7	

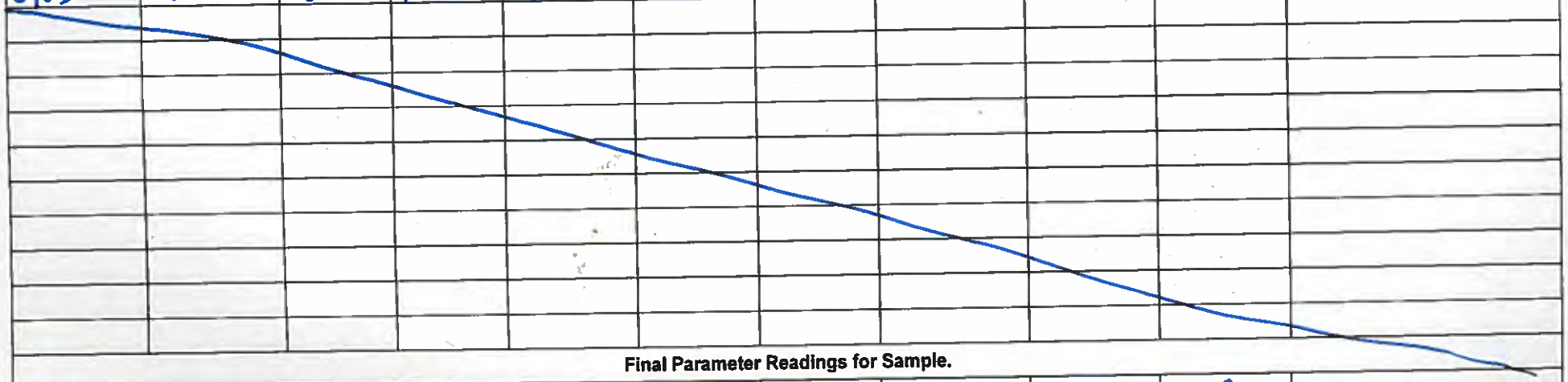
Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6-26-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: DA2MW-115
Sample ID: DA2MW-115-062618-GW
Well Head Condition: Locked: Y ✓ N __
Pooled water at head: Y __ N ✓ Inner Casing Clean: Y ✓ N __
Exterior Seal Good: Y ✓ N __ Inner Casing Straight and Clear: Y ✓ N __

PID Borehole Reading: N/A
LNAPL: Y __ N ✓ DNAPL: Y __ N ✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) SC
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
0826			7.00							
0835	200	1.8	7.65	10.7	7.27	766	180	3.30	-41.5	
0840	200	2.8	7.90	10.7	7.19	772	2.0	1.21	-33.5	
0845	200	3.8	7.70	10.7	7.17	778	2.0	1.08	-40.5	
0850	150	4.55	7.35	11.1	7.18	781	2.1	0.99	-42.3	
0855	150	5.30	7.45	10.8	7.18	780	2.1	0.88	-44.6	
0900	150	6.05	7.45	11.0	7.18	781	2.1	0.89	-42.6	
0903	150	6.80	7.48	10.8	7.18	782	1.9	0.84	-43.8	
Final Parameter Readings for Sample.										
0903			7.48	10.8	7.18	782	1.9	0.84	-43.8	



Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 9.26.18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FWGMW-019
Sample ID: FWGMW-019-092618-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth N/A
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) SC & JC
QC Sample: Y / N Type: N/A
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1255		0.625	115.00							
1300	125	~~0.750~~	115.20	13.7	7.55	721	2.1	10.43	235.3	
1305	125	1.25 ~~1.375~~	115.10	15.7	7.45	738	2.6	9.29	230.7	
1310	100	1.75	115.90	17.6	7.40	745	2.9	8.10	188.6	Switched to a bigger Compressor
~~1315~~ 1305	500	4.25	116.55	11.6	7.08	747	2.1	2.00	-54	
1320	200	5.25	116.25	12.4	7.08	750	3.0	1.60	-35	
1325	200	6.25	116.15	12.6	7.08	749	3.6	2.28	-14.3	
1330	200	7.25	116.20	12.4	7.08	748	6.0	2.21	-20.1	
1333 ~~1336~~	200	7.85	116.25	12.5	7.06	748	1.6	1.96	-24.2	

Final Parameter Readings for Sample.

1333			116.25	12.5	7.06	748	1.6	1.96	-24.2	

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06.26.18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: ~~[illegible]~~ FWGmw-023 ~~[illegible]~~ IC
Sample ID: FWGmw-023-062618-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y__ N X Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y __ N X DNAPL: Y __ N X Product Depth N/A
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) IC + SG
QC Sample: Y / N Type: N/A
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
15:40			117.60							
15:45	100.	0.5	117.60	17.2	7.60	631	1.9	10.48	11.5	
1550	100	1.0	117.60	18.0	7.55	636	2.1	10.23	136.9	
1555	100	1.5	117.56	18.8	7.51	638	2.0	9.91	152.7	
1600	100	2.0	117.57	19.5	7.49	641	2.0	8.48	162.9	
1605	175	2.875	117.62	13.0	7.21	641	2.9	5.25	-45.9	
1610	150	3.625	117.69	12.4	7.15	643	3.3	2.83	-58.3	
1613	150	4.38	117.66	12.3	7.15	645	4.5	~~2.59~~ 2.15	-52.3	
1616	150	5.13	117.62	12.3	7.15	645	4.7	2.07	-46.7	
1619	150	5.88	117.67	12.3	7.15	646	5.0	1.93	-43.5	
Final Parameter Readings for Sample.										
1619			117.67	12.3	7.15	646	5.0	1.93	-43.5	

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 06.26.18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL12mw-0245
Sample ID: LL12mw-245-062718-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth N/A
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) EC3, SC
QC Sample: Y/N Type: N/A
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
0745			10.40							
0750	100	0.1	10.40	12.0	6.84	1094	51.6	2.42	184.3	
0755	100	0.6	11.05	12.4	6.64	1108	20.3	1.54	186.0	
0800	100	1.1	11.60	12.1	6.48	1113	11.9	1.16	181.1	
0805	100	1.6	13.3	11.0	6.45	1112	17.1	1.01	172.7	
0810	100	2.1	14.85	10.7	6.44	1109	21.2	1.01	167.3	
0815	100	2.6	17.00	10.5	6.42	1109	8.0	1.20	161.5	
0818	100	2.9	18.20	12.4	6.49	1078	13.3	1.42	150.8	
0821	100	3.2	19.45	11.8	6.58	1108	1.9	1.42	144.4	
0824	100	3.5	18.85	11.6	6.61	1110	2.4	1.40	140.0	
0827	100	3.8	19.02	11.4	6.61	1111	1.9	1.40	136.6	
0830	100	4.1	19.35	11.4	6.62	1110	2.0	1.40	130.0	
0833	100	4.4	19.65	11.4	6.63	1110	2.0	1.44	123.6	
0836	100	4.7	20.1	11.4	6.66	1108	2.7	1.52	115.0	
0839	100	5.0	20.6	11.4	6.74	1104	3.3	1.60	108.5	
0842	100	6.3	20.85	11.3	6.85	1103	4.0	1.65	103.1	
0845	100	5.6	21.0	11.4	6.92	~~1108~~ 1198	4.8	1.75	100.0	
Final Parameter Readings for Sample.										
0845		5.6	21.0	11.4	6.92	~~1108~~ 1198	4.8	1.75	100.0	

Comments:

N/A

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: ~~6-26-18~~ 6.27.18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL12MW-187
Sample ID: LL12MW-187-062718-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N X DNAPL: Y__ N X Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) SC
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
0955			11.36							
1000	200	1.0	11.98	11.1	8.45	10766	7.6	1.30	236.0	
1005	100	1.5	12.05	11.0	6.24	10755	12.6	1.08	~~2636.0~~	236.0
1010	100	2.0	11.95	12.6	6.00	10577	24.4	0.94	233.3	
1015	200	3.0	12.08	11.3	6.15	10775	11.9	0.80	230.5	
1020	200	4.0	12.15	11.4	6.28	10817	9.8	0.76	228.3	
1025	200	5.0	12.20	11.4	6.35	10833	27.1	0.72	225.3	
1030	150	5.75	12.22	11.4	6.48	10854	25.3	0.69	222.8	
1033	150	6.5	12.22	11.5	6.45	10845	33.5	0.69	222.1	
1036	150	7.25	12.25	11.4	6.42	10833	60.1	0.68	220.6	
1039	150	8.00	12.25	11.5	6.49	10851	8.3	0.67	219.3	
1042	150	8.75	12.26	11.5	6.56	10844	8.3	0.65	218.1	
1045	150	9.50	12.23	11.6	6.58	10845	8.0	0.65	218.0	
Final Parameter Readings for Sample.										
1045			12.23	11.6	6.58	10845	8.0	0.65	218.0	

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6·27·18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL12MW-185
Sample ID: LL12mw-185-062718-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y __ N ✓ DNAPL: Y __ N ✓ Product Depth —
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) SC
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
0935			7.84							
0940	250	1.25	8.90	12.1	9.92	4160	11.3	2.29	196.4	
0945	250	2.50	10.05	11.9	6.95	4079	12.8	1.27	200.5	
0950	250	3.75	10.70	11.9	6.74	4053	14.5	1.06	201.1	
0955	100	4.25	11.98	12.3	6.55	4046	17.1	0.92	200.3	
1000	100	5.25	12.50	12.6	6.53	3978	2.0	0.83	199.0	
1005	100	5.75	12.80	13.5	6.47	3994	2.4	0.79	197.2	
1008	100	6.25	12.89	13.6	6.47	3992	2.5	0.79	196.6	
1011	100	6.75	13.05	13.3	6.50	3990	2.7	0.78	195.8	
1014	100	7.25	13.20	13.3	6.52	3985	2.9	0.77	195.5	
Final Parameter Readings for Sample.										
1214		see	above							

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6.27.18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL12MW-183
Sample ID: LL12MW-183-062718-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ~~~
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) JC | SC
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
1345			14.00							
1350	100	0.5	15.22	13.3	8.04	764	38.2	6.32	92	
1355	100	1.0	15.50	12.4	7.31	683	33.5	4.55	-1.0	
1400	100	1.5	15.50	13.7	7.27	671	32.5	4.36	-9.0	
1405	100	2.0	16.05	12.3	7.01	730	11.7	2.62	-41.5	
1410	100	2.5	16.35	12.3	6.99	702	11.3	2.83	-41.5	
1415	100	3.0	16.55	12.5	6.94	718	10.7	2.60	-45.0	
1418	100	3.5	16.70	12.6	6.93	727	8.4	2.40	-48.7	
1421	100	4.0	16.81	12.8	6.91	731	6.1	2.35	-50.0	
1424	100	4.5	16.88	12.8	6.92	737	5.0	2.26	-51.8	
Final Parameter Readings for Sample.										
1424		See Above								

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6.27.18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL4-MW-200
Sample ID: LL4mw-200-062718-GW
Well Head Condition: Locked: Y ✓ N__
Pooled water at head: Y__ N ✓ Inner Casing Clean: Y ✓ N__
Exterior Seal Good: Y ✓ N__ Inner Casing Straight and Clear: Y ✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N ✓ DNAPL: Y__ N ✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) JC/SC
QC Sample: Y / N Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1445			18.80							
1450	100	0.5	19.00	11.2	7.08	888	28.0	7.75	127.3	
1455	100	1.0	19.00	10.9	6.76	854	14.0	7.25	131.9	
1500	150	1.75	19.00	10.7	6.67	829	10.5	7.07	138.4	
1505	150	2.50	19.05	10.7	6.65	822	9.4	6.85	145.0	
1510	150	3.25	19.11	10.6	6.66	824	9.3	6.73	150.0	
1515	150	4.00	19.09	10.6	6.68	822	10.0	6.71	153.7	
Final Parameter Readings for Sample.										
1515		See Above								

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6-28-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LLMW-087
Sample ID: LLMW-087-062818-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) SC/JC
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
0750			8.67							
0755	250	1.25	9.69	12.0	7.23	716	48.3	2.65	133.8	
0800	250	2.50	9.95	12.2	6.89	671	24.2	1.69	146.5	
0805	150	3.25	10.00	12.6	6.76	661	18.3	1.71	151.6	
0810	150	4.00	10.05	12.5	6.78	690	21.0	1.62	153.4	
0815	150	4.75	10.15	12.4	6.74	704	11.6	1.50	154.4	
0818	150	5.50	10.24	12.3	6.73	708	10.0	1.35	155.0	
0821	150	6.25	10.25	12.3	6.71	710	9.9	1.31	155.1	
0824	150	7.00	10.25	12.4	6.70	713	9.7	1.27	155.5	
Final Parameter Readings for Sample.										
0824		See Above								

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6-28-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL/MW-086
Sample ID: LL/MW-086-062818-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) SL
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
0930			9.00							
0935	400	2.0	9.30	12.4	8.69	399.1	36.4	6.90	150.6	
0940	400	4.0	9.25	11.3	12.29	2478	26.0	4.78	59.1	
0945	400	6.0	9.21	11.2	12.26	1663	66	3.01	36.5	
0950	400	8.0	9.22	11.3	11.48	513	420	1.90	397	
0955	200	9.0	9.20	11.7	10.40	391	820	1.33	52.5	
1000	200	10.0	9.12	11.6	9.32	403.1	832.8	0.89	68.9	Emptied sediment from flow thru-cell.
1005	200	11.0	9.16	11.7	9.25	412.2	763.8	2.01	76.5	
1010	200	12.0	9.13	11.7	9.26	413.0	708.9	1.49	76.2	
1015	200	13.0	9.17	11.7	9.30	412.6	708.8	1.43	75.6	
1020	200	14.0	9.11	11.8	9.30	415.5	669.2	1.25	75.0	
1025	200	15.0	9.13	11.7	9.35	416.3	718.5	1.17	73.9	
1030	200	16.0	9.13	11.7	9.34	418.4	625.5	1.12	73.2	
1035	200	17.0	9.13	11.7	9.31	425.3	624.1	0.94	72.3	
1040	200	18.0	9.10	11.7	9.32	425.4	620.2	0.93	70.1	
1045	200	19.0	9.11	11.7	9.30	428.2	623.7	0.92	69.5	
1050	200	20.0	9.11	11.8	9.31	433.1	626.6	0.85	66.0	
1055	200	21.0	9.13	11.7	9.31	434.1	660.2	0.84	65.5	
Final Parameter Readings for Sample.										
1135		see page 2								

Comments:

Continued on Page 2.

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6-28-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: LL1MW-086 ~~062818-GW~~
Sample ID: LL1MW-086-062818-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N__ DNAPL: Y__ N__ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) SC
QC Sample: Y (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
1100	200	22.0	9.15	11.7	9.30	435.4	612	0.84	64.9	
1105	200	23.0	9.10	11.7	9.24	439.5	595.6	0.81	64.3	
1110	200	24.0	9.10	11.7	9.32	440.7	581	0.79	59.6	
1115	200	25.0	9.12	11.7	9.35	439.2	580.0	0.79	58.4	
1120	200	26.0	9.13	11.8	9.40	436.6	564.2	0.81	56.7	
1125	200	27.0	9.10	11.7	9.31	439.5	585	0.79	55.9	
1130	200	28.0	9.10	11.8	9.37	437.8	595	0.80	53.9	
1135	200	29.0	9.11	11.9	9.32	439.7	580.9	0.79	54.1	
Final Parameter Readings for Sample.										
1135		See Above								

Comments:

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6-28-18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FWGMW-011
Sample ID: FWGmw-011-062818-GW
Well Head Condition: Locked: Y✓ N__
Pooled water at head: Y__ N✓ Inner Casing Clean: Y✓ N__
Exterior Seal Good: Y✓ N__ Inner Casing Straight and Clear: Y✓ N__

PID Borehole Reading: N/A
LNAPL: Y__ N✓ DNAPL: Y__ N✓ Product Depth —
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) SC
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
1330			2.90							
1335	200	1	2.92	12.4	7.98	362.1	420	1.37	121.9	
1340	250	2.25	2.98	12.0	7.27	354.3	610	1.03	-128.5	
1345	250	3.50	3.10	11.3	7.16	351.4	239	1.01	-126.6	
1350	250	4.75	3.00	12.7	7.06	347.1	131.4	0.82	-132.8	
1355	200	~~5.00~~	3.04	12.3	7.06	345.4	126.2	0.81	-133.7	
1400	200	6.75	3.00	12.0	7.05	350.4	90.1	0.81	-99.4	
1405	200	7.75	2.98	12.3	7.02	353.0	80	0.98	-121.6	
1408	200	8.375	3.00	12.2	7.00	351.6	64.4	0.90	-116.4	
1411	200	8.95	3.00	12.2	7.03	351.0	58.9	0.90	-120.2	
1414	200	9.5 ~~10.75~~	2.98	12.2	7.05	349.9	48.5	0.82	-123.5	
1417	200	10.25	2.97	12.4	7.11	347.3	48.6	0.78	-125.6	
1420	200	10.75	2.95	12.7	7.13	346.1	47.4	0.75	-126.9	Compressor stopped
1435	100	11.25	3.00	15.1	6.91	334.9	34.6	2.40	-84.7	Restarted @ 1435
1438	300	12.15	3.00	11.4	6.90	332.0	35.2	1.16	-93.7	Emptied flow-thru cell.
1441	300	13.05	3.00	11.2	6.95	343.7	35.3	0.83	-101.6	
1444	300	13.95	2.98	11.2	6.97	347.0	36.2	0.69	-106.5	
1449	300	~~14.85~~	3.00	12.2	6.96	342.5	36.4	0.63	-108.2	
		15.45	Final Parameter Readings for Sample.							
~~1420~~		~~See Above~~								

Comments:

See Page 2 for continued log.

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6.28.18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FWGMW-011
Sample ID:
Well Head Condition: Locked: Y ✓ N
Pooled water at head: Y N ✓ Inner Casing Clean: Y ✓ N
Exterior Seal Good: Y ✓ N Inner Casing Straight and Clear: Y ✓ N

PID Borehole Reading: N/A
LNAPL: Y N DNAPL: Y N Product Depth
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s)
QC Sample: Y / N Type:
Parameter(s) Collected: See COC

Time (3-5 min) 30 min.	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water <0.3 ft.	Temp.°C ±5°C	pH ± 0.1	Sp. Cond. (mS/cm) ± 3%	Turbidity (NTUs) <10 NTU	DO (mg/L) ±0.3 mg/L	ORP (mV) ± 10mV or 10%	Comments
1454	100	15.95	3.00	12.4	6.92	334.1	36.6	0.60	-108.1	
1459	100	16.45	3.00	12.3	6.94	336.8	32.4	0.58	-110.5	
1504	100	16.95	3.01	12.2	6.94	338.4	28.2	0.58	-110.7	
1509	100	17.45	3.00	12.1	6.95	340.2	24.2	0.57	-111.9	
1514	100	17.95	3.00	12.2	6.95	339.7	23.7	0.57	-112.0	
1519	100	18.45	2.98	12.0	6.96	340.9	23.4	0.57	-42.7	
1524	100	18.95	3.00	12.4	6.95	338.7	22.4	0.56	-42.2	
1529	100	19.45	3.00	12.6	6.95	338.7	18.8	0.56	-112.8	
Final Parameter Readings for Sample.										
1529		See Above								

Comments:

Continued from Page 1.

LOW FLOW WELL PURGING AND FIELD WATER QUALITY MEASUREMENT FORM

Date: 6.26.18
Project Name: Camp Ravenna
Site Name: Camp Ravenna
Location ID: FWGMW-022
Sample ID: FWGMW-022-062618-GW
Well Head Condition: Locked: Y X N__
Pooled water at head: Y__ N X Inner Casing Clean: Y X N__
Exterior Seal Good: Y X N__ Inner Casing Straight and Clear: Y X N__

PID Borehole Reading: N/A
LNAPL: Y__ N ✓ DNAPL: Y__ N ✓ Product Depth ——
Purge Style: Micro-purge with dedicated bladder pump
Mid Screen Depth (ft btoc): see installation logs
Pump Intake (ft btoc) see installation logs
Sampler(s) SC/JC
QC Sample: Y / (N) Type:
Parameter(s) Collected: See COC

Time (3-5 min)	Purge Rate (100 – 500 mL/min)	Total Purge Vol. (L)	Depth to Water	Temp.°C	pH	Sp. Cond. (mS/cm)	Turbidity (NTUs)	DO (mg/L)	ORP (mV)	Comments
30 min.			<0.3 ft.	±5°C	± 0.1	± 3%	<10 NTU	±0.3 mg/L	± 10mV or 10%	
14:10			115.11							
1415	100	0.5	115.17	14.0	7.39	700	2.2	9.74	166.9	
1420	100	1.0	115.20	13.8	7.16	701	9.4	4.85	12.4	
1425	100	1.5	115.17	13.7	7.12	698	30.3	2.97	2.7	
1430	100	2.0	115.18	13.6	7.12	696	29.6	2.59	-5.0	
1435	100	2.5	~~120~~ 115.20	13.7	7.12	693	30.6	2.34	-14.3	
1440	100	3.0	115.21	13.7	7.11	701	22.9	1.79	-22.5	
1445	100	3.5	115.21	13.6	7.12	700	9.7	1.62	-27.5	
1448	100	3.8	115.20	13.3	7.11	700	9.8	1.59	-29.1	
Final Parameter Readings for Sample.										
1448			115.20	13.3	7.11	700	9.8	1.59	-29.1	

Comments:

Cardno

CONTAINER LOG

Container No. (1) #1-062018

Page 1 of 1

Satellite Accumulation Area ☐ Generator Accumulation Area ☐

Date (2)	Material Name (3)	Quantity Added (4)	Cumulative Quantity (5)	Person Adding Material (6)
6/20/18	Purge water	10 gal	10 gal	dep
6/21/18	purge water	15 gal	25 gal	dep
6/25/18	purge wate	15 gal	40 gal	dep
6/26/18	purgewater	10 gal	50 gal	dep
6/27/18	purge water	5 gal	55 gal	dep
				dep

(When 55 gals total reached, must move from SAA within 3 calendar days.)
Date Container Transferred to Generator Accumulation Area 6-20-18

Materials shipped offsite date: 7-20-18

(1) Container ID Number (e.g., FC-FMS#1-2)

(2) Date when waste was added to container

(3) Name of waste added (e.g., Diesel Fuel)

(4) For items such as filters, note the number of items. For liquids, note the number of gallons.

(5) The total quantity of items of number of gallons currently in the container.

(6) The name of the person adding the waste.

Cardno

CONTAINER LOG

Container No. (1) Drum-2-062518 **Page** 1 **of** 1

Satellite Accumulation Area ☐ **Generator Accumulation Area** ☐

Date (2)	Material Name (3)	Quantity Added (4)	Cumulative Quantity (5)	Person Adding Material (6)
6-25-18	purge water	10 gals	10 gals	dep
6-26-18	purge water	30 gals	40 gals	dep
6-27-18	purge water	15 gals	55 gals	dep
				dep

(When 55 gals total reached, must move from SAA within 3 calendar days.)
Date Container Transferred to Generator Accumulation Area 6-25-18

Materials shipped offsite date: 7-20-18

(1) Container ID Number (e.g., FC-FMS#1-2)

(2) Date when waste was added to container

(3) Name of waste added (e.g., Diesel Fuel)

(4) For items such as filters, note the number of items. For liquids, note the number of gallons.

(5) The total quantity of items of number of gallons currently in the container.

(6) The name of the person adding the waste.

Cardno

CONTAINER LOG

Container No. (1) Drum-3-062718 Page 1 of 1

Satellite Accumulation Area ☐ Generator Accumulation Area ☐

Date (2)	Material Name (3)	Quantity Added (4)	Cumulative Quantity (5)	Person Adding Material (6)
6-27-18	purge water	20 gal	20 gal	dep
6-28-18	purge water	35 gal	55 gal	dep
				dep

(When 55 gals total reached, must move from SAA within 3 calendar days.)
Date Container Transferred to Generator Accumulation Area 6-27-18

Materials shipped offsite date: 7-20-18

(1) Container ID Number (e.g., FC-FMS#1-2)

(2) Date when waste was added to container

(3) Name of waste added (e.g., Diesel Fuel)

(4) For items such as filters, note the number of items. For liquids, note the number of gallons.

(5) The total quantity of items of number of gallons currently in the container.

(6) The name of the person adding the waste.

Cardno

CONTAINER LOG

Container No. (1) Drum-4-062818 Page 1 of 1

Satellite Accumulation Area ☐ Generator Accumulation Area ☐

Date (2)	Material Name (3)	Quantity Added (4)	Cumulative Quantity (5)	Person Adding Material (6)
6-28-18	purge water	10 gals	10 gals	dep
6-29-18	composition of IDW sample	5 gals	15 gals	dep
				dep

(When 55 gals total reached, must move from SAA within 3 calendar days.)
Date Container Transferred to Generator Accumulation Area 6-29-18

Materials shipped offsite date: 7-20-18

(1) Container ID Number (e.g., FC-FMS#1-2)

(2) Date when waste was added to container

(3) Name of waste added (e.g., Diesel Fuel)

(4) For items such as filters, note the number of items. For liquids, note the number of gallons.

(5) The total quantity of items of number of gallons currently in the container.

(6) The name of the person adding the waste.

Daily Report

Project Name:	Remedial Investigation Work Plan for RVAAP-66 Facility-Wide Groundwater Sampling
Project Location:	Ravenna Army National Guard Base
Project Contract:	Contract Number W9133L-14-D-0008
Prepared By:	Danyelle Phillips (Cardno)
Prepared For:	TEC Weston JV
Work Tasks Conducted:	Receive and organize sample equipment and bottles. Prepare for groundwater sampling activities
Conducted By:	Danyelle Phillips (Cardno) & Katie Bryant (HydroGeo Environmental)
Weather:	Clear 60-80 deg. F
Date of Activity:	Tuesday, June 19 2017
Field Activity Summary:	Conducted Tailgate Health and Safety Meeting, review of FSP, Discussion of FSP and notetaking, reporting in, returning to the building by 1600
	Talked with Kevin Sedlack about St Rt 5 wells. Best approach is to park on the north side completely off the road.
	Organized contractor building.
	Received rental equipment and sample bottles. The lab did not have preprinted labels.
	Reconnaissance for St. Rt. 5 wells. Found all seven wells to be sampled.

Deviation From Plan: None

Other Comments:

Completed By:
Checked By:

Daily Report

Project Name:	Remedial Investigation Work Plan for RVAAP-66 Facility-Wide Groundwater Sampling
Project Location:	Ravenna Army National Guard Base
Project Contract:	Contract Number W9133L-14-D-0008
Prepared By:	Danyelle Phillips (Cardno)
Prepared For:	TEC Weston JV
Work Tasks Conducted:	Receive and organize bottles. Groundwater sampling
Conducted By:	Danyelle Phillips (Cardno) & Katie Bryant (HydroGeo Environmental)
Weather:	Cloudy 70 F
Date of Activity:	Wednesday June 20 2018
Field Activity Summary:	Conducted Tailgate Health and Safety Meeting, review of FSP, Discussion of FSP and notetaking, reporting in, returning to the building by 1800, and IDW management. Received remaining bottles from lab and completed bottle organization. Sampled monitoring wells - see COC for specific wells Drive samples to TestAmerica Labs in Canton, OH (Danyelle Phillips & Katie Bryant)

Deviation From Plan: None

Other Comments:

Completed By:
Checked By:

Daily Report

Project Name:	Remedial Investigation Work Plan for RVAAP-66 Facility-Wide Groundwater Sampling
Project Location:	Ravenna Army National Guard Base
Project Contract:	Contract Number W9133L-14-D-0008
Prepared By:	Danyelle Phillips (Cardno)
Prepared For:	TEC Weston JV
Work Tasks Conducted:	Groundwater sampling
Conducted By:	Danyelle Phillips (Cardno) & Katie Bryant (HydroGeo Environmental)
Weather:	Clear 70-80 F
Date of Activity:	Thursday, June 21 2018
Field Activity Summary:	Conducted Tailgate Health and Safety Meeting, review of FSP, Discussion of FSP and notetaking, reporting in, returning to the building by 1800, and IDW management. Calibrated water quality meters. Sampled offsite monitoring wells & onsite monitoring wells- see COC for specific wells May have missed analytes for SCLmw-001 & -002 from 20 June 2018. Needs to be QC'ed Drive samples to TestAmerica Labs in Canton, OH (Danyelle Phillips & Katie Bryant)

Deviation From Plan: None

Other Comments:

Completed By:
Checked By:

Daily Report

Project Name:	Remedial Investigation Work Plan for RVAAP-66 Facility-Wide Groundwater Sampling
Project Location:	Ravenna Army National Guard Base
Project Contract:	Contract Number W9133L-14-D-0008
Prepared By:	Danyelle Phillips (Cardno)
Prepared For:	TEC Weston JV
Work Tasks Conducted:	Groundwater sampling
Conducted By:	Danyelle Phillips, Jessica Cain, Caitlin Jafolla, Aja Reyes, Kate Ferguson (Cardno); Scott Carmichael (Walter Environmental); Katie Bryant (HydrogGeo Environmental)
Weather:	Clear, warm, 60-75° F
Date of Activity:	Monday, June 25 2018
Field Activity Summary:	Conducted Tailgate Health and Safety Meeting, review of FSP, Discussion of FSP and notetaking, reporting in, returning to the building by 1600, and IDW management. Kevin stopped by the contractor building to see the teams off and discuss IDW. He offered to complete the weekly IDW inspections for us in order to save some one the trip to Ravenna. TestAmerica courier took samples to the lab at 1400 All teams back at the contractor building at 1630. Range Control wants us to be back by 1600 since they leave at 1630. Danyelle Phillips (Cardno) drove samples to the lab.

Deviation From Plan: None

Other Comments:

Completed By:

Checked By:

Daily Report

Project Name:	Remedial Investigation Work Plan for RVAAP-66 Facility-Wide Groundwater Sampling
Project Location:	Ravenna Army National Guard Base
Project Contract:	Contract Number W9133L-14-D-0008
Prepared By:	Danyelle Phillips (Cardno)
Prepared For:	TEC Weston JV
Work Tasks Conducted:	Groundwater sampling
Conducted By:	Danyelle Phillips, Jessica Cain, Caitlin Jafolla, Aja Reyes, Kate Ferguson (Cardno); Scott Carmichael (Walter Environmental); Katie Bryant (HydrogGeo Environmental)
Weather:	Clear, 50-75° F, hot, thunderstorms in the evening
Date of Activity:	Tuesday, June 26 2018
Field Activity Summary:	Conducted Tailgate Health and Safety Meeting,review of FSP, Discussion of FSP and notetaking, reporting in, returning to the building by 1600, and IDW management. Calibrated water quality meters. Sampled monitoring wells - see COC for specific wells Kate Ferguson had signs of heat exhaustion. Danyelle Phillips called Core Health to ensure she was okay and that the proper precautions were taken. Danyelle Phillips texted Kevin Sedlak when everyone was offsite. One team was late (1645) and Range Control talked to us. All teams will finish sampling at 1530 to ensure they are offsite at 1630. Drive samples to TestAmerica Labs in Canton, OH (Danyelle Phillips only)

Deviation From Plan: None

Other Comments:

Completed By:

Checked By:

Daily Report

Project Name:	Remedial Investigation Work Plan for RVAAP-66 Facility-Wide Groundwater Sampling
Project Location:	Ravenna Army National Guard Base
Project Contract:	Contract Number W9133L-14-D-0008
Prepared By:	Danyelle Phillips (Cardno)
Prepared For:	TEC Weston JV
Work Tasks Conducted:	Groundwater sampling
Conducted By:	Danyelle Phillips, Jessica Cain, Caitlin Jafolla, Aja Reyes, Kate Ferguson (Cardno); Scott Carmichael (Walter Environmental); Katie Bryant (HydrogGeo Environmental)
Weather:	Rain, 70-75° F, heavy rain in the evening
Date of Activity:	Wednesday, June 27 2018
Field Activity Summary:	Conducted Tailgate Health and Safety Meeting - discussion of when to call Core Health, review of FSP, Discussion of FSP and notetaking, reporting in, returning to the building by 1600, and IDW management. Calibrated water quality meters. Sampled monitoring wells - see COC for specific wells Ohio EPA onsite from 1000 to 1300, observed Jess Cain, Scott Carmichael, Kate Ferguson, and Katie Bryant. Danyelle Phillips texted Kevin Sedlak when everyone was offsite. Every one was offsite by 1630. Drive samples to TestAmerica Labs in Canton, OH (Danyelle Phillips only) Have 21 more wells to sample. Will most likely need to sample Friday, June 29 2018

Deviation From Plan: None

Other Comments:

Completed By:
Checked By:

Daily Report

Project Name:	Remedial Investigation Work Plan for RVAAP-66 Facility-Wide Groundwater Sampling
Project Location:	Ravenna Army National Guard Base
Project Contract:	Contract Number W9133L-14-D-0008
Prepared By:	Danyelle Phillips (Cardno)
Prepared For:	TEC Weston JV
Work Tasks Conducted:	Groundwater sampling
Conducted By:	Danyelle Phillips, Jessica Cain, Caitlin Jafolla, Aja Reyes, Kate Ferguson (Cardno); Scott Carmichael (Walter Environmental); Katie Bryant (HydrogGeo Environmental)
Weather:	Cloudy, 70-75° F
Date of Activity:	Thursday, June 28 2018
Field Activity Summary:	Conducted Tailgate Health and Safety Meeting - discussion of when to call Core Health, review of FSP, Discussion of FSP and notetaking, reporting in, returning to the building by 1600, and IDW management. Calibrated water quality meters. Got keys for Ramsdell Quarry from Kevin Sedlak. Sampled monitoring wells - see COC for specific wells Danyelle Phillips texted Kevin Sedlak when everyone was offsite. Every one was offsite by 1630. Drive samples to TestAmerica Labs in Canton, OH (Danyelle Phillips only) Completed all groundwater sampling.

Deviation From Plan: None

Other Comments:

Completed By:
Checked By:

Daily Report

Project Name:	Remedial Investigation Work Plan for RVAAP-66 Facility-Wide Groundwater Sampling
Project Location:	Ravenna Army National Guard Base
Project Contract:	Contract Number W9133L-14-D-0008
Prepared By:	Danyelle Phillips (Cardno)
Prepared For:	TEC Weston JV
Work Tasks Conducted:	Groundwater sampling
Conducted By:	Danyelle Phillips, Caitlin Jafolla, Aja Reyes, Katie Bryant (HydrogGeo Environmental)
Weather:	Clear, 70-80°F
Date of Activity:	Friday, June 29 2018
Field Activity Summary:	Cleaned out contractor building. Kevin observed while we were cleaning and the keys were returned to him. All field rentals were boxed up and taken to Fedex by Caitlin Jafollla (Cardno). IDW was sampled, weekly inspection completed, and IDW samples picked up by courier. All field equipment unloaded in the Charlottesville office (Danyelle Phillips - Cardno, Katie Bryant - HydroGeo Environmental). One rental MP10 was found and shipped by FedEx on Monday, July 1, 2018.

Deviation From Plan: None

Other Comments:

Completed By:

Checked By:

Daily Report

Project Name:	Remedial Investigation Work Plan for RVAAP-66 Facility-Wide Groundwater Sampling
Project Location:	Ravenna Army National Guard Base
Project Contract:	Contract Number W9133L-14-D-0008
Prepared By:	Danyelle Phillips (Cardno)
Prepared For:	TEC Weston JV
Work Tasks Conducted:	IDW Inspection
Conducted By:	Danyelle Phillips
Weather:	Clear, 70-80°F
Date of Activity:	Friday, July 6 2018
Field Activity Summary:	Weekly inspection for IDW was completed.

Deviation From Plan: None

Other Comments:

Completed By:
Checked By:

Daily Report

Project Name: Remedial Investigation Work Plan for RVAAP-66 Facility-Wide Groundwater Sampling
Project Location: Ravenna Army National Guard Base
Project Contract: Contract Number W9133L-14-D-0008
Prepared By: Danyelle Phillips (Cardno)
Prepared For: TEC Weston JV
Work Tasks Conducted: IDW Inspection
Conducted By: Danyelle Phillips
Weather: Clear, 70-80°F
Date of Activity: Friday, July 13 2018
Field Activity Summary: Weekly inspection for IDW was completed.

Deviation From Plan: Scheduled IDW pick-up, but was unable to coordinate with Katie Tait.

Other Comments:

Completed By:
Checked By:

Daily Report

Project Name:	Remedial Investigation Work Plan for RVAAP-66 Facility-Wide Groundwater Sampling
Project Location:	Ravenna Army National Guard Base
Project Contract:	Contract Number W9133L-14-D-0008
Prepared By:	Danyelle Phillips (Cardno)
Prepared For:	TEC Weston JV
Work Tasks Conducted:	IDW Inspection
Conducted By:	Danyelle Phillips
Weather:	Clear, 70-80°F
Date of Activity:	Friday, July 20 2018
Field Activity Summary:	Weekly inspection for IDW and IDW Pick-up

Deviation From Plan: None

Other Comments:

Completed By:
Checked By:






FILE




2 FT .1 .2
3B PU


USACE
USACE
THIS CONTAINER ON HOLD
PENDING ANALYSIS
DO NOT TAMPER WITH CONTAINER
AUTHORIZED PERSONNEL ONLY
PRUDENT
CAUTION
SURFACE MAY BE SLIPPERY
KEEP CLEAN AND DRY

USACE USACE

Drum ID: Drum-1-062018

THIS CONTAINER ON HOLD

Cardno **PENDING ANALYSIS** Cardno

CONTENTS purge water from wells

Drum ID: Drum-1-062018

generation date: 06-20-18 fill date: 6-27-18

ORIGIN OF MATERIALS Monitoring Wells

ADDRESS OHARNG 8451 State Routes Ravenna, OH 44261

CONTACT OHARNG POC: K. Tait 614-336-6136

Cardno POC: D. Phillips 434-906-2085

DO NOT TAMPER WITH CONTAINER

AUTHORIZED PERSONNEL ONLY

BRADY BRADYID.COM

Contract #: W9133L-14-D-008 Task order: 0003

Drum ID: Drum-1-062018

THIS CONTAINER ON HOLD

Cardno **PENDING ANALYSIS** Cardno

CONTENTS purge water from wells

Drum ID: Drum-1-062018

generation date: 06-20-18 Fill date: 6-27-18

ORIGIN OF MATERIALS Monitoring Wells

ADDRESS OHARNG 8451 State Routes Ravenna, OH 44261

CONTACT OHARNG POC: K. Tait 614-336-6136

Cardno POC: D. Phillips 434-906-2085

DO NOT TAMPER WITH CONTAINER
AUTHORIZED PERSONNEL ONLY

BRADY BRADYID.COM

Contract #: W9133L-14-D-008 Task order: 0003

USACE

DRUM FUNNEL
MODEL NO. 1660

Drum ID: Drum-2-062518

THIS CONTAINER ON HOLD

Cardno **PENDING ANALYSIS** Cardno

CONTENTS purge water from wells
generation date: 6-25-18
Fill date: 6-27-18 Drum ID: Drum-2-062518
ORIGIN OF MATERIALS Monitoring wells
ADDRESS OHARNG ~~[illegible]~~ 9451 State Route 5, Ravenna OH 44266
CONTACT OHARNG POC: K. Tait 614-336-6736
Cardno POC: D. Phillips 434-906-2095

DO NOT TAMPER WITH CONTAINER
AUTHORIZED PERSONNEL ONLY

contract #: W9133L-14-D-0008

BRADY BRADYID.COM

Task Order: 0003

Drum ID: Drum-2-062518

THIS CONTAINER ON HOLD

Cardno **PENDING ANALYSIS** Cardno

CONTENTS purge water from wells

generation date: 6-25-18

Fill date: 6-27-18 Drum ID: Drum-2-062518

ORIGIN OF MATERIALS Monitoring wells

ADDRESS OHARNG ~~[illegible]~~ 8451 State Route 5 Ravenna OH 44261

CONTACT OHARNG POC: K. Tait 614-336-6[illegible]

Cardno POC: D. Phillips 434-906-2085

DO NOT TAMPER WITH CONTAINER
AUTHORIZED PERSONNEL ONLY

BRADY BRADYID.COM

contract #: W9133L-14-D-0008

Task Order: 0003

Drum ID: Drum-3-062718

THIS CONTAINER ON HOLD

Cardno PENDING ANALYSIS Cardno

CONTENTS purge water from wells

generation date: 6/27/18

fill date: 6/28/18

ORIGIN OF MATERIALS OHARNG Camp Ravenna

ADDRESS 8451 State Route S Ravenna, OH

CONTACT OHARNG POC: K. Tait 614-336-6138 44266

Cardno POC: D. Phillips 434-906-2085

DO NOT TAMPER WITH CONTAINER
AUTHORIZED PERSONNEL ONLY

BRADY BRADYID.COM

contract # W91336-14-D-008 task order: 0003

Drum ID: Drum-3-062718

THIS CONTAINER ON HOLD

Cardno **PENDING ANALYSIS** Cardno

CONTENTS purge water from wells

generation date: 6/27/18

fill date: 6/28/18

ORIGIN OF MATERIALS OHARNG Camp Ravenna

ADDRESS 8451 State Route 5 Ravenna, OH 44266

CONTACT OHARNG POC: K. Tait 614-336-6134

Cardno POC: D. Phillips 434-906-2085

DO NOT TAMPER WITH CONTAINER
AUTHORIZED PERSONNEL ONLY

BRADY BRADYID.COM

contract # W91336-14-D-008 task order: 0003

Drum ID: Drum-4-062818

THIS CONTAINER ON HOLD

Cardno **PENDING ANALYSIS** Cardno

CONTENTS purge water from wells
generation date: 6-28-18 ; 15 gals
Drum ID: Drum-4-062818

ORIGIN OF MATERIALS monitoring wells

ADDRESS 8451 State Route 5, Ravenna, OH 44266

CONTACT OHARNG POC: K. Tait 614-336-6136
Cardno POC: D. Phillips 434-906-2095

DO NOT TAMPER WITH CONTAINER
AUTHORIZED PERSONNEL ONLY

BRADY BRADYID.COM

Contract #: W9133L-14-D-0008

Task Order: 0003

Drum ID: Drum-4-062818

THIS CONTAINER ON HOLD

Cardno

PENDING ANALYSIS

Cardno

CONTENTS purge water from wells generation date: 6-28-18 ; 15 gals Drum ID: Drum-4-062818

ORIGIN OF MATERIALS monitoring wells

ADDRESS 8451 State Route 5, Ravenna, OH 44266

CONTACT OHARNG POC: K. Tait 614-336-6136 Cardno POC: D Phillips 434-906-2015

DO NOT TAMPER WITH CONTAINER
AUTHORIZED PERSONNEL ONLY

Contract #: W9133L-14-D-0008

BRADY BRADYID.COM

Task Order: 0003


USACE
USACE
Drum ID: Drum-S-062918
THIS CONTAINER ON HOLD
Cardno PENDING ANALYSIS Cardno
CONTENTS purge water from wells
generation date: 6/29/18
fill date: 6/29/18
ORIGIN OF MATERIALS OHARNG Camp Ravenna
ADDRESS 8451 State Route 5 Ravenna OH
CONTACT OHARNG POC: K Tait
Cardno POC: D. Phillips
DO NOT TAMPER WITH CONTAINER
AUTHORIZED PERSONNEL ONLY
contract # W9133L-14-D-0018 task order 0003
PRUDENT


USACE
USACE

USACE USACE

NON-HAZARDOUS WASTE

NON-HAZARDOUS WASTE

NON-HAZARDOUS WASTE

NON-HAZARDOUS WASTE

UN1A1/Y1.8/300
USA/M14358/17/02/314

CATEGORY 1 CALIBRATION STANDARDS LOG

PROJECT NAME: Kavenna **DELIVERY ORDER NO:**

INCLUSIVE DATES FOR CALIBRATION MATERIAL USAGE	INSTRUMENT DESCRIPTION	CALIBRATION MATERIAL *	Psi/BOTTLE	NIST # LOT # AND MANUFACTURER	PERSON (INITIALS)
6/21/18 Start: 0600 Finish 0828	YSI, 14L102084	pH, Water, cond. buffer		780221 / Field	dep
6/25/18 Start: 0630 Finish 0700	YSI, 15P101378	"		"	dep
6/25/18 Start: 0855 Finish 0908	YSI, 14L102084	"		"	dep
6/26/18 Start: 0600 Finish 0620	YSI, 14L102084	"		"	dep
Start: Finish					
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Figure 6-2. Calibration Standards Logs

CATEGORY 1 CALIBRATION STANDARDS LOG

PROJECT NAME: **DELIVERY ORDER NO:**

INCLUSIVE DATES FOR CALIBRATION MATERIAL USAGE	INSTRUMENT DESCRIPTION	CALIBRATION MATERIAL *	Psi/BOTTLE	NIST # LOT # AND MANUFACTURER	PERSON (INITIALS)
6/25 19:00 Start: ~~1605~~ Finish 19:15	YSI 80170 (79307)	CONDUCTIVITY		7710519 Exp 11/30/19	CNJ/ANR
Start: Finish		1409 µMho/cm @ 25C			
Start: Finish		20.4°C			
Start: Finish	CA				
Start: Finish	DO POST/Before CAL = 97.3				
Start: Finish	TURBITY CAL - MISSING 2nd STANDARD?				
Start: Finish					
Start: Finish	YSI 80170 (79307)	pH 7	BOTTLE	C214-28, EXP	
Start: Finish	YSI 80170 (79307)	pH 10	BOTTLE		
Start: Finish	YSI 80170 (79307)	pH 4	BOTTLE		
Start: Finish					
Start: Finish					
Start: Finish					
Start: 1936 Finish 1938	YSI 80170 79307	DI WATER	BOTTLE	C214-28, EXP 8-5-18	AK
Start: 1938 Finish 1942	YSI U79632X 79306	DI WATER	BOTTLE	C214-28 EXP 8-5-18	AK
Start: 1944 Finish 1946	YSI ~~80170~~ " 79306	CONDUCTIVITY	1409@25°C	7710519 EXP 11/30/19	AK
Start: 1946 Finish 1947	YSI 80170 79307	CONDUCTIVITY	1409@25°C BOTTLE	7710519 EXP 11/30/19	AK
6/26/2018 Start: 1948 Finish 1949	YSI U79632X 79306	pH 7	pH 7.0@ 25C BOTTLE	7710358 EXP 11/30/19	AK
Start: 1949 Finish 1950	YSI 80170 79307	pH 7	pH 7.0@25C BOTTLE	7710358 EXP 11/30/19	AK
Start: 1951 Finish 1952	YSI U79632X 79306	pH 10	pH 10.0@ 25C	" 7710177 EXP 10/31/19	AK
Start: 1952 Finish 1953	YSI 80170 79307	pH 10	pH 10.0@ 25°C	" 7710177 EXP 10/31/19	AK
Start: 1954 Finish 1955	YSI U79632X 79306	pH 4	pH 4.0@25°C	" 7710177 EXP 10/31/19	AK
Start 1955 Finish 1952	YSI 80170 79307	pH 4	pH 4.0@25°C	7710177 EXP 10/31/19	AK
1T58 Start: ~~1557~~ Finish 1559	YSI 80170 79307	SPRINGWTR TEST FOR TURBIDITY		GREAT VALUE WALMART	AK
Start: 1557 Finish 1558	YSI U79632X 79306	SPRINGWTR TEST FOR TURBIDITY		GREAT VALUE WALMART	AK
Start: 1559 Finish 1604	YSI 80170 79307	CONDUCTIVITY STANDARD	1409@25°C	7710519 EXP 11/30/19	AK
Start: 1604 Finish 1605	YSI U79632X 79306	CONDUCTIVITY STANDARD	1409@25°C	7710519 EXP 11/30/19	AK
6/27 Start: 1605 Finish 1607	YSI 80170 79307	pH 10	Buffer Solution	7710177 EXP 10/31/19	AK
Start: 1607 Finish 1608	YSI U79632X 79306	pH 10	Buffer solution	7710177 EXP 10/31/19	AK
Start: 1608 Finish 1609	YSI 80170 79307	pH 07	Buffer solution	7710358 EXP 11/30/19	AK
Start: 1609 Finish 1610	YSI U79632X 79306	pH 07	Buffer solution	7710358 EXP 11/30/19	AK

MANUFACTURER

FIELD ENVIRONMENTAL INSTRUMENTS

Figure 6-2. Calibration Standards Logs

CATEGORY 1 CALIBRATION STANDARDS LOG

PROJECT NAME: **DELIVERY ORDER NO:**

INCLUSIVE DATES FOR CALIBRATION MATERIAL USAGE	INSTRUMENT DESCRIPTION	CALIBRATION MATERIAL *	Psi/BOTTLE	NIST # LOT # AND MANUFACTURER	PERSON (INITIALS)
Start: 1610 Finish 1611	YSI 80170 79309	pH 4	Buffer Solution	7710177 10/31/19	
Start: 1611 Finish 1611	YSI U79632X 79306	pH 4	Buffer Solution	7710177 10/31/19	
Start: Finish					
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Figure 6-2. Calibration Standards Logs

*FEI - Field Env. Instruments
301 Brushton Ave. Suite A
Pittsburgh, PA 15221

June 25, 2018

CATEGORY 1 CALIBRATION STANDARDS LOG

PROJECT NAME: Ravenna June 2018 GW Sampling | **DELIVERY ORDER NO:**

INCLUSIVE DATES FOR CALIBRATION MATERIAL USAGE	YSI Pro DSS FEI#80167 Serial#15D101378 INSTRUMENT DESCRIPTION	CALIBRATION MATERIAL *	Psi/BOTTLE	NIST # LOT # AND MANUFACTURER	PERSON (INITIALS)	Post Cal. Readings
Start: 1655 Finish 1715	Probe ID# 16A102643	Cond. Soln. 1409 umoh/cm		G250-17 FEI*	KMB	1.409 ms/cm
Start: 1718 Finish 1724	Probe ID # 15D101130	pH 4.0 Buffer Soln		G233-01 FEI	KMB	4.02
Start: 1724 Finish 1727	↓	pH 7.0 Buffer Soln		B02219 FEI	KMB	7.01
Start: 1728 Finish 1733		pH 10.0 Buffer Soln		7803296 FEI	KMB	9.99
Start: 1740 Finish 1744	Probe ID # 17C101828	DI Water		G234-15 FEI	KMB	0.0 NTU
Start: Finish						
Start: Finish						
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Figure 6-2. Calibration Standards Logs

*FEI = Field Env. Instruments
301 Brushton Ave. Suite A
Pittsburgh, PA 15221

June 26, 2018

CATEGORY 1 CALIBRATION STANDARDS LOG

PROJECT NAME: Ravenna June 2018 GW Sampling | **DELIVERY ORDER NO:**

INCLUSIVE DATES FOR CALIBRATION MATERIAL USAGE	INSTRUMENT DESCRIPTION (YSI Pro DSS FEI# 80167 Serial# 15D101378)	CALIBRATION MATERIAL *	Psi/BOTTLE	NIST # LOT # AND MANUFACTURER	PERSON (INITIALS)	Post Cal. Readings
Start: 16 50 Finish 16 58	Probe ID# 16A102643	Cond. Std. 1409umhos/cm		G250-17 FEI *	KMB	1409 ms/cm
Start: 17 00 Finish 17 10	Probe ID# 15D101130	pH 4.0 Buffer Soln.		G233-01 FEI	KMB	4.01
Start: 17 10 Finish 17 13		pH 7.0 Buffer Soln.		7802219 FEI	KMB	7.00
Start: 17 13 Finish 1716		pH 10.0 Buffer Soln.		7803296 FEI	KMB	9.99
Start: 1720 Finish 1730	Probe ID# 17C101828	DI Water		G234-15 FEI	KMB	-0.1NTU
Start: Finish						
Start: Finish						
Start: Finish						
Start: Finish						
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Figure 6-2. Calibration Standards Logs

FEI - Field Env. Instruments
301 Brushton Ave. Suite A
Pittsburgh, PA 15221

June 27, 2018

CATEGORY 1 CALIBRATION STANDARDS LOG

PROJECT NAME: Ravenna June 2018 GW Sampling

DELIVERY ORDER NO:

INCLUSIVE DATES FOR CALIBRATION MATERIAL USAGE	INSTRUMENT DESCRIPTION (YSI Pro DSS FEI# 80167 serial# 15D101315)	CALIBRATION MATERIAL *	Psi/BOTTLE	NIST # LOT # AND MANUFACTURER	PERSON (INITIALS)
Start: 1550 Finish 1601	Probe ID# 16B102643	Cond. Soln. 1409 umoh/cm		G250-17 FEI	KMB
Start: 1602 Finish 1609	Probe ID# 15D101130	pH 4.0 Buffer Soln.		G233-01 FEI	KMB
Start: 1613 Finish 1616	↓	pH 7.0 Buffer Soln.		7802219 FEI	KMB
Start: 1617 Finish 1620		pH 10.0 Buffer Soln.		7803296 FEI	KMB
Start: 1620 Finish 1623	Probe ID# 17C101828	DI water		G23475 FEI	KMB
Start: Finish					
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Post Calibration
1.409 ms/cm
4.01
7.00
9.99
0 ONTU

Figure 6-2. Calibration Standards Logs

* FEI = Field Environmental
301 Broadway Ave
Suite 6
Pittsburgh, PA 15212

CATEGORY 1 CALIBRATION STANDARDS LOG

PROJECT NAME: **DELIVERY ORDER NO:**

INCLUSIVE DATES FOR CALIBRATION MATERIAL USAGE	INSTRUMENT DESCRIPTION	CALIBRATION MATERIAL *	Psi/BOTTLE	NIST # LOT # AND MANUFACTURER	PERSON (INITIALS)
Start: 1159 Finish 1410	YSI Pro DSS #04467	Cond. STD.	1401	C250-17 (FEI)	JC
Start: ~~6.66~~ Finish	Serial # 16H100049				
Start: 4.07 Finish 3.99		pH 4.0		C233-01 FEI	JC
Start: Finish					
Start: 7.10 Finish 7.01		pH 7.0		7302219, FEI	JC
Start: Finish					
Start: 10.04 Finish 9.99		pH 10.0		7493296, FEI	JC
Start: Finish					
Start: 8 Finish -0.1		Turbidity			JC -0.1
Start: Finish					
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Figure 6-2. Calibration Standards Logs

CATEGORY 1 CALIBRATION STANDARDS LOG

PROJECT NAME: Ravenna, 06.27.18 **DELIVERY ORDER NO:**

INCLUSIVE DATES FOR CALIBRATION MATERIAL USAGE	INSTRUMENT DESCRIPTION	CALIBRATION MATERIAL *	Psi/BOTTLE	NIST # LOT # AND MANUFACTURER	PERSON (INITIALS)
Start: 1600 Finish	YSI Pro DSS 84469	[illegible]	G234-15, FEI		JC
Start: 1.6 Finish 0.0	serial #16#10049	Turbidity			
Start: Finish					
Start: 1467 Finish 1409		Conductivity	1409 uhs/cm	G250-17, FEI	JC
Start: Finish					
Start: 4.04 Finish 4.0		pH 4		G233-01 FEI	JC
Start: Finish					
Start: 7.02 Finish 7.0		pH 7		7082219, FEI	JC
Start: Finish					
Start: 9.99 Finish 10.00		pH 10		G250-21-FEI	JC
Start: Finish					
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Figure 6-2. Calibration Standards Logs

CATEGORY 1 CALIBRATION STANDARDS LOG

PROJECT NAME:					DELIVERY ORDER NO:	
INCLUSIVE DATES FOR CALIBRATION MATERIAL USAGE		INSTRUMENT DESCRIPTION	CALIBRATION MATERIAL *	Psi/BOTTLE	NIST # LOT # AND MANUFACTURER	PERSON (INITIALS)
6/25/18 Start:	Finish	YSI Pro DSS 84470	Conductivity	1409 umho/cm	G250-17, FEI	SC
Start:	Finish	Serial #: 16H100050	pH 4.0		G233-01, FEI	SC
Start:	Finish		pH 7.0		7802219, FEI	SC
Start:	Finish		pH 10.0		7893296, FEI	SC
Start:	Finish		Turbidity 0.0		G234-15, FEI	SC
6/26/18 Start: 2145	Finish 2220	84469				
Start:	Finish	YSI Pro DSS ~~84470~~	Turbidity 0.0	0.0	G250-17 FEI	SC
Start:	Finish	Serial # 16H100049	Conductivity	1409 umho/cm	G234-15, FEI	SC
Start:	Finish		pH	4.0	G233-01, FEI	SC
Start:	Finish		pH	7.0	7802219, FEI	SC
Start:	Finish		pH	10.0	7803296, FEI	SC
Start:	Finish					
6/27/18 Start: 1554	Finish	YSI Pro DSS 84469	Turbidity	0.0	G234-15, FEI	SC
Start:	Finish	Serial #16H100049	Conductivity	1409 umho/cm	G250-17, FEI	SC
Start:	Finish		pH	4.0	G233-01, FEI	SC
Start:	Finish		pH	7.0	7802219, FEI	SC
Start:	Finish		pH	10.0	G250-21, FEI	SC
Start:	Finish					
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Post cal = 1411
Postcal = 3.98
Post cal = 7.06
Post Cal = 10.01
Post cal = 0.0

Figure 6-2. Calibration Standards Logs

076003 Ravenna Friday, July 6
Weather: cloudy 65°F
Staff: Danielle Phillips
0650: going to Environmental office to get contractor key.
0700 at environmental office
~~0750~~ 0705: got key. Kevin out of office today. Katie in at 0730 will return key when done.
0718 = at contractor building completing TDW inspection
0725 = completed inspection, took pictures, left filters and air lines for next contractor. Sent email.
0731 = back to environmental office
0741 = back at environmental office
0743 = driving back to charlottesville
1408 = dropping car off

7-6-18

Crews
Ravenna
Friday, July
Weather: clear, 70°F
Staff: Danielle Phillips
0705: going to get gas & key from
Contractor Building
0718 = at contractor building
getting key
0740 = finished IDW inspection.
Kevin let me in the contractor
building. Katie is off today
will not get a response until
Monday most likely. Kevin sa
they could do pick-up, I
need to ask Jim & Brent.
Sending email.

7-13-18

dup

[illegible] Ravenna Friday, July [illegible]

Weather = clear, 80°F

Staff = Danielle Phillips

1205 = at environmental office. Had back & forth with Enviro Serve. Sending approved driver between 1300 - 1400. Had previously had unapproved driver. Spoke with Katie on the phone.

1227 = at the contractor building. Katie Tait changed the labels for me. Main Gate said they would call to ensure that driver has approved.

1240 = inspection complete. Driver said will be here at 1330. Calling Katie to let her know

1332 = Kevin & Katie at the building

1355 = Driver offsite. Took Pice. Katie took hard copy of Ramsdell Quarry Waiver.

1402 = leaving site.

7-2018

dup

RAVENNA 076003 DL 2618

0730 STOPPED AT RANGE CONTROL FOR WINKLEPECK KEYS

0800 NTAmw-120 Start purge

0950 complete

10:05 THRU GATE TO 904 to NTAmw-003

27.

RAVENNA 076003 062718

0736 attempted to access U20mw-005 BUT IT was very overgrown and Hard to locate IN THE RAIN

ANR & CMJ YSI 79306

0930 Reset Calibration settings to default setting. Recalibrated pH 10, 7, 4 Specific Conductivity 1409@25°C Turbidity Calibrated using Store bought Spring Water Processed by Micron filtration, Ozonation, UV. Particulates suspended in DI Batt wtr Brand Great Value (Walmart)

1330 ANR & CMJ Reset YSI 79307 default settings Recalibrated turbidity using Springwater. Processed by microfiltration, ozonation & UV

1415-1430 Tried to access EBGmw131 & EBGmw-125 from the south along fenceline road No access. →

28

Rite in the Rain

wet road & risk getting stuck.
Drove $

ANR&CMJ 06/28/2018

Rite in the Rain

Ravenna June 2018 Sampling Event

Date: June 21, 2018

Personnel: KMB & DEP

Weather: Partly Cloudy & 60s in AM / mid 80s & sunny PM

PPE: Class D

0700 - Arrive at LLmw-088

0720 - Begin purging LLmw088

0810 - Begin sampling LLmw-088

0840 - Leave LLmw-088

0850 - Arrive at FWGmw-017

0915 - Begin purging FWGmw-017

1000 - Sample FWGmw-017

1040 - Leave FWGmw-017

1047 - Arrive at U3mw-246

1110 - Begin purging U3mw-246

12:35 Sample U3mw-246

1322 Leave U3mw-246

1328 Arrive at FWGmw-018 & FWGmw-020

1420 Sample FWGmw-018

1342 Begin purging FWGmw-018

1455 Leave FWGmw-018

1500-1520 Drop of equip & coolers at contractor building

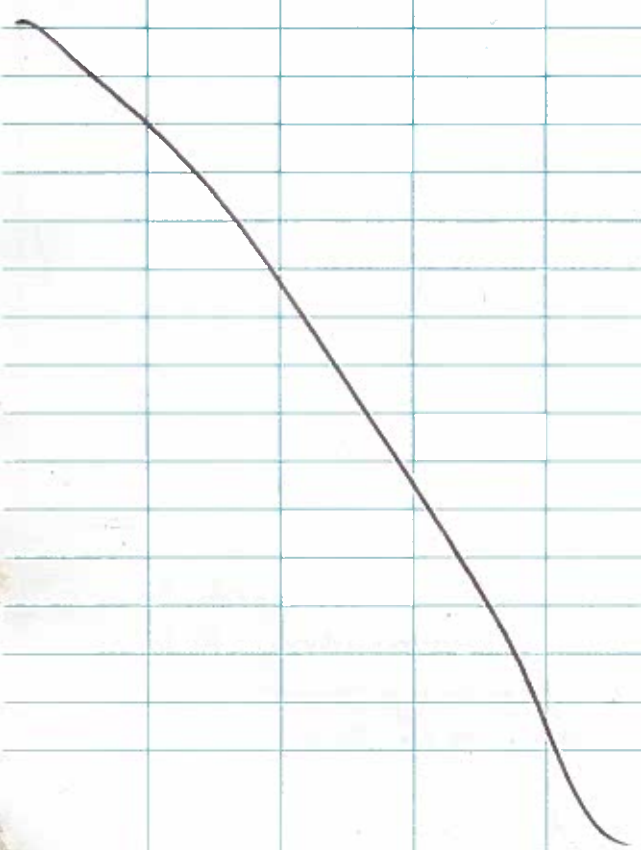
1520-1528 Talk to range control about sampling at CBlock

1522 Drive to CBlock

1530 Arrive at CBLmw-004

Rite in the Rain

1607 - Begin purging CBLmw-004
1640 - Begin sampling CBLmw-004
1730 - Leave CBLmw-004, drive to contractor building to drop off equip. & collect coolers to take to lab, notify range control we have returned
1810 - take coolers to lab



Ravenna June 2018 GW Sampling Event

Date: June 25, 2018
Personnel: KMB & KF
Weather: mid-60s to mid-70s, sunny
PPE: Class D
0720 - Arrive on site - gate check
0734 - Arrive at contractor building to get equip/coolers
0820 - Leave for FBQmw-171
0831 - Arrive at FBQmw-171
0845 - Begin purging well FBQmw-171
0918 - Sample FBQmw-171 (Duplicate)
0941 - Leave FBQmw-171
0945 - Arrive at FBQmw-172
1005 - Begin purging FBQmw-172
1040 - Sample FBQmw-172
1049 - Leave FBQmw-172
1052 - Arrive FBQmw-174
1110 - Water Level ~~15.51'~~ 17.76'
Depth to top of pump 15.51'
waiting to hear from Danyelle wether to proceed with sampling
1123 - Leave FBQmw-174
1125 - Arrive at FBQmw-175
1130 - Begin purging FBQmw-175

Rite in the Rain

1255 - Sample FBQmw175
1300 - Leave FBQmw175
1303 - Arrive at FBQmw174 - proceed w/ sampling per Danyelle
1308 - Begin purging FBQmw174
1340 - Sample FBQmw174
1418 - Leave FBQmw174
1422 - Arrive at FBQmw176
1428 - Begin purging FBQmw176
1628 - Sample FBQmw-176
1629 - Leave FBQmw-176
1634 - Arrive at contractor building, upload equip.
1643 - Leave site
1655 - Arrive at hotel & calibrate YSI
1800 - Finish calibrating YSI

Ravenna June 2018 GW Sampling Event

Date: June 26, 2018
Personnel: KMB & KF
Weather: mid 50s (AM) to mid 80s (PM), sunny
PPE: Class D
07:15 - Arrive onsite, gate check, collect equip
07:35 - Leave for LL4mw-193
0744 - Arrive at LL4mw-193
0800 - Begin purging LL4mw-193
0833 - Sample LL4mw-193
0842 - Leave LL4mw-193
0850 - Arrive at LL2mw-247
0900 - Begin purging LL2mw-247
1010 - Sample LL2mw-247 (Dup/MS/MSD)
1025 - turbidity increase during sampling
- metals were sampled before turbidity increase & appear to be clear of suspended sed.
11:45 - Leave LL2mw-247
11:52 - Arrive at LL2mw-059
1156 - Begin purging LL2mw-059
1228 - Sample LL2mw-059
1245 - Leave LL2mw-059
1255 - Arrive at LL3mw-244
1300 - Begin purging LL3mw-244
1331 - Sample LL3mw-244

Rite in the Rain

1345 - Leave LL3mw-244

1351 - Arrive at LL3mw ~~244~~ KMB 237

1400 - Begin purging LL3mw-237

1431 - Sample LL3mw-237

1435 - Leave LL3mw-237

1442 - Arrive at LL3mw-234

1447 - Begin purging LL3mw-234

1543 - Sample LL3mw-234

1546 - Leave LL3mw-234

1602 - Arrive at contractor building to unload equip.

~~1645 Arri~~

1630 - Leave site

1645 - Arrive at hotel and calibrate YSI

1730 - Finish calibrating YSI

Ravenna June 2018 GW Sampling Event

Date: June 27, 2018

Personnel: KMB & KF

Weather: mid 60s to 70s, rain, chance of t-storms

PPE: Class D

0700 - Arrive onsite, gate check, collect equip.

0715 - Leave for LL1mw-080

0727 - Arrive at LL1mw-080

0737 - Begin purging LL1mw-080

0812 - Sample LL1mw-080

0817 - Leave LL1mw

0822 - Arrive at LL1mw-081

0832 - Begin purging LL1mw-081

1035 - Sample LL1mw-081

1043 - Leave LL1mw-081

1055 - Arrive at LL1mw-084

1106 - Begin purging LL1mw-084

1138 - Sample LL1mw-084

1200 - Leave LL1mw-084

1202 - Arrive at LL1mw-083

1213 - Begin purging LL1mw-083

1325 - Sample LL1mw-083

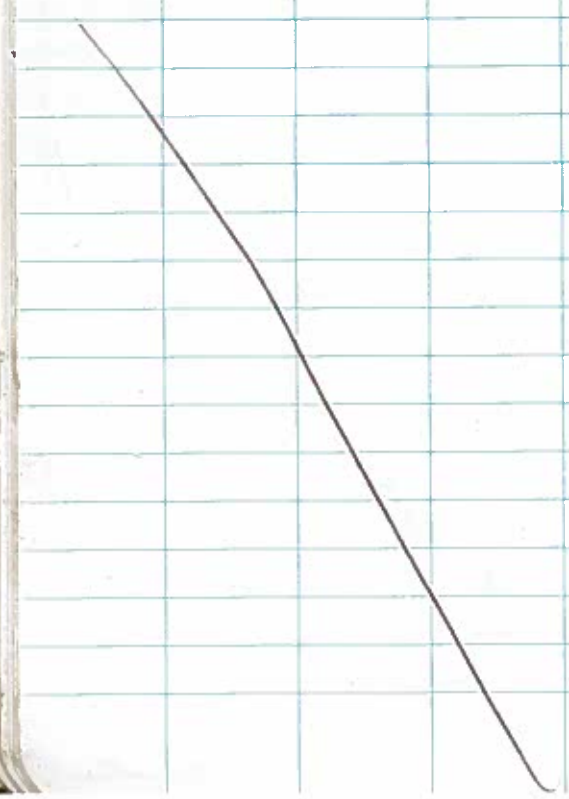
~~1330~~ - Leave LL1mw-083

1350 - Arrive at LL2mw-264

1400 - Begin purging LL2mw-264

Rite in the Rain

1435 - Sample LL2mw-264
1440 - Leave LL2mw-264
1500 - Return to contractor building to drop off equip. & coolers
1515 - Find LL10mw-005, per Danyelle request
Flag for other team to locate when sampling tomorrow
1545 - Return to contractor building & calibrate YSI
1625 - Leave site



Ravenna June 2018 GW Sampling Event

Date: June 28, 2018
Personnel: KMB & KF
Weather: cloudy, mist, mid 60s (AM) - sunny, 80s (PM)
PPE: Class D
0705 - Arrive onsite, gate check, collect equip
0715 - Leave for LL2mw-267
0730 - Arrive at LL2mw-267
0738 - Begin purging LL2mw-267
orange/red water, strong odor, orange colloidal suspended sed.
0905 - sample LL2mw-267
0930 - Leave LL2mw-267
0940 - Arrive at LL10mw-005
0945 - Begin purging LL10mw-005
1020 - Sample LL10mw-005
1035 - Leave LL10mw-005
1105 - Arrive at quarry with Danyelle, sign-in
1115 - Arrive at RQLmw-011
1121 - Begin purging RQLmw-011
1151 - Sample RQLmw-011 (MS/MSD)
1215 - Leave RQLmw-011
1220 - Arrive at RQLmw-012
1230 - Begin purging RQLmw-012
1255 - Sample RQLmw-012

Rite in the Rain

1305- Leave RQLmw-012
1307- Arrive at RQLmw-014
1312 - Begin purging RQLmw-014
1340 - Sample RQLmw-014
1345 - Leave RQLmw-014
1346- Arrive at RQLmw-013
1351 - Begin purging RQLmw-013
1414 - Sample RQLmw-013
1423- Leave RQLmw-013
1426- Arrive at RQLmw-009
1430- Begin purging RQLmw-009
1458- Sample RQLmw-009
1527 - Leave RQLmw-009, sign out of qua
1545 - Arrive at contractor building, unload c
prep coolers for shipping
1645 - Leave site

076003 RAVENNA

MONDAY, JUNE 25, 2018

STAFF AJA, ~~DANIELLE P~~ DANYELLE PHILLIPS, ~~&~~ CAITLYN JAFOLLA, JESSICA CAIN, KATIE (CARDIO) KATIE & SCOTT Mc

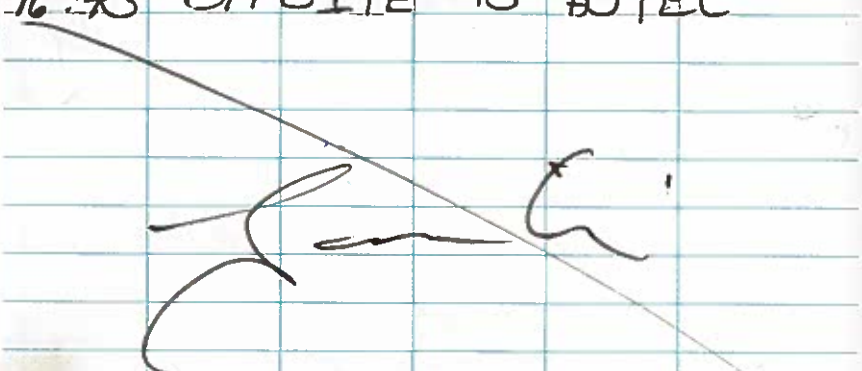
0620 HOTEL LOBBY MEETING

0730 ARRIVE AT CONTRACTOR BUILDING

0851 ON SITE

16:09 ARRIVE AT CONTRACTOR BUILDING

16:43 OFFSITE TO HOTEL



076003 RAVENNA

TUESDAY, JUNE 26, 2018

STAFF AJA, DANYLLE PHILLIPS, CAITLYN JAFOLLA, KATE, JESSICA CAIN (CARDIO) KATIE & SCOTT CalMICHAEL

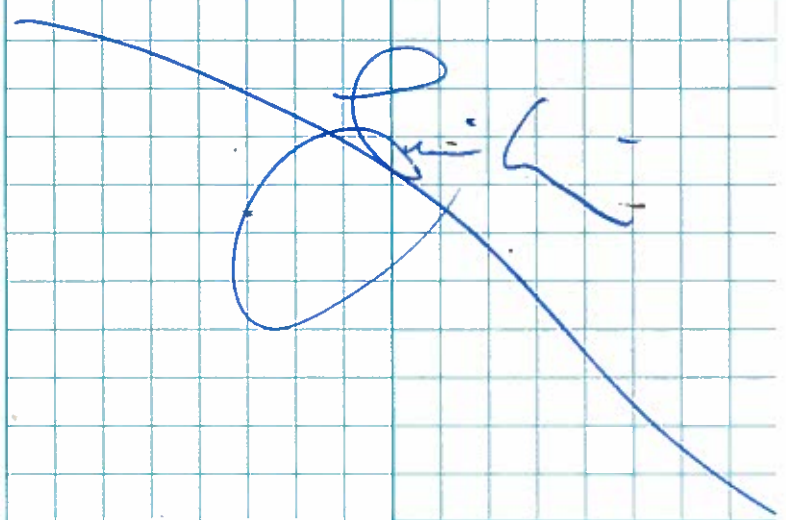
6 45 SAFETY MEETING & CALIBRATION

7:10 ARRIVE AT CONTRACTOR BUILDING

8:00 ON SITE FOR SAMPLING

1646 ARRIVE AT CONTRACTOR BUILDING

1706 OFFSITE



Rite in the Rain

076003 RAVENNA

JUNE 27, 2018, WEDNESDAY

WEATHER: 75°F, RAIN

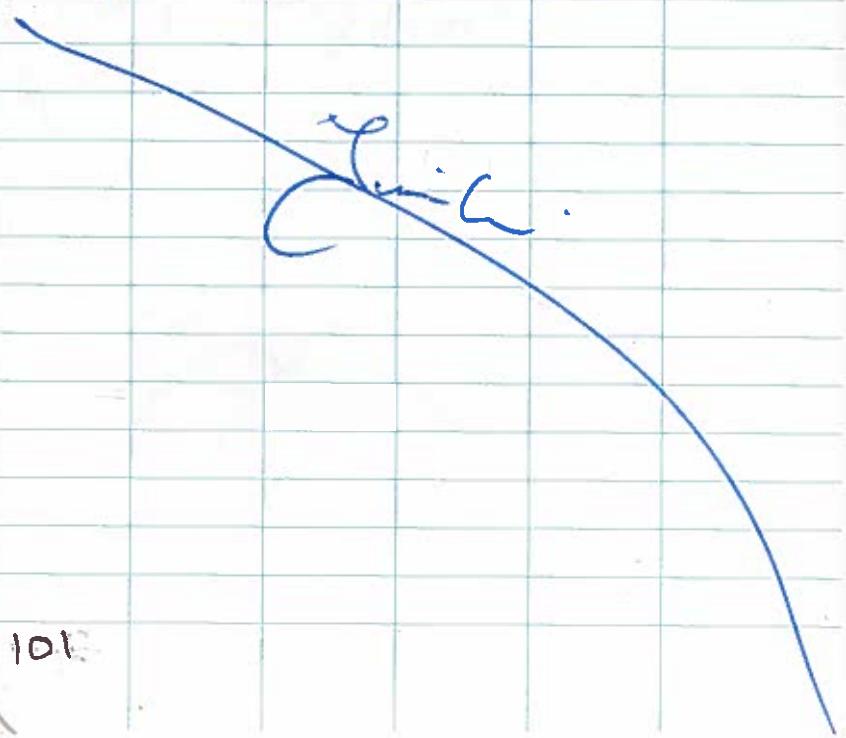
STAFF: JESSICA CAIN, CAITLYN JOFOLLA, DANYLLE PHILLIPS, KATE (CARDNO), SCOTT CALMICHAEL (Walter), & KATIE

0700 ARRIVE ON SITE CONTRACTOR BLDG.

7:20 OUT TO SAMPLE

15:25 ARRIVE ON SITE @ CONTRACTOR BUILDING

16:31 OFFSITE



076003 RAVENNA

JUNE 28, 2018: THURSDAY

WEATHER: OVERCAST

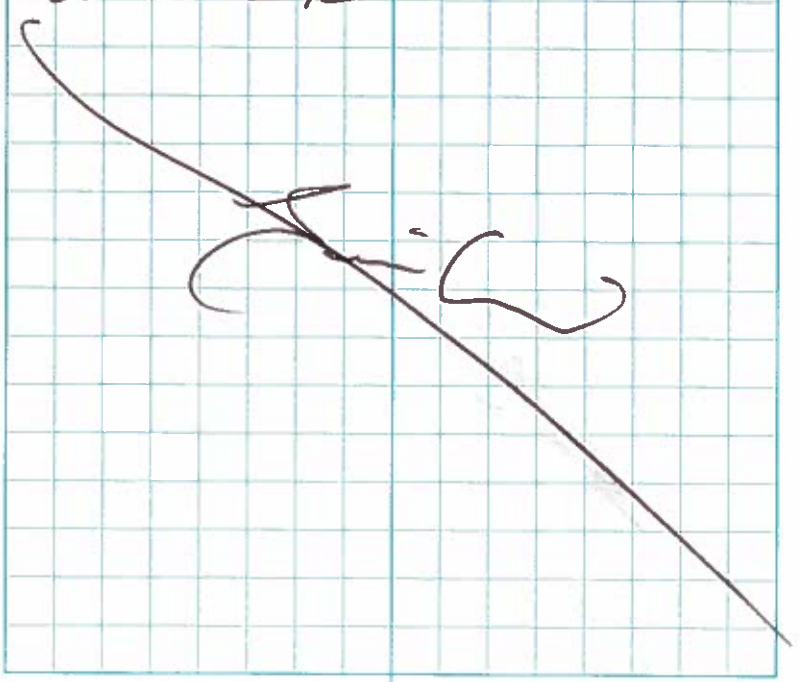
STAFF: DANYLLE PHILLIPS, CAITLYN JOFOLLA, KATE (CARDNO), ASA SCOTT #C, MICHAEL, KATIE

7:10 ARRIVE ON SITE

7:26 OFFSITE

14:10 ARRIVE AT CONTRACTOR BUILDING

1630 OFFSITE



Rite in the Rain

07600S Ravenna Tuesday, 6/19/18

0700 = at gate security is checking our ids

0714 = access from lane 4; to the east; walk in from woods

0718 = LL3mw-246 = drive across bar ditch; 17 & 24 on south side; talked w/ Kevin about off-site wells. Can pull off road to be safe

0742 = at main gate

0930 = MP 10 controller is finicky; looks like solenoid valve is cracked. It is discharging but may break later this week

1146 = received 2 batches of bottles & coolers & 1 fedex package; Lab lost pre-printed labels & will be arriving tomorrow

1147: Team 1, Day 1 = NTAmw-120

*Svocs Full, Explosives & dup Nitro-Cr(VI), Perchlorate, Nitroguanidine, Cellulose

Day 1: Team 3 = FWGmw-023-019-022/023 = VOCs, SVOCs, Cyanide, Cr, Perchlorate, Nitrog, Nitroc

022 = VOCs, SVOCs, PCBs, Cyanide, Cr, Perchlorate, Nitrog, Nitroc

019 = VOCs, SVOCs, PCBs, Cyanide, Cr, Per Nitrog

Day 3, Team 1

Day 3, Team 1 = LL2mw-272, LL1mw-089/272 = SVOCs, explosives, cyanide, Cr, Perchlorate, Nitrog + C, 089 = SVOCs, explosives, Cyanide, Cr, Perchlorate, Nitrog + C (dup mw/msd)

Day 3, Team 3 = LL4mw-200 = Cyanide

1313 = Sgt Major Finicain at Range Control; ask about staying later at 1430, Kevin went to Rock at CBlock Quarry & there is a tree down

1433 = going to talk to Range Control about staying late. Called Will and asked for more cyanide bottles

1442 = leaving Range control; might be able to stay late this week, Kevin will need to put it in writing; will not be able to stay late next week; leave today at 1630

1446 = 250 plastic, no pres; 250 ambers, no pres; 500 ambers no preservative; Terra blanks

This week

CBLmw-001: (dup) SVOCs, PCBs, explosives, Metals, CR (VI)

CBLmw-002: Alkalinity, Sulfide

CBLmw-003: Nitrate

CBLmw-004S all the same

Kevin.m.Sedlak.ctr@mail.mil sent email about staying late

FWGmw-018: VOCs, SVOCs, PCBs, Explo, Cyanide, Metals, CR, Perchlorate, Nitrog + C

FWGmw-020: 11, + Nitrate

FWGmw-021: same as FWGmw-018

FWGmw-024: VOCs, SVOCs, Explo, Metals, Cr, Perchlorate, Nitrog + C

FWGmw-017: VOCs, SVOCs, Explo, Metals, CR, Perchlorate, Nitrog + C (same as 024)

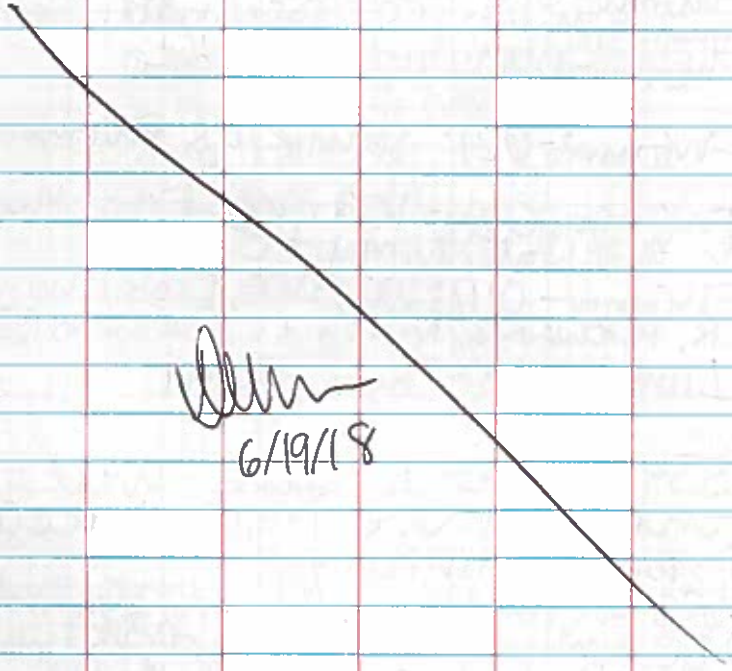
LL1mw-088: Day 3, Team 1

1554 = talked to Jim; will send one more MPIO since our 15 being finicky

1620 = we need temp blanks, cyanide, 250 ambers, 500 ambers, 250 plastic

1641 = offsite, left Range Control

FWGmw-021 (south side
1706 = FWGmw-018 & -020 ;
on southside of road (in btw
2nd & 3rd gate
1709 = FWGmw-017 & 024 ; probably
on southside ; looking for
LLmw-088 = can take gravel
road.
1721 = back at the hotel.



6/19/18

Tuesday, 6/19/18 as well.
0800 = at Kevins office getting well
keys & signing waiver
0803 = look for keys in contractor
building.
0813 = leaving Kevins office, will
~~leave~~ back on Monday for Ramsdel
Quarry briefing
1044 = call Will Cordell for pickup
call receiving for drop offs =
330-966-3121, stay open until
5:30 - 6 pm
1423 = finished organizing bottles
going to C-Block Quarry
1444 = Go to dock, use buzzer;
Tim Lavey; Will recieve
1451 = talking to Range Control
1601 = purging CBLmw-001, had
to run back to Contractor
building for tubing.
1757 = leaving CBLmw-002
1907 = leaving Lab, going to walmart
to return battery
2028 = back at hotel
2124 = things to print: updated bottle
list, Liz notes,
KO slides

0700 = heading to LL1mw-088
0730 = on base to pick up cooler & supplies.
0747 = leaving base back to -088
0840 = finished sampling LL1mw-088, & calibrated YSI
1039 = finished sampling FWGmw-017 & -024
1047 = at LL3mw-246 & FWGmw-021
1322 = leaving LL3mw-246 & FWGmw-021
1329 = at FWGmw-018 & -020
1453 = done with -018 & -020; heading to Base & back to CBlock Quarry
1522 = talked to Range Control heading to CBL
1810 = heading to the lab

6/21/18

[signature]

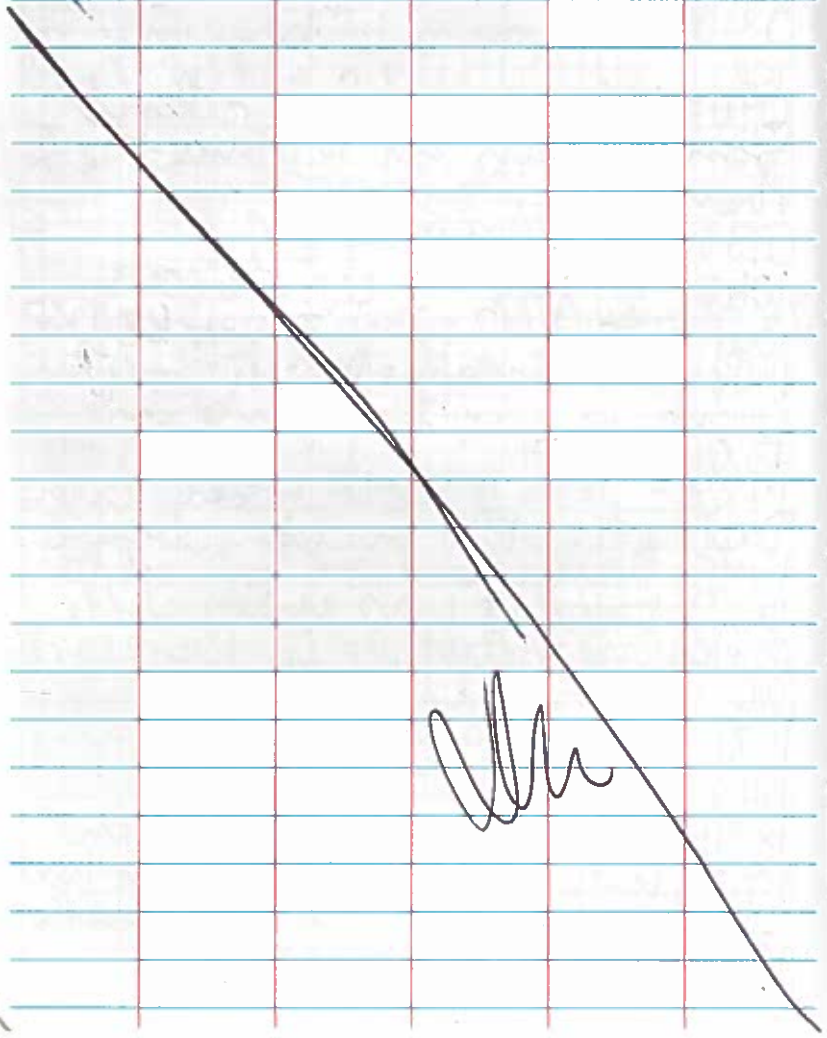
Carmichael, Jessica Cain, Danyelle Phillips
0620 = tailgate meeting, RQL briefing
0730 = at guard shack
0743 = Kevin at Contractor Building said we can have Kevin do the weekly IDW inspection
0827 = all field crews are out, going to range control
0853 = calibrating YSI & organizing contractor building
0932 = dumping trash & going to check on groups / bring ice
0935 = at FBQmw-171 → going to nw
1003 = at FBQmw-172 w/ Kate & Katie; finished FBQmw-171 & started 172
1018 = Caitlin & Aja at FWGmw-001
1039 = LL7mw-006 = Scott & Jess → Caitlin & Aja at FWGmw-001
1100 = have = LL1mw-005 from J&S
1219 = got LL7mw-006 from Scott & samples from K&K. Jess's battery died. One charger is not working

do not have a 200Pt tape for Jess & Scott's wells. Need to call Kornel
1404 = Kornel is adding a 200" tape to the order
1410 = added 5 galls to drum
1432 = off Base to get ice & gas
1540 = ~~[illegible]~~ purging NTAmw-118. Helping C & A catch up.
1555 = sampling NTAmw-062518, Caitlin got bit by a tick - will need to report it.
1805 = delivered coolers to lab in canton, crew offsite by 1645, calibrating 45I's at the hotel.
1806 = going to Walmart for field equipement.
1815 = at Walmart.
1840 = leaving Walmart

6-25-18 [signature]

0730 = teams are out for the day Jess & Scott coming back for bottles. Going to get ice. Need to update IDW log.
0810 = back on site bagging ice
0911 = going to get water level from Caitlin at NTAmw-120 & then to LL10mw-003
0938 = at LL10mw-003.
1042 = finished at LL10mw-003. Going to LL12-247 to see RB & KF.
1403 = courier came & took coolers. Going to give Jess gloves at FWGmw-119
1729 = Jess & Scott were late. Did not get to building until 1645. Range Control talked to us & said it was inexcusable. Every one must be in there cars by 1600 now.
1730 = going to lab
1817 = at the lab
1830 = calling Lynne Black about Kate Ferguson - might have heat stroke - said to call Corehealth
1833 = calling Corehealth

worried and feels better. Care Health will call her back.



0645 = at gate won't let us on until 0700 sharp.
0745 = Kevin came to 1036, OEPA will be here at 1000. Also said he is not concerned about the artesian well overflowing. Do not need to purge. Try to get one water quality reading. Might use pump or vlq something up.
0809 = updated IDW log
0836 = trying to find LL1mw-089
41° 12' 16.2" 81° 00' 40.8
0857 = YSI 14L100142 = NTU not calibrating
0859 = Caitlin & Aja could not find LL10mw-005. Will look later today
0932 = LL12mw-242 with Jess, so I going to next well.
1022 = Scott at LL12mw-187
1053 = with Kevin & OEPA at LL12mw-187, sampling now
1209 = Jess is sampling LL12mw-244
Going to pick up bottles
1226 = Caitlin at LL2mw-272, Katie at LL1mw-083

1630 = every one offsite - going to lab
1725 = delivered 3 coolers to lab of chromiums.

6-27-18

[signature]

0730: all teams out
0732: at artesian well
0901: CJ & AR found EBG wells, SC & JC done with SCFmw-004 & LLmw-087. Going offsite to get ice & Ramsdell key
0927 = got Ramsdell key from Kevin. Getting ice now
0947 = back on site
1032 = finished bagging ice. Going to scott & Jess. Might need to filter
1112 = in RQL w/ Kate Ferguson & Katie Bryant.
1227 = Katie & Kate finished RQLmw 011 & I gave them the coolers for RQLmw-007
1410 = courier took out 4 coolers of chromium. Jess forgot to sample for SVOCs & LLmw-064 will try to resample
1411 = going back to RQL.
1712 = all teams offsite. heading to lab.
1801 = leaving the lab.

6-28-18 [signature]

076003 Ravenna Friday, 6-29-18
Weather: Clear, 70°F
Staff = AR, CJ, KB, DP
0730 = onsite, organizing contrac
building
0800 = took IDW sample, lab
coming at 1000.
0930 = finished organizing.
took IDW inspections &
took pictures
0935 = took pictures of contracte
buildings. Caitlin is going to
wait for lab & take rental
to Fedex
0952 = Kevin observed us while w
cleaned the contractor buildin
1004 = courier came for IDW.
offsite
1005 = Kevin satisfied w/ contract
building. Driving home
1500 = back in Charlottesvill
1800 = left rental car compan
Realized needed to return one
MPIO.

6-29-18

RVAAP-01 Ramsdell Quarry Landfill (RQL) – Land Use Control (LUC) Brief for Contractors/Personnel

The Army National Guard (ARNG)/Ohio Army National Guard (OHARNG) are required to conduct Long Term Monitoring (LTM)/LUC monitoring at RVAAP-01 RQL at Camp Ravenna/former Ravenna Army Ammunition Plant (RVAAP). LUCs include any type of physical, legal, or administrative mechanisms that restrict use of or limit access to real property to prevent or reduce risks to human health and the environment. Established LUCs are set forth in the *Final Remedial Design for Soil and Dry Sediment at the RVAAP-01 Ramsdell Quarry Landfill*, dated 9 April 2014, and formalized in Appendix A-2 of the Property Management Plan (PMP).

The RQL Area of Concern (AOC) consists of approximately 14 acres and was initially a stone quarry that operated until 1941. During operations, the quarry was excavated 30 to 40 feet below existing grade. The excavated sandstone and quartzite pebble conglomerate was used for road and construction ballast. From 1946 to the 1950s, the bottom of the quarry was used to burn explosives from Load Line 1. Between 1941 and 1989, the western and southern sections of the abandoned quarry were used for landfill operations. No information is available regarding landfill disposal activities from 1941 to 1976, and no information is available on other activities at the quarry from the 1950s to 1976. Only nonhazardous solid waste was deposited in RQL from 1976 until it was closed in 1989. In 1978, a portion of the abandoned quarry was permitted as a sanitary landfill by the State of Ohio. The sanitary landfill was closed in 1990 under State of Ohio solid waste regulations. A clay cap was placed on the former permitted landfill area covering approximately four (4) acres of the AOC. RQL is to be managed as Restricted Access due to residual asbestos and contamination and the closed landfill at the AOC.

The following LUCs have been developed for RQL considering specific parameters established for Restricted Access and must be adhered to:

- All activities must be in compliance with established digging restrictions and established exposure limits (Security Guard/Maintenance Worker - one (1) hour/day for 250 days/year for 25 years).
    - All digging or excavation within the quarry bottom is prohibited due to residual asbestos and contamination.
    - Digging and excavation on the landfill cap will be regulated by the post closure care plan and the State of Ohio solid waste regulations.
    - Due to not meeting the industrial/commercial standard, exposure monitoring for the full-time facility employee must be conducted to ensure and document that exposure at the AOC is not above the established exposure limit set for the Security Guard/Maintenance worker of one (1) hour/day for 250 days/year for 25 years.
- Permanent warning signs will be installed and maintained around RQL on the gates and on the chain link and high tensile wire fence at 300 feet centers to warn of the asbestos hazard in the quarry bottom. The signs will meet the requirements of OAC 3745-20-07 (B)(1)(b).
- As no soil disturbing activities are allowed within the quarry bottom, OSHA asbestos awareness training set forth in 29 CFR 1926.1101(k)(9)(vii) is not required. Any personnel entering the quarry bottom will be briefed of the asbestos hazards.
- Periodic monitoring of LUCs, in the form of site inspections, is required to be conducted by the ARNG/OHARNG to confirm that the LUCs remain effective and still meet LUC objectives for continued remedy protectiveness. Site inspections are required to be conducted on an annual basis and inspections of the solid waste landfill are conducted in accordance with State of Ohio solid waste regulations and the Ohio Environmental Protection Agency (Ohio EPA) Director's Final Findings and Orders (Ohio EPA 2004). The required annual inspection is to be submitted to the Ohio EPA for review and approval.

If a LUC violation is identified, please contact Range Control at (614)336-6041 to report.

I have been briefed and understand the requirements and LUCs/restrictions at Ramsdell Quarry Landfill. I will comply with all requirements. I will complete the access log for RQL when obtaining the key and accessing the AOC.

Printed Name	Signature	Company	Date
Danyelle Phillips		Cardno	6-25-18
Scott Carmichael		Walter Env. Group	6-25-18
Jessica Cain		Cardno	6-25-18
Kathryn Bryant		HydroGeo Environmental	6-25-18
Aja Reyes		Cardno	25 Jun 2018
Kate Ferguson		cardno	6-25-18
CAITLIN JAFFOLLA		CARDNO	6-25-18

TEC-Weston Joint Venture

TAILGATE SAFETY MEETING REPORT

A tailgate safety meeting should be held before each unique activity, for each new crew and daily thereafter.

Site Name: Ravenna 076003 **Date:** 6/19/18

Contract No.: W9133L-14-D-0008 **Delivery Order No.:** 0003

HEALTH & SAFETY PLAN REVIEW

☑ H & S objectives	☑ Site emergency procedures	☑ Chem. hazards. contaminants	☐ Physical hazards
☑ Site history	☐ Air-horn signals, if any	☑ Exposure pathways	☐ Well drilling oper.
☑ Gen. site hazard assess.	☑ Hospital location	☐ Exposure monitoring program	☐ Noise monitoring
☐ Chain of command	☑ Telephone location	☑ Acute symptoms, if distinct	☐ Heat stress
☑ Visitor policy	☑ Response to media inquiries	☑ Decontamination procedures	

FIELD ACTIVITY

Safety Topics and Suggestions

site history; bottle safety, ticks

Personal Protective Equipment (PPE)

modified level D

Emergency Information and Procedures

Shelter in contractor building

Injuries and Accidents Since Previous Meeting

—

Additional comments

—

TAILGATE SAFETY MEETING ATTENDEES		DATE	6/19/18
NAME	COMPANY		SIGNATURE
Danyelle Phillips	Cardno		
Kathryn Bryant	Hydroterra Environmental		

Meeting conducted by: Danyelle Phillips Title: Geologist

Signature: Date/Time: 6/19/18 0807

Cardno TEC WESTON

TEC-Weston Joint Venture

TEC-Weston Joint Venture

TAILGATE SAFETY MEETING REPORT

A tailgate safety meeting should be held before each unique activity, for each new crew and daily thereafter.

Site Name: Ravenna **Date:** 6/20/18

Contract No.: W9133L-14-D-0008 **Delivery Order No.:** 0003

HEALTH & SAFETY PLAN REVIEW

☑ H & S objectives	☑ Site emergency procedures	☑ Chem. hazards. contaminants	☑ Physical hazards
☑ Site history	☑ Air-horn signals, if any	☑ Exposure pathways	☑ Well drilling oper.
☑ Gen. site hazard assess.	☑ Hospital location	☑ Exposure monitoring program	☑ Noise monitoring
☑ Chain of command	☑ Telephone location	☑ Acute symptoms, if distinct	☑ Heat stress
☑ Visitor policy	☑ Response to media inquiries	☑ Decontamination procedures	

FIELD ACTIVITY

Safety Topics and Suggestions

thunderstorm safety ; ticks, slips & trips, monitoring well safety

Personal Protective Equipment (PPE)

modified level D : nitriles, safety glasses, high vis

Emergency Information and Procedures

Shelter in the nearest building, shelter in car

Injuries and Accidents Since Previous Meeting

—

Additional comments

—

TAILGATE SAFETY MEETING ATTENDEES		DATE	6/20/18
NAME	COMPANY		SIGNATURE
Danyelle Phillips	Cardno		
Kathryn Bryant	HydroGeo Environmental		

Meeting conducted by Danyelle Phillips Title Geologist

Signature Date/Time 6/20/18 0805

TEC-Weston Joint Venture

TEC-Weston Joint Venture

TAILGATE SAFETY MEETING REPORT

A tailgate safety meeting should be held before each unique activity, for each new crew and daily thereafter.

Site Name: Ravenna **Date:** 6/21/18

Contract No.: W9133L-14-D-0008 **Delivery Order No.:** 0003

HEALTH & SAFETY PLAN REVIEW

☑ H & S objectives	☑ Site emergency procedures	☑ Chem. hazards. contaminants	☑ Physical hazards
☑ Site history	☑ Air-horn signals, if any	☑ Exposure pathways	☑ Well drilling oper.
☑ Gen. site hazard assess.	☑ Hospital location	☑ Exposure monitoring program	☑ Noise monitoring
☑ Chain of command	☑ Telephone location	☑ Acute symptoms, if distinct	☑ Heat stress
☑ Visitor policy	☑ Response to media inquiries	☑ Decontamination procedures	

FIELD ACTIVITY

Safety Topics and Suggestions

State Rt 5 safety, bugs, poison ivy

Personal Protective Equipment (PPE)

modified level D

Emergency Information and Procedures

shelter in cars, nearest building

Injuries and Accidents Since Previous Meeting

—

Additional comments

TAILGATE SAFETY MEETING ATTENDEES		DATE	6/21/18
NAME	COMPANY		SIGNATURE
Danyelle Phillips	Cardno		
Kathryn Bryant	Hydrogeo Environmental		Kathryn Bryant

Meeting conducted by Danyelle Phillips Title Geologist

Signature Date/Time 6-21-18 / 0705

6-21-18 / 0705

Cardno TEC WESTON

TEC-Weston Joint Venture

Cardno TEC WESTON
TEC-Weston Joint Venture

TAILGATE SAFETY MEETING REPORT

A tailgate safety meeting should be held before each unique activity, for each new crew and daily thereafter.

Site Name: Ravenna **Date:** 6/25/18

Contract No.: W9133L-14-D-0008 **Delivery Order No.:** 0003

HEALTH & SAFETY PLAN REVIEW

☑ H & S objectives	☑ Site emergency procedures	☑ Chem. hazards. contaminants	☑ Physical hazards
☑ Site history	☑ Air-horn signals, if any	☑ Exposure pathways	☑ Well drilling oper.
☑ Gen. site hazard assess.	☑ Hospital location	☑ Exposure monitoring program	☑ Noise monitoring
☑ Chain of command	☑ Telephone location	☑ Acute symptoms, if distinct	☑ Heat stress
☑ Visitor policy	☑ Response to media inquiries	☑ Decontamination procedures	

FIELD ACTIVITY

Safety Topics and Suggestions

Proper water, field safety, ticks

Personal Protective Equipment (PPE)

modified level D

Emergency Information and Procedures

shelter in cars

Injuries and Accidents Since Previous Meeting

Additional comments

TAILGATE SAFETY MEETING ATTENDEES		DATE	6/25/18
NAME	COMPANY		SIGNATURE
Danyelle Phillips	Cardno		[signature]
Aja Reyes	Cardno		[signature]
~~Katty Bryt~~ Kathryn Bryant	HydroGeo Environmental		Katy Bryt
CAITLIN JAFOLLA	CARDNO		[signature]
Scott Carmichael	Walter Env. Group		[signature]
Jessica Cain	Cardno		[signature]
Kate Ferguson	cardno		[signature]

Meeting conducted by Danyelle Phillips Title Geologist

Signature [signature] Date/Time 6-25-18 / 0700

Cardno TEC WESTON
TEC-Weston Joint Venture

TEC-Weston Joint Venture

TAILGATE SAFETY MEETING REPORT

A tailgate safety meeting should be held before each unique activity, for each new crew and daily thereafter.

Site Name: Ravenna **Date:** 6/26/18

Contract No.: W9133L-14-D-0008 **Delivery Order No.:** 0003

HEALTH & SAFETY PLAN REVIEW

☑ H & S objectives	☑ Site emergency procedures	☑ Chem. hazards. contaminants	☑ Physical hazards
☑ Site history	☑ Air-horn signals, if any	☑ Exposure pathways	☑ Well drilling oper.
☑ Gen. site hazard assess.	☑ Hospital location	☑ Exposure monitoring program	☑ Noise monitoring
☑ Chain of command	☑ Telephone location	☑ Acute symptoms, if distinct	☐ Heat stress
☑ Visitor policy	☑ Response to media inquiries	☑ Decontamination procedures	

FIELD ACTIVITY

Safety Topics and Suggestions

tick checks, proper hydration, trips & slips, well sampling, proper sample ID

Personal Protective Equipment (PPE)

modified level D

Emergency Information and Procedures

shelter in cars, call Range Control

Injuries and Accidents Since Previous Meeting

One tick bite - Caitlin Iaffola

Additional comments

—

TAILGATE SAFETY MEETING ATTENDEES		DATE	6-26-18
NAME	COMPANY		SIGNATURE
Danyelle Phillips	Cardno		
Scott Carmichael	Walter Env. Group		
Aja Reyes	Cardno		
Kathryn Bryant	HydroGeo Environmental		
CAITLIN JAFOLLA	CARDNO		
Kate Ferguson	Cardno		
Jessica Cain	Cardno		

Meeting conducted by Danyelle Phillips Title Geologist

Signature Date/Time 6-26-18 / 0630

Cardno TEC WESTON

TEC-Weston Joint Venture

TEC-Weston Joint Venture

TAILGATE SAFETY MEETING REPORT

A tailgate safety meeting should be held before each unique activity, for each new crew and daily thereafter.

Site Name: W9133L-14-D-0008 ↓dep **Date:** 6-27-18

Contract No.: Ravenna **Delivery Order No.:** 0003

HEALTH & SAFETY PLAN REVIEW

☑ H & S objectives	☑ Site emergency procedures	☑ Chem. hazards. contaminants	☑ Physical hazards
☑ Site history	☑ Air-horn signals, if any	☑ Exposure pathways	☑ Well drilling oper.
☑ Gen. site hazard assess.	☑ Hospital location	☑ Exposure monitoring program	☑ Noise monitoring
☑ Chain of command	☑ Telephone location	☑ Acute symptoms, if distinct	☑ Heat stress
☑ Visitor policy	☑ Response to media inquiries	☑ Decontamination procedures	

FIELD ACTIVITY

Safety Topics and Suggestions

Call Core Health for any medical issues. If emergency call Range control. Thunderstorm safety = seek shelter if Thunder & lightning are 10secs apart. Proper hydration

Personal Protective Equipment (PPE)

modified level D

Emergency Information and Procedures

shelter in cars, call Range Control

Injuries and Accidents Since Previous Meeting

called Core Health - Though Kate Ferguson had heat exhaustion. She was fine.

Additional comments

—

TAILGATE SAFETY MEETING ATTENDEES		DATE	6-27-18
NAME	COMPANY		SIGNATURE
Danyelle Phillips	Cardno		
Kathryn Bryant	HydroGeo Environmental		
Scott Carmichael	Walter Group		
Kate Ferguson	Cardno		
Aja Reyes	Cardno		
CAITLIN JAFOLLA	CARDNO		

Meeting conducted by Danyelle Phillips Title Geologist / SHSO

Signature Date/Time 6-27-18 / 0630

Cardno TEC WESTON Joint Venture

TEC-Weston Joint Venture

TAILGATE SAFETY MEETING REPORT

A tailgate safety meeting should be held before each unique activity, for each new crew and daily thereafter.

Site Name: Ravenna **Date:** 6-28-17

Contract No.: W9133L14-D-008 **Delivery Order No.:** 0003

HEALTH & SAFETY PLAN REVIEW

☑ H & S objectives	☑ Site emergency procedures	☑ Chem. hazards. contaminants	☐ Physical hazards
☑ Site history	☑ Air-horn signals, if any	☑ Exposure pathways	☐ Well drilling oper.
☑ Gen. site hazard assess.	☑ Hospital location	☐ Exposure monitoring program	☐ Noise monitoring
☑ Chain of command	☑ Telephone location	☑ Acute symptoms, if distinct	☑ Heat stress
☐ Visitor policy	☑ Response to media inquiries	☑ Decontamination procedures	

FIELD ACTIVITY

Safety Topics and Suggestions

Proper hydration - have gatorade powder in the contractor building. Driving in mud - have tow straps

Personal Protective Equipment (PPE)

modified level D

Emergency Information and Procedures

shelter in cars, Call Range Control

Injuries and Accidents Since Previous Meeting

—

Additional comments

—

TAILGATE SAFETY MEETING ATTENDEES		DATE	6-28-18
NAME	COMPANY		SIGNATURE
Danyelle Phillips	Cardno		
Kathryn Bryant	Hydrotech Environmental		
Scott Carmichael	Walter Env. Group		
Kate Ferguson	Cardno		
Aja Reyes	Cardno		
CAITLIN JAFOLLA	CARDNO		
Jessica Cain	Cardno		

Meeting conducted by Danyelle Phillips Title SHSO / Geologist

Signature Date/Time 6-28-18 / 0630

Cardno TEC WESTON Joint Venture

CAMP RAVENNA WEEKLY NON-HAZARDOUS & HAZARDOUS WASTE INSPECTION/INVENTORY SHEET

Contractor: Cardno Month: June Year: 2018 Waste Description: purge water

Container Nos. 4

	WEEK 1	WEEK 2	WEEK 3	WEEK 4
	Date: 6-29-18 Time: 0904	Date: Time:	Date: Time:	Date: Time:
Point of Contact (Name / Number)	K. Tait 614-336-6136			
Project Name:	Camp Ravenna			
Contracting Agency and POC:	Cardno-D. Phillips			
Waste Determination: Pending Analysis, Hazardous, Non-Hazardous, etc.	Pending Analysis			
*Location on installation:	Building 1036			
Date Generated:	6-20-18 to 6-28-18			
Projected date of disposal:	7-13-18			
Non-Haz, Satellite, 90 day storage area	Non-Haz			
Waste generation site:	FWG monitoring wells			
Number of Containers (size / type):	4, 55-gal drums			
Condition of Container:	good			
Containers closed, no loose lids, no loose bungs?	(yes) / no	yes / no	yes / no	yes / no
Waste labeled properly and visible (40 CFR 262.34 (c) (1):	(yes) / no	yes / no	yes / no	yes / no
Secondary containment	(yes) / no	yes / no	yes / no	yes / no
Incompatibles stored together?	yes / (no)	yes / no	yes / no	yes / no
Any spills?	yes / (no)	yes / no	yes / no	yes / no
Spill kit available?	(yes) / no	yes / no	yes / no	yes / no
Fire extinguisher present and charged?	(yes) / no	yes / no	yes / no	yes / no
Containers grounded if ignitables?	yes / no / (na)	yes / no / na	yes / no / na	yes / no / na
Emergency notification form/info present?	(yes) / no	yes / no	yes / no	yes / no
Container log binder present?	(yes) / no	yes / no	yes / no	yes / no
Signs posted if required?	yes / (no)	yes / no	yes / no	yes / no
Photo's submitted	(yes) / no	yes / no	yes / no	yes / no
Printed Name: Danyelle Phillips				
Signature:				

This form is required for Non-Hazardous and Hazardous waste including PCB and special waste.

CONTRACTORS ARE REQUIRED TO SUBMIT THIS FORM WEEKLY TO THE CAMP RAVENNA ENV OFFFICE WHEN WASTE IS STORED ON SITE.

CONTRACTORS ARE ENCOURAGED TO INCLUDE PHOTOS WITH EACH WEEKLY INSPECTION SHEET WHEN WASTE IS STORED ON SITE.

*Draw detailed map showing location of waste within the site.

CAMP RAVENNA WEEKLY NON-HAZARDOUS & HAZARDOUS WASTE INSPECTION/INVENTORY SHEET

Contractor: Cardno **Month:** June **Year:** 2018 **Waste Description:** purge water

Container Nos. 4

	WEEK 1	WEEK 2	WEEK 3	WEEK 4
	Date: 6-29-18 Time: 0904	Date: 7-6-18 Time: 0720	Date: Time:	Date: Time:
Point of Contact (Name / Number)	K. Tait 614-336-6136	K. Tait 614-336-6136		
Project Name:	Camp Ravenna	Camp Ravenna		
Contracting Agency and POC:	Cardno-D. Phillips	Cardno-D. Phillips		
Waste Determination: Pending Analysis, Hazardous, Non-Hazardous, etc.	Pending-Analysis	Pending-Analysis		
*Location on installation:	Building 1036	Building 1036		
Date Generated:	6-20-18 to 6-28-18	6-20-18 to 6-28-18		
Projected date of disposal:	7-13-18	7-13-18		
Non-Haz, Satellite, 90 day storage area	Non-Haz	Non-Haz		
Waste generation site:	FWG monitoring wells	FWG monitoring wells		
Number of Containers (size / type):	4, 55-gal drums	4, 55-gal drums		
Condition of Container:	good	good		
Containers closed, no loose lids, no loose bungs?	(yes) / no	(yes) / no	yes / no	yes / no
Waste labeled properly and visible (40 CFR 262.34 (c) (1):	(yes) / no	(yes) / no	yes / no	yes / no
Secondary containment	(yes) / no	(yes) / no	yes / no	yes / no
Incompatibles stored together?	yes / (no)	yes / (no)	yes / no	yes / no
Any spills?	yes / (no)	yes / (no)	yes / no	yes / no
Spill kit available?	(yes) / no	(yes) / no	yes / no	yes / no
Fire extinguisher present and charged?	(yes) / no	(yes) / no	yes / no	yes / no
Containers grounded if ignitables?	yes / no / (na)	yes / no / (na)	yes / no / na	yes / no / na
Emergency notification form/info present?	(yes) / no	(yes) / no	yes / no	yes / no
Container log binder present?	(yes) / no	(yes) / no	yes / no	yes / no
Signs posted if required?	yes / (no)	yes / (no)	yes / no	yes / no
Photo's submitted	(yes) / no	(yes) / no	yes / no	yes / no
Printed Name: Danyelle Phillips	Danyelle Phillips	Danyelle Phillips		
Signature:				

This form is required for Non-Hazardous and Hazardous waste including PCB and special waste.

CONTRACTORS ARE REQUIRED TO SUBMIT THIS FORM WEEKLY TO THE CAMP RAVENNA ENV OFFFICE WHEN WASTE IS STORED ON SITE.

CONTRACTORS ARE ENCOURAGED TO INCLUDE PHOTOS WITH EACH WEEKLY INSPECTION SHEET WHEN WASTE IS STORED ON SITE.

*Draw detailed map showing location of waste within the site.

CAMP RAVENNA WEEKLY NON-HAZARDOUS & HAZARDOUS WASTE INSPECTION/INVENTORY SHEET

Contractor: Cardno **Month:** June **Year:** 2018 **Waste Description:** purge water

Container Nos. 4

	WEEK 1	WEEK 2	WEEK 3	WEEK 4
	Date: 6-29-18 Time: 0904	Date: 7-6-18 Time: 0720	Date: 7-13-18 Time: 0732	Date: Time:
Point of Contact (Name / Number)	K. Tait 614-336-6136	K. Tait 614-336-6136	K. Tait 614-336-6136	
Project Name:	Camp Ravenna	Camp Ravenna	Camp Ravenna	
Contracting Agency and POC:	Cardno - D. Phillips	Cardno - D. Phillips	Cardno - D. Phillips	
Waste Determination: Pending Analysis, Hazardous, Non-Hazardous, etc.	Pending - Analysis	Pending - Analysis	Pending - Analysis	
*Location on installation:	Building 1036	Building 1036	Building 1036	
Date Generated:	6-20-18 to 6-28-18	6-20-18 to 6-28-18	6-20-18 to 6-28-18	
Projected date of disposal:	7-13-18	7-13-18	7-20-18	
Non-Haz, Satellite, 90 day storage area	Non-Haz	Non-Haz	Non-Haz	
Waste generation site:	FWG monitoring wells	FWG monitoring wells	FWG monitoring wells	
Number of Containers (size / type):	4, 55-gal drums	4, 55-gal drums	4, 55-gal drums	
Condition of Container:	good	good	good	
Containers closed, no loose lids, no loose bungs?	(yes) / no	(yes) / no	(yes) / no	yes / no
Waste labeled properly and visible (40 CFR 262.34 (c) (1):	(yes) / no	(yes) / no	(yes) / no	yes / no
Secondary containment	(yes) / no	(yes) / no	(yes) / no	yes / no
Incompatibles stored together?	yes / (no)	yes / (no)	yes / (no)	yes / no
Any spills?	yes / (no)	yes / (no)	yes / (no)	yes / no
Spill kit available?	(yes) / no	(yes) / no	(yes) / no	yes / no
Fire extinguisher present and charged?	(yes) / no	(yes) / no	(yes) / no	yes / no
Containers grounded if ignitables?	yes / no / (na)	yes / no / (na)	yes / no / (na)	yes / no / na
Emergency notification form/info present?	(yes) / no	(yes) / no	(yes) / no	yes / no
Container log binder present?	(yes) / no	(yes) / no	(yes) / no	yes / no
Signs posted if required?	yes / (no)	yes / (no)	yes / (no)	yes / no
Photo's submitted	(yes) / no	(yes) / no	(yes) / no	yes / no
Printed Name:	Danyelle Phillips	Danyelle Phillips	Danyelle Phillips	Danyelle Phillips
Signature:				

This form is required for Non-Hazardous and Hazardous waste including PCB and special waste.

CONTRACTORS ARE REQUIRED TO SUBMIT THIS FORM WEEKLY TO THE CAMP RAVENNA ENV OFFFICE WHEN WASTE IS STORED ON SITE.

CONTRACTORS ARE ENCOURAGED TO INCLUDE PHOTOS WITH EACH WEEKLY INSPECTION SHEET WHEN WASTE IS STORED ON SITE.

*Draw detailed map showing location of waste within the site.

CAMP RAVENNA WEEKLY NON-HAZARDOUS & HAZARDOUS WASTE INSPECTION/INVENTORY SHEET

Contractor: Cardno **Month:** June **Year:** 2018 **Waste Description:** purge water

Container Nos. 4

	WEEK 1	WEEK 2	WEEK 3	WEEK 4
	Date: 6-29-18 Time: 0904	Date: 7-6-18 Time: 0720	Date: 7-13-18 Time: 0732	Date: 7-20-18 Time: 1234
Point of Contact (Name / Number)	K. Tait 614-336-6136	K. Tait 614-336-6136	K Tait 614-336-6136	K. Tait 614-336-6136
Project Name:	Camp Ravenna	Camp Ravenna	Camp Ravenna	Camp Ravenna
Contracting Agency and POC:	Cardno - D. Phillips	Cardno - D. Phillips	Cardno - D. Phillips	Cardno - D. Phillips
Waste Determination: Pending Analysis, Hazardous, Non-Hazardous, etc.	Pending - Analysis	Pending - Analysis	Pending - Analysis	Non-Haz
*Location on installation:	Building 1036	Building 1036	Building 1036	Building 1036
Date Generated:	6-20-18 to 6-28-18	6-20-18 to 6-28-18	6-20-18 to 6-28-18	6-20-18 to 6-28-18
Projected date of disposal:	7-13-18	7-13-18	7-20-18	7-20-18
Non-Haz, Satellite, 90 day storage area	Non-Haz	Non-Haz	Non-Haz	Non-Haz
Waste generation site:	FWG monitoring wells	FWG monitoring wells	FWG monitoring wells	FWG monitoring well
Number of Containers (size / type):	4, 55-gal drums	4, 55-gal drums	4, 55-gal drums	4, 55-gal drums
Condition of Container:	good	good	good	good
Containers closed, no loose lids, no loose bungs?	yes / no	yes / no	yes / no	yes / no
Waste labeled properly and visible (40 CFR 262.34 (c) (1):	yes / no	yes / no	yes / no	yes / no
Secondary containment	yes / no	yes / no	yes / no	yes / no
Incompatibles stored together?	yes / no	yes / no	yes / no	yes / no
Any spills?	yes / no	yes / no	yes / no	yes / no
Spill kit available?	yes / no	yes / no	yes / no	yes / no
Fire extinguisher present and charged?	yes / no	yes / no	yes / no	yes / no
Containers grounded if ignitables?	yes / no / na	yes / no / na	yes / no / na	yes / no / na
Emergency notification form/info present?	yes / no	yes / no	yes / no	yes / no
Container log binder present?	yes / no	yes / no	yes / no	yes / no
Signs posted if required?	yes / no	yes / no	yes / no	yes / no
Photo's submitted	yes / no	yes / no	yes / no	yes / no
Printed Name:	Danyelle Phillips	Danyelle Phillips	Danyelle Phillips	Danyelle Phillips
Signature:				

This form is required for Non-Hazardous and Hazardous waste including PCB and special waste.

CONTRACTORS ARE REQUIRED TO SUBMIT THIS FORM WEEKLY TO THE CAMP RAVENNA ENV OFFFICE WHEN WASTE IS STORED ON SITE.

CONTRACTORS ARE ENCOURAGED TO INCLUDE PHOTOS WITH EACH WEEKLY INSPECTION SHEET WHEN WASTE IS STORED ON SITE.

*Draw detailed map showing location of waste within the site.

ATTACHMENT D
IDW DOCUMENTATION – JUNE 2018 SAMPLING EVENT

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FOR LEAK, FIRE OR MEDICAL EMERGENCY, CALL INFOTRAC AT 1-800-535-5053 AND REFERENCE CONTRACT #104631

BILL OF LADING MATERIAL MANIFEST

1. Generator ID Number: OH5210020736
2. Page 1 of: 1
3. Emergency Response Phone: (800) 535-5053
Document Number: 124365

4. Generator's Name and Mailing Address: FORMER RAVENNA ARMY AMMUNITION PLANT C/O CAMP RAVENNA
1438 SR 534 SW, NEWTON FALLS, OH 44444
Generator's Phone: (614) 336-6136

Generator's Site Address (if different than mailing address): FORMER RAVENNA ARMY AMMUNITION PLANT
8451 STATE RT 5, RAVENNA, OH 44266

5. Transporter 1 Company Name: ENVIROSERVE, DIV. OF SUNPRO
6. US EPA ID Number: OH0000333336
A. Transporter's Phone: (216) 642-1311

7. Transporter 2 Company Name: VALICOR ENVIRONMENTAL SERVICES
8. US EPA ID Number: OHR000200386
B. Transporter's Phone: (513) 733-4666

9. Designated Facility Name and Site Address: VALICOR (MONROE)
1045 REED ROAD, MONROE, OH 45050
10. US EPA ID Number: OHR000200386
C. Facility's Phone: (513) 733-4666

	11. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	HM	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol
a.	NON HAZARDOUS, NON D.O.T. REGULATED MATERIAL (WATER) VES-LFP-11441		4	DM	1550	P
b.						
c.						
d.						
e.						

15. Special Handling Instructions and Additional Information

ENVSRV PO#
0047317

16. GENERATOR CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national governmental regulations.

GENERATOR

Printed/Typed Name: Kathryn S. Tait
Signature: Kathryn S. Tait
Month: 07 Day: 20 Year: 18

17. Transporter 1 Acknowledgement of Receipt of Materials

TRANSPORTER

Printed/Typed Name: DAVID MEIER
Signature:
Month: 07 Day: 30 Year: 18

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name: Steven Monroe
Signature:
Month: 7 Day: 30 Year: 18

19. Discrepancy

19a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

19b. Alternate Facility (or Generator)

US EPA ID Number

Facility's Phone:

19c. Signature of Alternate Facility (or Generator)

Signature

Month Day Year

DESIGNATED FACILITY

20. Facility Owner or Operator: Certification of receipt of materials covered by this manifest except as noted in Item 19a

Printed/Typed Name: Andrew Mark
Signature:
Month: 7 Day: 30 Year: 18

ORIGINAL – RETURN TO GENERATOR

Valicor Environmental Services

☐ New
☒ Requalification

Valicor Internal Use Only
Isolation: ☐ Yes ☐ No

NAME OF WASTE STREAM	PROFILE/APPROVAL NUMBER
NON-HAZ IDW GROUNDWATER	VES-WWT-11441

☐ M-town: Water ☒ Monroe ☐ St. Louis ☐ Kansas City ☐ AL ☐ WV ☐ M-town: Oil ☐ 7900 ☐ Solidification ☐ Reuse Stream

GENERATOR SITE INFORMATION	BILLING INFORMATION
Generator Name FORMER RAVENNA ARMY AMMUNITION PLANT **C/O** CAMP RAVENNA **EPA ID#** OH5210020736	**Billing Name** EnviroServe
Contact Person KATIE TAIT **- Project Manager**	**Contact Person** Michael Samelak
Site Address 8451 STATE RT 5	**Address** 4600 Brookpark Road
City RAVENNA	**City** Cleveland
State OH	**State** Ohio
Zip 44266	**Zip** 44134
Phone (614) 336-6136	**Phone** (216) 642-1311
Fax	**Fax** (216) 408-6280
Email	**Purchase Order Required** ☐ Yes # ☐ No

DOT Shipping Name Transporter: ☐ Valicor ☐ Other
NON HAZARDOUS, NON D.O.T. REGULATED MATERIAL (WATER)

RCRA Hazardous ☐ Yes ☒ No ☐ EXEMPT
Generating Process: GROUNDWATER SAMPLING

PHYSICAL CHARACTERISTICS

Infectious or Biological Waste: ☐ Yes ☒ No
NRC Regulated Radioactivity: ☐ Yes ☒ No

Reactivity: ☒ None ☐ Water ☐ Shock ☐ Pyrophoric
☐ Cyanides ☐ Sulfides ☐ DOT Explosive

☐ Gas ☐ Aerosol ☐ Lab-Pack ☐ Other

☒ Solids 0-5 %
☐ Sludges %
☒ Free Liquids 95-100 %

LAYERS ☐ Single-Layered ☐ Bi-Layered ☐ Multi-Layered

ODOR ☒ None ☐ Mild ☐ Strong Describe:

VISCOCITY
☒ Low ☐ Medium ☐ High

FREQUNECY & SHIPPING ☒ **DRUM** ☐ **TOTE** ☐ **Bulk**
☐ ONE TIME ☐ Weekly ☒ Monthly ☐ Annually Gallons Totes/Drums 10

COLOR/APPEARANCE: CLEAR TO BROWN LIQUID

PH ☐ N/A ☐ 0-2.0 ☐ 2.1-4 ☒ 4.1-10 ☐ 10.1-12.0 ☐ >12.5 Exact:

ADDITIONAL CHARACTERISTICS

Does waste contain greater than 0ppm Polychlorinated Biphenyl's (PCB)'s	☐ Yes ☒ No
Is this PCB waste regulated by TSCA? (PCB ≥ 50 ppm or derived from a ≥ 50 ppm source)	☐ Yes ☒ No
Is this waste derived from drilling or hydraulic fracking Operations relating to the oil & gas industry?	☐ Yes ☒ No
If yes, is the material considered to be associated with UOG (unconventional Oil and Gas) Extraction wastewaters ie, brine or flowback waters?	☐ Yes ☐ No
Is waste subject to the National Emission Standards for Benzene Waste Operations? (40 CFR 61 Subpart FF)	☐ Yes ☒ No
Is Waste regulated as an ozone depleting Substance? (40CFR Part 82)	☐ Yes ☒ No
Is this waste regulated as a marine pollutant?	☐ Yes ☒ No

FLASH POINT (liquid only)
☐ <73°F ☐ 73-140°F ☐ 141-200°F ☒ > 200°F ☐ Exact

CWT CLASSIFICATION (40 CFR PART 437)
☒ **OIL SUBCATEGORY**
• Used Oil • Coolants •Oil Water Mixture •Contaminated Ground Water

☐ **METAL SUBCATEGORY**
• Waste acid and bases with or without metals
• Metal finish rinse waters and sludges
• Cleaning, rinsing, and surface preparation solutions from electroplating or phosphating operations

☐ **ORGANIC SUBCATEGORY**
• Landfill Leachate •contaminated ground water from non-petroleum source
• Solvent bearing wastes • Off-Spec organic product
• Wastewater from paint washes, adhesives, and/or epoxies.

PHYSICAL/CHEMICAL CONSTITUANTS
Attach All MSDS's, sample analysis and other information

WATER	95-100 %
SOIL/SEDIMENT	1-5 %
	%

CONSTITUENT SUBCATEGORIES
☐ Oil (> 100ppm)
☐ Metal (Cd 0.2 ppm), (Cr 8.9ppm), Cu(4.9ppm), (Ni37.5ppm)
☐ Organic (< 100ppm oil and grease, metals below limits above)

GENERATOR'S CERTIFICATION: I hereby certify that the above and attached description is complete and accurate to the best of my knowledge and ability to determine that no deliberate or willful omission of composition properties exists and that all known or suspected hazards have been disclosed. I certify that the materials tested are representative of all materials described by this profile. Also, I acknowledge that oil containing more than 1,000 ppm total halogens is presumed to be hazardous waste per 40 CFR279. However, that presumption can be rebutted by applying my knowledge of my halogen content of the used oil in light of the materials or processes used in my operations. To the best of my knowledge and belief, I certify to VALICOR that our used oils are generated from industrial usage and we do not mix hazardous waste with our oil. I understand that every time I and or another of our employees sign the non-hazardous manifest or bill of lading, we are re-certifying this rebuttal presumption. In addition, to the best of my knowledge and belief, all information on these forms is a complete and accurate representation of our waste stream(s). I will notify VALICOR in ADVANCE of changes in the waste stream(s). I will comply with all local, state, and federal regulations with regards to your waste stream(s).

Customer Signature _____ Title _____ Date _____

Valicor Approval Signature _____ Title _____ Date _____

TEC-Weston Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903

July 11, 2018

Ms. Katie Tait
OHARNG Environmental Specialist 2
Camp Ravenna Joint Military Training Center
1438 State Route 534 SW
Newton Falls, OH 44444

Reference **Contract Number: W9133L-14-D-0008**
Delivery Order: 0003

Subject: **Investigation Derived Waste (IDW) Letter Report for June 2018 Sampling Event IDW, RVAAP-66 Facility Wide Groundwater, Ravenna Army Ammunition Plant (RVAAP) Restoration Program, Camp Ravenna Joint Military Training Center, Portage and Trumbull Counties, Ohio**

Dear Ms. Tait:

TEC-Weston Joint Venture (TEC-Weston JV) completed the sampling of monitoring wells in June 2018. All work was performed in accordance with the *Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater* (TEC-Weston JV, 2016). These activities resulted in the generation of Investigation Derived Waste (IDW) consisting of recovered waters from well purging and decontamination of sampling equipment. The purpose of this letter report is to characterize and classify the IDW and request approval for off-site disposal at a licensed treatment facility. This letter report follows guidance established by the following:

1. *Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater* (RIWP) (TEC-Weston JV, 2016); and

2. *Facility-Wide Sampling and Analysis Plan for Environmental Investigations* (FWSAP) (SAIC, 2011).

The water recovered from sampling operations was containerized in four 55-gallon drums. On June 29, 2018, one composite sample was collected (IDW-062918-W) for IDW characterization parameters: Toxicity Characteristic Leaching Procedure (TCLP) volatile organic compounds (VOCs), TCLP semi-VOCs (SVOCs), TCLP metals, TCLP herbicides, TCLP pesticides, total sulfide, total cyanide, corrosivity (pH), and flashpoint. The sampling event was conducted in accordance with the requirements outlined in Section 7.0 of the RIWP and Section 8.4 of the FWSAP.

Analytical Screening of Results

Upon receipt of the laboratory results, the analytical data were reviewed to determine if the waste was potentially hazardous or nonhazardous.

The data were compared to disposal screening criteria, which are from three sources:

1. Concentration of Contaminants for Toxicity Characteristic (40 Code of Federal Regulations [CFR] 261.24), as listed in Table 8-1 of the FWSAP;
2. Table 8-2 of the FWSAP; and
3. 40 CFR 261.23 – Characteristic of Reactivity.

If analytical results do not exceed disposal criteria then the IDW is classified as “non-hazardous.” If analytical results exceed disposal criteria then the IDW is classified as “hazardous.” All analytical results were below

disposal screening criteria. Attachment 1, Table 1, shows the sample results compared to the disposal screening criteria. The laboratory analytical report is included in Attachment 2.

Conclusions and Recommendation

Based on the observed analytical results, it is recommended the IDW be classified as non-hazardous waste and be disposed of off-site at a licensed water treatment facility.

Upon ARNG/OHARNG approval of this IDW Report and proposed off-site disposal, TEC-Weston JV will proceed with the off-site disposal.

We appreciate the opportunity to work with you. If you have any questions or comments regarding this deliverable, please feel free to contact me by telephone at (512)-651-7108 or email at Brent.Ferry@WestonSolutions.com.

Sincerely,

Brent C. Ferry, PG
Environmental Restoration Project Manager, TEC-Weston Joint Venture
Direct 512-651-7108 Mobile 309-236-9235 Fax 512-651-7101
Address 5301 Southwest Parkway, Suite 450, Austin, Texas 78735
Email Brent.Ferry@WestonSolutions.com Web www.westonsolutions.com

Attachment 1: Investigation Derived Waste Screening Summary Tables
Attachment 2: Laboratory Report

Attachment 1: Investigation Derived Waste Screening Summary Tables

Table 1. Investigation Derived Waste Screening Summary Table								
Sample Name	**CAS Number**	**Analyte**	**Result**	**Qualifier**	**FWSAP IDW Disposal Standard**	**Units**	**Disposal Standard Source**	**Result Exceeds Hazardous Criteria?**
IDW-062918-W	N/A	Flashpoint	>**200**		>140	Degrees F	FWSAP (2011) Table 8-2	Non-Hazardous
IDW-062918-W	7440-38-2	Arsenic	ND		5	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	7440-39-3	Barium	0.028	J	100	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	7440-47-3	Chromium	ND		5	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	7439-92-1	Lead	ND		5	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	7782-49-2	Selenium	ND		1	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	7440-22-4	Silver	ND		5	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	7439-97-6	Mercury	ND		0.2	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	57-74-9	Chlordane (technical)	ND		0.03	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	72-20-8	Endrin	ND		0.02	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	76-44-8	Heptachlor	ND		0.008	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	1024-57-3	Heptachlor epoxide	ND		0.008	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	58-89-9	gamma-BHC (Lindane)	ND		0.4	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	72-43-5	Methoxychlor	ND		10	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	8001-35-2	Toxaphene	ND		0.5	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	94-75-7	2,4-D	ND		10	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	93-72-1	Silvex (2,4,5-TP)	ND		1	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous

Table 1. Investigation Derived Waste Screening Summary Table								
Sample Name	**CAS Number**	**Analyte**	**Result**	**Qualifier**	**FWSAP IDW Disposal Standard**	**Units**	**Disposal Standard Source**	**Result Exceeds Hazardous Criteria?**
IDW-062918-W	75-35-4	1,1-Dichloroethene	ND		0.7	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	107-06-2	1,2-Dichloroethane	ND		0.5	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	78-93-3	2-Butanone (MEK)	ND		200	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	71-43-2	Benzene	ND		0.5	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	56-23-5	Carbon tetrachloride	ND		0.5	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	108-90-7	Chlorobenzene	ND		100	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	67-66-3	Chloroform	ND		6	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	127-18-4	Tetrachloroethene	ND		0.7	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	79-01-6	Trichloroethene	ND		0.5	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	75-01-4	Vinyl chloride	ND		0.2	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	106-46-7	1,4-Dichlorobenzene	ND		7.5	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	95-95-4	2,4,5-Trichlorophenol	ND		400	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	88-06-2	2,4,6-Trichlorophenol	ND		2	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	121-14-2	2,4-Dinitrotoluene	ND		0.13	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	95-48-7	2-Methylphenol	ND		200	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	15831-10-4	3 & 4 Methylphenol	ND		200	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	118-74-1	Hexachlorobenzene	ND		0.13	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous

Table 1. Investigation Derived Waste Screening Summary Table								
Sample Name	**CAS Number**	**Analyte**	**Result**	**Qualifier**	**FWSAP IDW Disposal Standard**	**Units**	**Disposal Standard Source**	**Result Exceeds Hazardous Criteria?**
IDW-062918-W	87-68-3	Hexachlorobutadiene	ND		0.5	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	67-72-1	Hexachloroethane	ND		3	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	98-95-3	Nitrobenzene	ND		2	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	87-86-5	Pentachlorophenol	ND		100	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	110-86-1	Pyridine	ND		5	mg/L	FWSAP (2011) Table 8-1	Non-Hazardous
IDW-062918-W	57-12-5	Cyanide, Total	0.0076	JB	0.01	mg/L	FWSAP (2011) Table 8-2	Non-Hazardous
IDW-062918-W	18496-25-8	Sulfide	ND		3.0	mg/L	FWSAP (2011) Table 8-2	Non-Hazardous
IDW-062918-W	N/A	pH	**7.4**	HF	$2 \leq pH \leq 12.5$	SU	FWSAP (2011) Table 8-2	Non-Hazardous

Notes:
F – Fahrenheit
mg/L – milligrams per liter
CAS – Chemical Abstract Service Number
CFR – Code of Federal Regulations
Data Qualifier Flags:
B – Compound was found in the blank and sample
HF – Field parameter with a holding time of 15 minutes. Test performed by laboratory at client's request.
J – Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.
ND – Not detected at the reporting limit
FWSAP – Facility-Wide Sampling and Analysis Plan
IDW – Investigation Derived Waste
mg/L = milligrams per liter
N/A – Not applicable or not available
SU – Standard units
W – Water

Attachment 2: Laboratory Report

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING



ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Denver
4955 Yarrow Street
Arvada, CO 80002
Tel: (303)736-0100

TestAmerica Job ID: 280-111549-1
Client Project/Site: Ravenna, OH

For:
Cardno GS, Inc
2496 Old Ivy Road
Suite 300
Charlottesville, Virginia 22903

Attn: Mr. Peter Chapman

Authorized for release by:
7/10/2018 3:51:01 PM

Patrick McEntee, Manager of Project Management
(303)736-0107
patrick.mcentee@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Qualifiers

GC/MS Semi VOA

Qualifier	Qualifier Description
*	LCS or LCSD is outside acceptance limits.

GC Semi VOA

Qualifier	Qualifier Description
*	LCS or LCSD is outside acceptance limits.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

General Chemistry

Qualifier	Qualifier Description
HF	Field parameter with a holding time of 15 minutes. Test performed by laboratory at client's request.
B	Compound was found in the blank and sample.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 280-111549-1

Laboratory: TestAmerica Denver

Narrative

CASE NARRATIVE

Client: Cardno GS, Inc

Project: Ravenna, OH

Report Number: 280-111549-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

RECEIPT
The sample was received on 6/30/2018 9:00 AM; the sample arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 0.6º C.

TCLP VOLATILE ORGANIC COMPOUNDS (GC-MS)
Sample IDW-062918-W (280-111549-1) was analyzed for TCLP volatile organic compounds (GC-MS) in accordance with EPA SW-846 Methods 1311/8260B. The samples were leached on 07/05/2018 and analyzed on 07/06/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TCLP SEMIVOLATILE ORGANIC COMPOUNDS (GC-MS)
Sample IDW-062918-W (280-111549-1) was analyzed for TCLP semivolatile organic compounds (GC-MS) in accordance with EPA SW-846 Method 1311/8270D. The samples were leached on 07/05/2018, prepared on 07/06/2018 and analyzed on 07/09/2018.

Pyridine failed the recovery criteria low for LCS 240-334978/8-A. Refer to the QC report for details. The client was notified on July 10, 2018, and instructed the laboratory to report the data and narrate the anomaly.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TCLP ORGANOCHLORINE PESTICIDES (GC)
Sample IDW-062918-W (280-111549-1) was analyzed for TCLP Organochlorine Pesticides (GC) in accordance with EPA SW-846 Method 1311/8081B. The samples were leached on 07/05/2018, prepared on 07/06/2018 and analyzed on 07/10/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TCLP CHLORINATED HERBICIDES
Sample IDW-062918-W (280-111549-1) was analyzed for TCLP chlorinated herbicides in accordance with EPA SW-846 Methods 1311/8151A. The samples were leached on 07/05/2018, prepared on 07/06/2018 and analyzed on 07/09/2018.

TestAmerica Denver's practice for the reporting of dual column data in packages requiring forms and/or raw data is to report the surrogates from both columns, and the preferred result for any given target analyte from the analyst selected column. The preferred results for target analytes and surrogates are reported as PRIMARY on the Sample Datasheets. Analytes 2,4-DB/dinoseb co-elute on one

Job ID: 280-111549-1 (Continued)

Laboratory: TestAmerica Denver (Continued)

of the columns used for this analysis. As a result, there are no results reported for the %Difference in the concentration on the Form X.

2,4-D and Silvex (2,4,5-TP) failed the recovery criteria high for LCS 240-334985/6-A. Refer to the QC report for details. These analytes were biased high in the LCS and were not detected in the associated samples; therefore, the data have been reported.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TCLP METALS

Sample IDW-062918-W (280-111549-1) was analyzed for TCLP Metals in accordance with EPA SW-846 Method 1311/6010C. The samples were leached on 07/05/2018, prepared on 07/06/2018 and analyzed on 07/09/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TCLP MERCURY

Sample IDW-062918-W (280-111549-1) was analyzed for TCLP mercury in accordance with EPA SW-846 Methods 1311/7470A. The samples were leached on 07/05/2018, prepared on 07/06/2018 and analyzed on 07/10/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

IGNITABILITY

Sample IDW-062918-W (280-111549-1) was analyzed for ignitability in accordance with EPA SW-846 Method 1010. The samples were analyzed on 07/05/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TOTAL CYANIDE

Sample IDW-062918-W (280-111549-1) was analyzed for total cyanide in accordance with EPA SW-846 Method 9012B. The samples were prepared and analyzed on 07/09/2018.

Cyanide, Total was detected in method blank MB 240-335328/1-A at a level that was above the method detection limit but below the reporting limit. The value should be considered an estimate, and has been flagged. If the associated sample reported a result above the MDL and/or RL, the result has been flagged. Refer to the QC report for details.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

SULFIDE

Sample IDW-062918-W (280-111549-1) was analyzed for sulfide in accordance with EPA SW-846 9034. The samples were prepared and analyzed on 07/05/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

CORROSIVITY (PH)

Sample IDW-062918-W (280-111549-1) was analyzed for Corrosivity (pH) in accordance with EPA SW-846 9040C. The samples were analyzed on 07/05/2018.

No analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Detection Summary

Client: Cardno GS, Inc
Project/Site: Ravenna, OH

TestAmerica Job ID: 280-111549-1

Client Sample ID: IDW-062918-W

Lab Sample ID: 280-111549-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Barium	0.028	J	0.50	0.0013	mg/L	1		6010C	TCLP
Cadmium	0.00049	J	0.050	0.00020	mg/L	1		6010C	TCLP
Flashpoint	>200		1.00	1.00	Degrees F	1		1010A	Total/NA
Cyanide, Total	7.6	J B	10	6.0	ug/L	1		9012B	Total/NA
pH	7.4	HF	0.1	0.1	SU	1		9040C	Total/NA

This Detection Summary does not include radiochemical test results.

Method Summary

Client: Cardno GS, Inc
Project/Site: Ravenna, OH

TestAmerica Job ID: 280-111549-1

Method	Method Description	Protocol	Laboratory
8260B	Volatile Organic Compounds (GC/MS)	SW846	TAL CAN
8270D	Semivolatile Organic Compounds (GC/MS)	SW846	TAL CAN
8081B	Organochlorine Pesticides (GC)	SW846	TAL CAN
8151A	Herbicides (GC)	SW846	TAL CAN
6010C	Metals (ICP)	SW846	TAL CAN
7470A	Mercury (CVAA)	SW846	TAL CAN
1010A	Ignitability, Pensky-Martens Closed-Cup Method	SW846	TAL CAN
9012B	Cyanide, Total andor Amenable	SW846	TAL CAN
9034	Sulfide, Acid soluble and Insoluble (Titrimetric)	SW846	TAL CAN
9040C	pH	SW846	TAL CAN
1311	TCLP Extraction	SW846	TAL CAN
3010A	Preparation, Total Metals	SW846	TAL CAN
3510C	Liquid-Liquid Extraction (Separatory Funnel)	SW846	TAL CAN
3520C	Liquid-Liquid Extraction (Continuous)	SW846	TAL CAN
5030B	Purge and Trap	SW846	TAL CAN
7470A	Preparation, Mercury	SW846	TAL CAN
8151A	Extraction (Herbicides)	SW846	TAL CAN
9012B	Cyanide, Total and/or Amenable, Distillation	SW846	TAL CAN
9030B	Sulfide, Distillation (Acid Soluble and Insoluble)	SW846	TAL CAN

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL CAN = TestAmerica Canton, 4101 Shuffel Street NW, North Canton, OH 44720, TEL (330)497-9396

Sample Summary

Client: Cardno GS, Inc
Project/Site: Ravenna, OH

TestAmerica Job ID: 280-111549-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
280-111549-1	IDW-062918-W	Water	06/29/18 08:00	06/30/18 09:00

Method: 8260B - Volatile Organic Compounds (GC/MS) - TCLP

Client Sample ID: IDW-062918-W
Date Collected: 06/29/18 08:00
Date Received: 06/30/18 09:00

Lab Sample ID: 280-111549-1
Matrix: Water

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1-Dichloroethene	ND		0.025	0.00019	mg/L			07/06/18 21:50	1
1,2-Dichloroethane	ND		0.025	0.00021	mg/L			07/06/18 21:50	1
2-Butanone (MEK)	ND		0.25	0.0012	mg/L			07/06/18 21:50	1
Benzene	ND		0.025	0.00013	mg/L			07/06/18 21:50	1
Carbon tetrachloride	ND		0.025	0.00026	mg/L			07/06/18 21:50	1
Chlorobenzene	ND		0.025	0.00014	mg/L			07/06/18 21:50	1
Chloroform	ND		0.025	0.00013	mg/L			07/06/18 21:50	1
Tetrachloroethene	ND		0.025	0.00015	mg/L			07/06/18 21:50	1
Trichloroethene	ND		0.025	0.00010	mg/L			07/06/18 21:50	1
Vinyl chloride	ND		0.025	0.00020	mg/L			07/06/18 21:50	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*102*		*73 - 120*		*07/06/18 21:50*	*1*
4-Bromofluorobenzene (Surr)	*91*		*76 - 120*		*07/06/18 21:50*	*1*
Toluene-d8 (Surr)	*101*		*80 - 120*		*07/06/18 21:50*	*1*
Dibromofluoromethane (Surr)	*107*		*73 - 123*		*07/06/18 21:50*	*1*

Method: 8270D - Semivolatile Organic Compounds (GC/MS) - TCLP

Client Sample ID: IDW-062918-W
Date Collected: 06/29/18 08:00
Date Received: 06/30/18 09:00

Lab Sample ID: 280-111549-1
Matrix: Water

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,4-Dichlorobenzene	ND		0.0040	0.00033	mg/L		07/06/18 10:14	07/09/18 17:41	1
2,4,5-Trichlorophenol	ND		0.0040	0.0020	mg/L		07/06/18 10:14	07/09/18 17:41	1
2,4,6-Trichlorophenol	ND		0.0040	0.0018	mg/L		07/06/18 10:14	07/09/18 17:41	1
2,4-Dinitrotoluene	ND		0.0040	0.0021	mg/L		07/06/18 10:14	07/09/18 17:41	1
2-Methylphenol	ND		0.0040	0.00021	mg/L		07/06/18 10:14	07/09/18 17:41	1
3 & 4 Methylphenol	ND		0.0040	0.00019	mg/L		07/06/18 10:14	07/09/18 17:41	1
Hexachlorobenzene	ND		0.00080	0.00016	mg/L		07/06/18 10:14	07/09/18 17:41	1
Hexachlorobutadiene	ND		0.0040	0.00054	mg/L		07/06/18 10:14	07/09/18 17:41	1
Hexachloroethane	ND		0.0040	0.00040	mg/L		07/06/18 10:14	07/09/18 17:41	1
Nitrobenzene	ND		0.0040	0.00051	mg/L		07/06/18 10:14	07/09/18 17:41	1
Pentachlorophenol	ND		0.016	0.0031	mg/L		07/06/18 10:14	07/09/18 17:41	1
Pyridine	ND	*	0.0040	0.00036	mg/L		07/06/18 10:14	07/09/18 17:41	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4,6-Tribromophenol (Surr)	*87*		*28 - 120*	*07/06/18 10:14*	*07/09/18 17:41*	*1*
2-Fluorobiphenyl (Surr)	*84*		*38 - 120*	*07/06/18 10:14*	*07/09/18 17:41*	*1*
2-Fluorophenol (Surr)	*83*		*10 - 120*	*07/06/18 10:14*	*07/09/18 17:41*	*1*
Nitrobenzene-d5 (Surr)	*86*		*32 - 120*	*07/06/18 10:14*	*07/09/18 17:41*	*1*
Phenol-d5 (Surr)	*77*		*10 - 120*	*07/06/18 10:14*	*07/09/18 17:41*	*1*
Terphenyl-d14 (Surr)	*97*		*23 - 127*	*07/06/18 10:14*	*07/09/18 17:41*	*1*

Method: 8081B - Organochlorine Pesticides (GC) - TCLP

Client Sample ID: IDW-062918-W
Date Collected: 06/29/18 08:00
Date Received: 06/30/18 09:00

Lab Sample ID: 280-111549-1
Matrix: Water

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chlordane (technical)	ND		0.0050	0.000047	mg/L		07/06/18 10:20	07/10/18 12:28	1
Endrin	ND		0.00050	0.0000025	mg/L		07/06/18 10:20	07/10/18 12:28	1
gamma-BHC (Lindane)	ND		0.00050	0.0000025	mg/L		07/06/18 10:20	07/10/18 12:28	1
Heptachlor	ND		0.00050	0.0000033	mg/L		07/06/18 10:20	07/10/18 12:28	1
Heptachlor epoxide	ND		0.00050	0.0000026	mg/L		07/06/18 10:20	07/10/18 12:28	1
Methoxychlor	ND		0.0010	0.0000047	mg/L		07/06/18 10:20	07/10/18 12:28	1
Toxaphene	ND		0.020	0.000058	mg/L		07/06/18 10:20	07/10/18 12:28	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
DCB Decachlorobiphenyl	*58*		*21 - 135*	*07/06/18 10:20*	*07/10/18 12:28*	*1*
DCB Decachlorobiphenyl	*59*		*21 - 135*	*07/06/18 10:20*	*07/10/18 12:28*	*1*
Tetrachloro-m-xylene	*61*		*33 - 123*	*07/06/18 10:20*	*07/10/18 12:28*	*1*
Tetrachloro-m-xylene	*60*		*33 - 123*	*07/06/18 10:20*	*07/10/18 12:28*	*1*

Method: 8151A - Herbicides (GC) - TCLP

Client Sample ID: IDW-062918-W
Date Collected: 06/29/18 08:00
Date Received: 06/30/18 09:00

Lab Sample ID: 280-111549-1
Matrix: Water

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2,4-D	ND	*	0.0040	0.0022	mg/L		07/06/18 10:42	07/09/18 22:55	1
Silvex (2,4,5-TP)	ND	*	0.0010	0.00043	mg/L		07/06/18 10:42	07/09/18 22:55	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenylacetic acid	*106*		*41 - 130*	*07/06/18 10:42*	*07/09/18 22:55*	*1*
2,4-Dichlorophenylacetic acid	*112*		*41 - 130*	*07/06/18 10:42*	*07/09/18 22:55*	*1*

Method: 6010C - Metals (ICP) - TCLP

Client Sample ID: IDW-062918-W
Date Collected: 06/29/18 08:00
Date Received: 06/30/18 09:00

Lab Sample ID: 280-111549-1
Matrix: Water

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.050	0.0041	mg/L		07/06/18 14:00	07/09/18 17:32	1
Barium	**0.028**	**J**	0.50	0.0013	mg/L		07/06/18 14:00	07/09/18 17:32	1
Cadmium	**0.00049**	**J**	0.050	0.00020	mg/L		07/06/18 14:00	07/09/18 17:32	1
Chromium	ND		0.050	0.00063	mg/L		07/06/18 14:00	07/09/18 17:32	1
Lead	ND		0.050	0.0028	mg/L		07/06/18 14:00	07/09/18 17:32	1
Selenium	ND		0.050	0.0060	mg/L		07/06/18 14:00	07/09/18 17:32	1
Silver	ND		0.050	0.00062	mg/L		07/06/18 14:00	07/09/18 17:32	1

Method: 7470A - Mercury (CVAA) - TCLP

Client Sample ID: IDW-062918-W
Date Collected: 06/29/18 08:00
Date Received: 06/30/18 09:00

Lab Sample ID: 280-111549-1
Matrix: Water

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	0.00013	mg/L		07/06/18 14:00	07/10/18 09:52	1

Client: Cardno GS, Inc
Project/Site: Ravenna, OH

TestAmerica Job ID: 280-111549-1

General Chemistry

Client Sample ID: IDW-062918-W
Date Collected: 06/29/18 08:00
Date Received: 06/30/18 09:00

Lab Sample ID: 280-111549-1
Matrix: Water

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Flashpoint	**>200**		1.00	1.00	Degrees F			07/05/18 10:00	1
Cyanide, Total	**7.6**	**J B**	10	6.0	ug/L		07/09/18 15:10	07/09/18 16:37	1
Sulfide	ND		3000	1400	ug/L		07/05/18 10:33	07/05/18 14:45	1
pH	**7.4**	**HF**	0.1	0.1	SU			07/05/18 15:25	1

Surrogate Summary

Client: Cardno GS, Inc
Project/Site: Ravenna, OH

TestAmerica Job ID: 280-111549-1

Method: 8260B - Volatile Organic Compounds (GC/MS)

Matrix: Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)							
		DCA	BFB	TOL	DBFM				
Lab Sample ID	Client Sample ID	(73-120)	(76-120)	(80-120)	(73-123)				
LCS 240-335060/9	Lab Control Sample	106	94	101	111				

Surrogate Legend

DCA = 1,2-Dichloroethane-d4 (Surr)
BFB = 4-Bromofluorobenzene (Surr)
TOL = Toluene-d8 (Surr)
DBFM = Dibromofluoromethane (Surr)

Method: 8260B - Volatile Organic Compounds (GC/MS)

Matrix: Water **Prep Type: TCLP**

		Percent Surrogate Recovery (Acceptance Limits)							
		DCA	BFB	TOL	DBFM				
Lab Sample ID	Client Sample ID	(73-120)	(76-120)	(80-120)	(73-123)				
280-111549-1	IDW-062918-W	102	91	101	107				
LB 240-334991/1-A MB	Method Blank	105	93	102	111				

Surrogate Legend

DCA = 1,2-Dichloroethane-d4 (Surr)
BFB = 4-Bromofluorobenzene (Surr)
TOL = Toluene-d8 (Surr)
DBFM = Dibromofluoromethane (Surr)

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Matrix: Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)							
		TBP	FBP	2FP	NBZ	PHL	TPHL		
Lab Sample ID	Client Sample ID	(28-120)	(38-120)	(10-120)	(32-120)	(10-120)	(23-127)		
LCS 240-334978/8-A	Lab Control Sample	89	88	86	101	74	100		
MB 240-334978/7-A	Method Blank	77	84	81	80	71	89		

Surrogate Legend

TBP = 2,4,6-Tribromophenol (Surr)
FBP = 2-Fluorobiphenyl (Surr)
2FP = 2-Fluorophenol (Surr)
NBZ = Nitrobenzene-d5 (Surr)
PHL = Phenol-d5 (Surr)
TPHL = Terphenyl-d14 (Surr)

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Matrix: Water **Prep Type: TCLP**

		Percent Surrogate Recovery (Acceptance Limits)							
		TBP	FBP	2FP	NBZ	PHL	TPHL		
Lab Sample ID	Client Sample ID	(28-120)	(38-120)	(10-120)	(32-120)	(10-120)	(23-127)		
280-111549-1	IDW-062918-W	87	84	83	86	77	97		

Surrogate Legend

TBP = 2,4,6-Tribromophenol (Surr)
FBP = 2-Fluorobiphenyl (Surr)

Surrogate Summary

Client: Cardno GS, Inc
Project/Site: Ravenna, OH

TestAmerica Job ID: 280-111549-1

2FP = 2-Fluorophenol (Surr)
NBZ = Nitrobenzene-d5 (Surr)
PHL = Phenol-d5 (Surr)
TPHL = Terphenyl-d14 (Surr)

Method: 8081B - Organochlorine Pesticides (GC)

Matrix: Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)			
		DCBP1	DCBP2	TCX1	TCX2
Lab Sample ID	Client Sample ID	(21-135)	(21-135)	(33-123)	(33-123)
LCS 240-334981/5-A	Lab Control Sample	59	62	54	56
LCS 240-334981/7-A	Lab Control Sample	56	58	56	59
LCS 240-334981/9-A	Lab Control Sample	53	58	55	56
LCSD 240-334981/10-A	Lab Control Sample Dup	54	60	59	59
LCSD 240-334981/6-A	Lab Control Sample Dup	54	56	49	55
LCSD 240-334981/8-A	Lab Control Sample Dup	55	59	52	55
MB 240-334981/4-A	Method Blank	58	61	57	60

Surrogate Legend
DCBP = DCB Decachlorobiphenyl
TCX = Tetrachloro-m-xylene

Method: 8081B - Organochlorine Pesticides (GC)

Matrix: Water **Prep Type: TCLP**

		Percent Surrogate Recovery (Acceptance Limits)			
		DCBP1	DCBP2	TCX1	TCX2
Lab Sample ID	Client Sample ID	(21-135)	(21-135)	(33-123)	(33-123)
280-111549-1	IDW-062918-W	58	59	61	60

Surrogate Legend
DCBP = DCB Decachlorobiphenyl
TCX = Tetrachloro-m-xylene

Method: 8151A - Herbicides (GC)

Matrix: Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)	
		DCPAA1	DCPAA2
Lab Sample ID	Client Sample ID	(41-130)	(41-130)
LCS 240-334985/6-A	Lab Control Sample	96	93
MB 240-334985/5-A	Method Blank	101	99

Surrogate Legend
DCPAA = 2,4-Dichlorophenylacetic acid

Method: 8151A - Herbicides (GC)

Matrix: Water **Prep Type: TCLP**

		Percent Surrogate Recovery (Acceptance Limits)	
		DCPAA1	DCPAA2
Lab Sample ID	Client Sample ID	(41-130)	(41-130)
280-111549-1	IDW-062918-W	106	112

Surrogate Legend
DCPAA = 2,4-Dichlorophenylacetic acid

Method: 8260B - Volatile Organic Compounds (GC/MS)

Lab Sample ID: LCS 240-335060/9
Matrix: Water
Analysis Batch: 335060

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1-Dichloroethene	1.00	0.988		mg/L		99	76 - 131
1,2-Dichloroethane	1.00	0.954		mg/L		95	72 - 125
2-Butanone (MEK)	2.00	1.80		mg/L		90	55 - 137
Benzene	1.00	0.957		mg/L		96	80 - 122
Carbon tetrachloride	1.00	0.907		mg/L		91	69 - 130
Chlorobenzene	1.00	0.921		mg/L		92	80 - 120
Chloroform	1.00	1.04		mg/L		104	80 - 122
Tetrachloroethene	1.00	0.902		mg/L		90	79 - 120
Trichloroethene	1.00	0.891		mg/L		89	80 - 121
Vinyl chloride	1.00	0.982		mg/L		98	73 - 132

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*106*		*73 - 120*
4-Bromofluorobenzene (Surr)	*94*		*76 - 120*
Toluene-d8 (Surr)	*101*		*80 - 120*
Dibromofluoromethane (Surr)	*111*		*73 - 123*

Lab Sample ID: LB 240-334991/1-A MB
Matrix: Water
Analysis Batch: 335060

Client Sample ID: Method Blank
Prep Type: TCLP

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1-Dichloroethene	ND		0.025	0.00019	mg/L			07/06/18 18:06	1
1,2-Dichloroethane	ND		0.025	0.00021	mg/L			07/06/18 18:06	1
2-Butanone (MEK)	ND		0.25	0.0012	mg/L			07/06/18 18:06	1
Benzene	ND		0.025	0.00013	mg/L			07/06/18 18:06	1
Carbon tetrachloride	ND		0.025	0.00026	mg/L			07/06/18 18:06	1
Chlorobenzene	ND		0.025	0.00014	mg/L			07/06/18 18:06	1
Chloroform	ND		0.025	0.00013	mg/L			07/06/18 18:06	1
Tetrachloroethene	ND		0.025	0.00015	mg/L			07/06/18 18:06	1
Trichloroethene	ND		0.025	0.00010	mg/L			07/06/18 18:06	1
Vinyl chloride	ND		0.025	0.00020	mg/L			07/06/18 18:06	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*105*		*73 - 120*		*07/06/18 18:06*	*1*
4-Bromofluorobenzene (Surr)	*93*		*76 - 120*		*07/06/18 18:06*	*1*
Toluene-d8 (Surr)	*102*		*80 - 120*		*07/06/18 18:06*	*1*
Dibromofluoromethane (Surr)	*111*		*73 - 123*		*07/06/18 18:06*	*1*

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: MB 240-334978/7-A
Matrix: Water
Analysis Batch: 335228

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 334978

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,4-Dichlorobenzene	ND		0.0040	0.00033	mg/L		07/06/18 10:14	07/09/18 12:50	1

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 240-334978/7-A
Matrix: Water
Analysis Batch: 335228

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 334978

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2,4,5-Trichlorophenol	ND		0.0040	0.0020	mg/L		07/06/18 10:14	07/09/18 12:50	1
2,4,6-Trichlorophenol	ND		0.0040	0.0018	mg/L		07/06/18 10:14	07/09/18 12:50	1
2,4-Dinitrotoluene	ND		0.0040	0.0021	mg/L		07/06/18 10:14	07/09/18 12:50	1
2-Methylphenol	ND		0.0040	0.00021	mg/L		07/06/18 10:14	07/09/18 12:50	1
3 & 4 Methylphenol	ND		0.0040	0.00019	mg/L		07/06/18 10:14	07/09/18 12:50	1
Hexachlorobenzene	ND		0.00080	0.00016	mg/L		07/06/18 10:14	07/09/18 12:50	1
Hexachlorobutadiene	ND		0.0040	0.00054	mg/L		07/06/18 10:14	07/09/18 12:50	1
Hexachloroethane	ND		0.0040	0.00040	mg/L		07/06/18 10:14	07/09/18 12:50	1
Nitrobenzene	ND		0.0040	0.00051	mg/L		07/06/18 10:14	07/09/18 12:50	1
Pentachlorophenol	ND		0.016	0.0031	mg/L		07/06/18 10:14	07/09/18 12:50	1
Pyridine	ND		0.0040	0.00036	mg/L		07/06/18 10:14	07/09/18 12:50	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4,6-Tribromophenol (Surr)	*77*		*28 - 120*	*07/06/18 10:14*	*07/09/18 12:50*	*1*
2-Fluorobiphenyl (Surr)	*84*		*38 - 120*	*07/06/18 10:14*	*07/09/18 12:50*	*1*
2-Fluorophenol (Surr)	*81*		*10 - 120*	*07/06/18 10:14*	*07/09/18 12:50*	*1*
Nitrobenzene-d5 (Surr)	*80*		*32 - 120*	*07/06/18 10:14*	*07/09/18 12:50*	*1*
Phenol-d5 (Surr)	*71*		*10 - 120*	*07/06/18 10:14*	*07/09/18 12:50*	*1*
Terphenyl-d14 (Surr)	*89*		*23 - 127*	*07/06/18 10:14*	*07/09/18 12:50*	*1*

Lab Sample ID: LCS 240-334978/8-A
Matrix: Water
Analysis Batch: 335228

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 334978

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,4-Dichlorobenzene	0.0800	0.0701		mg/L		88	47 - 120
2,4,5-Trichlorophenol	0.0800	0.0771		mg/L		96	54 - 120
2,4,6-Trichlorophenol	0.0800	0.0767		mg/L		96	54 - 120
2,4-Dinitrotoluene	0.0800	0.0732		mg/L		91	60 - 120
2-Methylphenol	0.0800	0.0726		mg/L		91	46 - 120
3 & 4 Methylphenol	0.0800	0.0746		mg/L		93	40 - 120
Hexachlorobenzene	0.0800	0.0713		mg/L		89	51 - 120
Hexachlorobutadiene	0.0800	0.0712		mg/L		89	44 - 120
Hexachloroethane	0.0800	0.0692		mg/L		86	44 - 120
Nitrobenzene	0.0800	0.0756		mg/L		94	55 - 120
Pentachlorophenol	0.160	0.139		mg/L		87	30 - 120
Pyridine	0.160	0.0300	*	mg/L		19	23 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2,4,6-Tribromophenol (Surr)	*89*		*28 - 120*
2-Fluorobiphenyl (Surr)	*88*		*38 - 120*
2-Fluorophenol (Surr)	*86*		*10 - 120*
Nitrobenzene-d5 (Surr)	*101*		*32 - 120*
Phenol-d5 (Surr)	*74*		*10 - 120*
Terphenyl-d14 (Surr)	*100*		*23 - 127*

Method: 8081B - Organochlorine Pesticides (GC)

Lab Sample ID: MB 240-334981/4-A
Matrix: Water
Analysis Batch: 335447

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 334981

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chlordane (technical)	ND		0.0050	0.000047	mg/L		07/06/18 10:20	07/10/18 11:02	1
Endrin	ND		0.00050	0.0000025	mg/L		07/06/18 10:20	07/10/18 11:02	1
gamma-BHC (Lindane)	ND		0.00050	0.0000025	mg/L		07/06/18 10:20	07/10/18 11:02	1
Heptachlor	ND		0.00050	0.0000033	mg/L		07/06/18 10:20	07/10/18 11:02	1
Heptachlor epoxide	ND		0.00050	0.0000026	mg/L		07/06/18 10:20	07/10/18 11:02	1
Methoxychlor	ND		0.0010	0.0000047	mg/L		07/06/18 10:20	07/10/18 11:02	1
Toxaphene	ND		0.020	0.000058	mg/L		07/06/18 10:20	07/10/18 11:02	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
DCB Decachlorobiphenyl	*58*		*21 - 135*	*07/06/18 10:20*	*07/10/18 11:02*	*1*
DCB Decachlorobiphenyl	*61*		*21 - 135*	*07/06/18 10:20*	*07/10/18 11:02*	*1*
Tetrachloro-m-xylene	*57*		*33 - 123*	*07/06/18 10:20*	*07/10/18 11:02*	*1*
Tetrachloro-m-xylene	*60*		*33 - 123*	*07/06/18 10:20*	*07/10/18 11:02*	*1*

Lab Sample ID: LCS 240-334981/5-A
Matrix: Water
Analysis Batch: 335447

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 334981

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Endrin	0.00160	0.00111		mg/L		69	36 - 124
gamma-BHC (Lindane)	0.00160	0.00103		mg/L		64	23 - 120
Heptachlor	0.00160	0.00112		mg/L		70	37 - 120
Heptachlor epoxide	0.00160	0.00108		mg/L		68	44 - 120
Methoxychlor	0.00160	0.00106		mg/L		66	36 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
DCB Decachlorobiphenyl	*59*		*21 - 135*
DCB Decachlorobiphenyl	*62*		*21 - 135*
Tetrachloro-m-xylene	*54*		*33 - 123*
Tetrachloro-m-xylene	*56*		*33 - 123*

Lab Sample ID: LCS 240-334981/7-A
Matrix: Water
Analysis Batch: 335447

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 334981

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Toxaphene	0.0400	0.0266		mg/L		66	10 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
DCB Decachlorobiphenyl	*56*		*21 - 135*
DCB Decachlorobiphenyl	*58*		*21 - 135*
Tetrachloro-m-xylene	*56*		*33 - 123*
Tetrachloro-m-xylene	*59*		*33 - 123*

Method: 8081B - Organochlorine Pesticides (GC) (Continued)

Lab Sample ID: LCS 240-334981/9-A
Matrix: Water
Analysis Batch: 335447

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 334981

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Chlordane (technical)			0.00400	0.00246	J	mg/L		61	10 - 120		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
DCB Decachlorobiphenyl	*53*		*21 - 135*
DCB Decachlorobiphenyl	*58*		*21 - 135*
Tetrachloro-m-xylene	*55*		*33 - 123*
Tetrachloro-m-xylene	*56*		*33 - 123*

Lab Sample ID: LCSD 240-334981/10-A
Matrix: Water
Analysis Batch: 335447

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 334981

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Chlordane (technical)			0.00400	0.00239	J	mg/L		60	10 - 120	3	35

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
DCB Decachlorobiphenyl	*54*		*21 - 135*
DCB Decachlorobiphenyl	*60*		*21 - 135*
Tetrachloro-m-xylene	*59*		*33 - 123*
Tetrachloro-m-xylene	*59*		*33 - 123*

Lab Sample ID: LCSD 240-334981/6-A
Matrix: Water
Analysis Batch: 335447

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 334981

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Endrin			0.00160	0.00103		mg/L		64	36 - 124	7	35
gamma-BHC (Lindane)			0.00160	0.000997		mg/L		62	23 - 120	3	35
Heptachlor			0.00160	0.00110		mg/L		69	37 - 120	2	35
Heptachlor epoxide			0.00160	0.00104		mg/L		65	44 - 120	4	35
Methoxychlor			0.00160	0.000994	J	mg/L		62	36 - 120	7	35

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
DCB Decachlorobiphenyl	*54*		*21 - 135*
DCB Decachlorobiphenyl	*56*		*21 - 135*
Tetrachloro-m-xylene	*49*		*33 - 123*
Tetrachloro-m-xylene	*55*		*33 - 123*

Lab Sample ID: LCSD 240-334981/8-A
Matrix: Water
Analysis Batch: 335447

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 334981

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Toxaphene			0.0400	0.0271		mg/L		68	10 - 120	2	35

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
DCB Decachlorobiphenyl	*55*		*21 - 135*

Method: 8081B - Organochlorine Pesticides (GC) (Continued)

Lab Sample ID: LCSD 240-334981/8-A
Matrix: Water
Analysis Batch: 335447

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 334981

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
DCB Decachlorobiphenyl	*59*		*21 - 135*
Tetrachloro-m-xylene	*52*		*33 - 123*
Tetrachloro-m-xylene	*55*		*33 - 123*

Method: 8151A - Herbicides (GC)

Lab Sample ID: MB 240-334985/5-A
Matrix: Water
Analysis Batch: 335190

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 334985

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2,4-D	ND		0.0040	0.0022	mg/L		07/06/18 10:42	07/09/18 21:46	1
Silvex (2,4,5-TP)	ND		0.0010	0.00043	mg/L		07/06/18 10:42	07/09/18 21:46	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenylacetic acid	*101*		*41 - 130*	*07/06/18 10:42*	*07/09/18 21:46*	*1*
2,4-Dichlorophenylacetic acid	*99*		*41 - 130*	*07/06/18 10:42*	*07/09/18 21:46*	*1*

Lab Sample ID: LCS 240-334985/6-A
Matrix: Water
Analysis Batch: 335190

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 334985

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
2,4-D	0.0200	0.0269	*	mg/L		135	42 - 120
Silvex (2,4,5-TP)	0.00500	0.00705	*	mg/L		141	41 - 120

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2,4-Dichlorophenylacetic acid	*96*		*41 - 130*
2,4-Dichlorophenylacetic acid	*93*		*41 - 130*

Method: 6010C - Metals (ICP)

Lab Sample ID: MB 240-335000/2-A
Matrix: Water
Analysis Batch: 335417

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 335000

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.050	0.0041	mg/L		07/06/18 14:00	07/09/18 16:50	1
Barium	ND		0.50	0.0013	mg/L		07/06/18 14:00	07/09/18 16:50	1
Cadmium	ND		0.050	0.00020	mg/L		07/06/18 14:00	07/09/18 16:50	1
Chromium	ND		0.050	0.00063	mg/L		07/06/18 14:00	07/09/18 16:50	1
Lead	ND		0.050	0.0028	mg/L		07/06/18 14:00	07/09/18 16:50	1
Selenium	ND		0.050	0.0060	mg/L		07/06/18 14:00	07/09/18 16:50	1
Silver	ND		0.050	0.00062	mg/L		07/06/18 14:00	07/09/18 16:50	1

Method: 6010C - Metals (ICP) (Continued)

Lab Sample ID: LCS 240-335000/3-A
Matrix: Water
Analysis Batch: 335417

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 335000

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	2.00	2.03		mg/L		102	50 - 150
Barium	2.00	1.95		mg/L		98	50 - 150
Cadmium	0.0500	0.0487	J	mg/L		97	50 - 150
Chromium	0.200	0.193		mg/L		96	50 - 150
Lead	0.500	0.473		mg/L		95	50 - 150
Selenium	2.00	2.09		mg/L		105	50 - 150
Silver	0.0500	0.0497	J	mg/L		99	50 - 150

Lab Sample ID: LB 240-334959/1-B
Matrix: Water
Analysis Batch: 335417

Client Sample ID: Method Blank
Prep Type: TCLP
Prep Batch: 335000

Analyte	LB Result	LB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.050	0.0041	mg/L		07/06/18 14:00	07/09/18 16:45	1
Barium	ND		0.50	0.0013	mg/L		07/06/18 14:00	07/09/18 16:45	1
Cadmium	ND		0.050	0.00020	mg/L		07/06/18 14:00	07/09/18 16:45	1
Chromium	ND		0.050	0.00063	mg/L		07/06/18 14:00	07/09/18 16:45	1
Lead	ND		0.050	0.0028	mg/L		07/06/18 14:00	07/09/18 16:45	1
Selenium	ND		0.050	0.0060	mg/L		07/06/18 14:00	07/09/18 16:45	1
Silver	ND		0.050	0.00062	mg/L		07/06/18 14:00	07/09/18 16:45	1

Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 240-335003/2-A
Matrix: Water
Analysis Batch: 335479

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 335003

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	0.00013	mg/L		07/06/18 14:00	07/10/18 09:41	1

Lab Sample ID: LCS 240-335003/3-A
Matrix: Water
Analysis Batch: 335479

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 335003

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.00500	0.00537		mg/L		107	80 - 120

Lab Sample ID: LB 240-334959/1-C
Matrix: Water
Analysis Batch: 335479

Client Sample ID: Method Blank
Prep Type: TCLP
Prep Batch: 335003

Analyte	LB Result	LB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.0020	0.00013	mg/L		07/06/18 14:00	07/10/18 09:39	1

Method: 1010A - Ignitability, Pensky-Martens Closed-Cup Method

Lab Sample ID: LCS 240-334774/1
Matrix: Water
Analysis Batch: 334774

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Flashpoint	81.0	83.00		Degrees F		102	97 - 103

Method: 9012B - Cyanide, Total andor Amenable

Lab Sample ID: MB 240-335328/1-A
Matrix: Water
Analysis Batch: 335358

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 335328

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cyanide, Total	6.10	J	10	6.0	ug/L		07/09/18 15:10	07/09/18 16:24	1

Lab Sample ID: LCS 240-335328/2-A
Matrix: Water
Analysis Batch: 335358

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 335328

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Cyanide, Total	884	951		ug/L		108	59 - 129

Method: 9034 - Sulfide, Acid soluble and Insoluble (Titrimetric)

Lab Sample ID: MB 240-334822/1-A
Matrix: Water
Analysis Batch: 334879

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 334822

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfide	ND		3000	1400	ug/L		07/05/18 10:33	07/05/18 14:45	1

Lab Sample ID: LCS 240-334822/2-A
Matrix: Water
Analysis Batch: 334879

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 334822

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Sulfide	7600	7070		ug/L		93	70 - 120

QC Association Summary

Client: Cardno GS, Inc
Project/Site: Ravenna, OH

TestAmerica Job ID: 280-111549-1

GC/MS VOA

Leach Batch: 334991

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	TCLP	Water	1311	
LB 240-334991/1-A MB	Method Blank	TCLP	Water	1311	

Analysis Batch: 335060

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	TCLP	Water	8260B	334991
LB 240-334991/1-A MB	Method Blank	TCLP	Water	8260B	334991
LCS 240-335060/9	Lab Control Sample	Total/NA	Water	8260B	

GC/MS Semi VOA

Leach Batch: 334959

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	TCLP	Water	1311	

Prep Batch: 334978

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	TCLP	Water	3510C	334959
MB 240-334978/7-A	Method Blank	Total/NA	Water	3510C	
LCS 240-334978/8-A	Lab Control Sample	Total/NA	Water	3510C	

Analysis Batch: 335228

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	TCLP	Water	8270D	334978
MB 240-334978/7-A	Method Blank	Total/NA	Water	8270D	334978
LCS 240-334978/8-A	Lab Control Sample	Total/NA	Water	8270D	334978

GC Semi VOA

Leach Batch: 334959

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	TCLP	Water	1311	

Prep Batch: 334981

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	TCLP	Water	3520C	334959
MB 240-334981/4-A	Method Blank	Total/NA	Water	3520C	
LCS 240-334981/5-A	Lab Control Sample	Total/NA	Water	3520C	
LCS 240-334981/7-A	Lab Control Sample	Total/NA	Water	3520C	
LCS 240-334981/9-A	Lab Control Sample	Total/NA	Water	3520C	
LCSD 240-334981/10-A	Lab Control Sample Dup	Total/NA	Water	3520C	
LCSD 240-334981/6-A	Lab Control Sample Dup	Total/NA	Water	3520C	
LCSD 240-334981/8-A	Lab Control Sample Dup	Total/NA	Water	3520C	

Prep Batch: 334985

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	TCLP	Water	8151A	334959
MB 240-334985/5-A	Method Blank	Total/NA	Water	8151A	
LCS 240-334985/6-A	Lab Control Sample	Total/NA	Water	8151A	

GC Semi VOA (Continued)

Analysis Batch: 335190

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	TCLP	Water	8151A	334985
MB 240-334985/5-A	Method Blank	Total/NA	Water	8151A	334985
LCS 240-334985/6-A	Lab Control Sample	Total/NA	Water	8151A	334985

Analysis Batch: 335447

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	TCLP	Water	8081B	334981
MB 240-334981/4-A	Method Blank	Total/NA	Water	8081B	334981
LCS 240-334981/5-A	Lab Control Sample	Total/NA	Water	8081B	334981
LCS 240-334981/7-A	Lab Control Sample	Total/NA	Water	8081B	334981
LCS 240-334981/9-A	Lab Control Sample	Total/NA	Water	8081B	334981
LCSD 240-334981/10-A	Lab Control Sample Dup	Total/NA	Water	8081B	334981
LCSD 240-334981/6-A	Lab Control Sample Dup	Total/NA	Water	8081B	334981
LCSD 240-334981/8-A	Lab Control Sample Dup	Total/NA	Water	8081B	334981

Metals

Leach Batch: 334959

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	TCLP	Water	1311	
LB 240-334959/1-B	Method Blank	TCLP	Water	1311	
LB 240-334959/1-C	Method Blank	TCLP	Water	1311	

Prep Batch: 335000

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	TCLP	Water	3010A	334959
LB 240-334959/1-B	Method Blank	TCLP	Water	3010A	334959
MB 240-335000/2-A	Method Blank	Total/NA	Water	3010A	
LCS 240-335000/3-A	Lab Control Sample	Total/NA	Water	3010A	

Prep Batch: 335003

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	TCLP	Water	7470A	334959
LB 240-334959/1-C	Method Blank	TCLP	Water	7470A	334959
MB 240-335003/2-A	Method Blank	Total/NA	Water	7470A	
LCS 240-335003/3-A	Lab Control Sample	Total/NA	Water	7470A	

Analysis Batch: 335417

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	TCLP	Water	6010C	335000
LB 240-334959/1-B	Method Blank	TCLP	Water	6010C	335000
MB 240-335000/2-A	Method Blank	Total/NA	Water	6010C	335000
LCS 240-335000/3-A	Lab Control Sample	Total/NA	Water	6010C	335000

Analysis Batch: 335479

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	TCLP	Water	7470A	335003
LB 240-334959/1-C	Method Blank	TCLP	Water	7470A	335003
MB 240-335003/2-A	Method Blank	Total/NA	Water	7470A	335003
LCS 240-335003/3-A	Lab Control Sample	Total/NA	Water	7470A	335003

QC Association Summary

Client: Cardno GS, Inc
Project/Site: Ravenna, OH

TestAmerica Job ID: 280-111549-1

General Chemistry

Analysis Batch: 334774

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	Total/NA	Water	1010A	
LCS 240-334774/1	Lab Control Sample	Total/NA	Water	1010A	

Prep Batch: 334822

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	Total/NA	Water	9030B	
MB 240-334822/1-A	Method Blank	Total/NA	Water	9030B	
LCS 240-334822/2-A	Lab Control Sample	Total/NA	Water	9030B	

Analysis Batch: 334879

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	Total/NA	Water	9034	334822
MB 240-334822/1-A	Method Blank	Total/NA	Water	9034	334822
LCS 240-334822/2-A	Lab Control Sample	Total/NA	Water	9034	334822

Analysis Batch: 334882

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	Total/NA	Water	9040C	
LCS 240-334882/2	Lab Control Sample	Total/NA	Water	9040C	

Prep Batch: 335328

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	Total/NA	Water	9012B	
MB 240-335328/1-A	Method Blank	Total/NA	Water	9012B	
LCS 240-335328/2-A	Lab Control Sample	Total/NA	Water	9012B	

Analysis Batch: 335358

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-111549-1	IDW-062918-W	Total/NA	Water	9012B	335328
MB 240-335328/1-A	Method Blank	Total/NA	Water	9012B	335328
LCS 240-335328/2-A	Lab Control Sample	Total/NA	Water	9012B	335328

Lab Chronicle

Client: Cardno GS, Inc
Project/Site: Ravenna, OH

TestAmerica Job ID: 280-111549-1

Client Sample ID: IDW-062918-W

Date Collected: 06/29/18 08:00
Date Received: 06/30/18 09:00

Lab Sample ID: 280-111549-1

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
TCLP	Leach	1311			1.0 g	1.0 mL	334991	07/05/18 17:40	PW1	TAL CAN
TCLP	Analysis	8260B		1	0.1 mL	5 mL	335060	07/06/18 21:50	TJL1	TAL CAN
TCLP	Leach	1311			1.0 g	1.0 mL	334959	07/05/18 16:05	PW1	TAL CAN
TCLP	Prep	3510C			250 mL	2 mL	334978	07/06/18 10:14	WKD	TAL CAN
TCLP	Analysis	8270D		1			335228	07/09/18 17:41	JMG	TAL CAN
TCLP	Leach	1311			1.0 g	1.0 mL	334959	07/05/18 16:05	PW1	TAL CAN
TCLP	Prep	3520C			250 mL	3 mL	334981	07/06/18 10:20	WKD	TAL CAN
TCLP	Analysis	8081B		1			335447	07/10/18 12:28	OCR	TAL CAN
TCLP	Leach	1311			1.0 g	1.0 mL	334959	07/05/18 16:05	PW1	TAL CAN
TCLP	Prep	8151A			100 mL	10 mL	334985	07/06/18 10:42	BMB	TAL CAN
TCLP	Analysis	8151A		1			335190	07/09/18 22:55	RTR	TAL CAN
TCLP	Leach	1311			1.0 g	1.0 mL	334959	07/05/18 16:05	PW1	TAL CAN
TCLP	Prep	3010A			50 mL	50 mL	335000	07/06/18 14:00	AJC	TAL CAN
TCLP	Analysis	6010C		1			335417	07/09/18 17:32	KLC	TAL CAN
TCLP	Leach	1311			1.0 g	1.0 mL	334959	07/05/18 16:05	PW1	TAL CAN
TCLP	Prep	7470A			50 mL	50 mL	335003	07/06/18 14:00	AJC	TAL CAN
TCLP	Analysis	7470A		1			335479	07/10/18 09:52	AJC	TAL CAN
Total/NA	Analysis	1010A		1			334774	07/05/18 10:00	TPH	TAL CAN
Total/NA	Prep	9012B			6.0 mL	6.0 mL	335328	07/09/18 15:10	JWW	TAL CAN
Total/NA	Analysis	9012B		1	6.0 mL	6.0 mL	335358	07/09/18 16:37	JWW	TAL CAN
Total/NA	Prep	9030B			50 mL	50 mL	334822	07/05/18 10:33	JMB	TAL CAN
Total/NA	Analysis	9034		1			334879	07/05/18 14:45	JMB	TAL CAN
Total/NA	Analysis	9040C		1			334882	07/05/18 15:25	JESW	TAL CAN

Laboratory References:

TAL CAN = TestAmerica Canton, 4101 Shuffel Street NW, North Canton, OH 44720, TEL (330)497-9396

Accreditation/Certification Summary

Client: Cardno GS, Inc
Project/Site: Ravenna, OH

TestAmerica Job ID: 280-111549-1

Laboratory: TestAmerica Denver

The accreditations/certifications listed below are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
A2LA	DoD ELAP		2907.01	10-31-19

Laboratory: TestAmerica Canton

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
California	State Program	9	2927	02-23-19
Connecticut	State Program	1	PH-0590	12-31-19
Florida	NELAP	4	E87225	06-30-19
Illinois	NELAP	5	200004	07-31-18 *
Kansas	NELAP	7	E-10336	01-31-19
Kentucky (UST)	State Program	4	58	02-23-19
Kentucky (WW)	State Program	4	98016	12-31-18
Minnesota	NELAP	5	039-999-348	12-31-18
Minnesota (Petrofund)	State Program	1	3506	07-31-18 *
Nevada	State Program	9	OH-000482008A	07-31-18 *
New Jersey	NELAP	2	OH001	06-30-19
New York	NELAP	2	10975	03-31-19
Ohio VAP	State Program	5	CL0024	09-06-19
Oregon	NELAP	10	4062	02-23-19
Pennsylvania	NELAP	3	68-00340	08-31-18 *
Texas	NELAP	6	T104704517-17-9	08-31-18 *
USDA	Federal		P330-16-00404	12-28-19
Virginia	NELAP	3	460175	09-14-18 *
Washington	State Program	10	C971	01-12-19
West Virginia DEP	State Program	3	210	12-31-18

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

TestAmerica Denver
4955 Yarrow Street
Arvada, CO 80002
Phone (303) 736-0100 Fax (303) 431-7171

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information	Sampler: dep	Lab PM: McEntee, Patrick J	Carrier Tracking No(s):	COC No:
Client Contact: Danyelle Phillips	Phone: 434-906-2085	E-Mail: patrick.mcentee@testamericainc.com		Page: Page:
Company: Cardno TEC, Inc				Job #:
Address: 1658 Cole Boulevard Suite 190	Due Date Requested:			
City: Golden	TAT Requested (days):			
State, Zip: CO, 80401				
Phone: 434-906-2085	PO #:			
Email: Danyelle.Phillips@cardno-gs.com	WO #: 076003.009.011			
Project Name: Ravenna, OH - IDW	TestAmerica Project #: 28014271			
Site: Ravenna	SSOW#:			

Analysis Requested

Preservation Codes:

A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	1311/8260B - TCLP VOCs	1311/8270D - TCLP SVOCs	1311/6010C/6020A/7470A - TCLP Metals	1311/8081B - TCLP Pesticides	1311/8151A - TCLP Herbicides	9034 - Sulfide	9012B - Cyanide	9040C - pH	1010A - Flashpoint	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	N	N	N	N	C/B	B	N	N		
IDW-062918-W	6-29-18	0800	C	W			X	X	X	X	X	X	X	X	X	12	

280-111549 Chain of Custody

dup

Possible Hazard Identification	Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological	☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months
Deliverable Requested: I, II, III, IV, Other (specify)	Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

	Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
1		6-28-18 / 0840	Cardno		6-29-18 - 1000	TA 240
2	Relinquished by:	Date/Time: 6-29 1700	Company	Received by:	Date/Time: 06-30-18 0900	Company TA DEN
3	Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks: 0.6 +0.0 OFFERED BY KD 06-30-18

TestAmerica Denver
4955 Yarrow Street
Arvada, CO 80002
Phone (303) 736-0100 Fax (303) 431-7171

3.0/C3.0

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information (Sub Contract Lab)	Sampler:	Lab PM: McEntee, Patrick J	Carrier Tracking No(s):	COC No: 280-445536.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: patrick.mcentee@testamericainc.com	State of Origin: Ohio	Page: Page 1 of 1
Company: TestAmerica Laboratories, Inc.		Accreditations Required (See note): DoD ELAP - A2LA		Job #: 280-111549-1
Address: 4101 Shuffel Street NW, ,	Due Date Requested: 7/10/2018			
City: North Canton	TAT Requested (days):			
State, Zip: OH, 44720				
Phone: 330-497-9396(Tel) 330-497-0772(Fax)	PO #:			
Email:	WO #:			
Project Name: Ravenna, OH	Project #: 28014271			
Site:	SSOW#:			

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

C Z Z W127 MS

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8260B/1311_Z TCLP Volatiles	8270D/1311_T TCLP Semivolatiles	8081B/1311_T TCLP Pesticides	8151A/1311_T TCLP Herbicides	6010C/1311T_M TCLP Metals	7470A/1311T_Hg TCLP Mercury	9012B/9012B_Prep	9034_Calc/9030B (MOD) Local Method	9040C/ pH	1010A				Total Number of containers	Special Instructions/Note:
			Preservation Code:																		
IDW-062918-W (280-111549-1)	6/29/18	08:00 Eastern		Water			X	X	X	X	X	X	X	X	X					12	DIL3 - report dilute/undilute, one result per analyte. Only report results that are within

Note: Since laboratory accreditations are subject to change, TestAmerica Laboratories, Inc. places the ownership of method, analyte & accreditation compliance upon out subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to TestAmerica Laboratories, Inc. attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said complicance to TestAmerica Laboratories, Inc.

Possible Hazard Identification	*Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)*
Unconfirmed	☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* _____ *Months*
Deliverable Requested: I, II, III, IV, Other (specify) Primary Deliverable Rank: 4	Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Laura Castro	7-3-18 1625	TAL		7/5/18 915	TAL
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

Ver: 09/20/2016

7/10/2018

TestAmerica Canton Sample Receipt Form/Narrative **Login # :** _____
Canton Facility

Client TA Denver Site Name _____ Cooler unpacked by:

Cooler Received on 7/5/18 Opened on 7/5/18

FedEx: 1st Grd (Exp) UPS FAS Clipper Client Drop Off TestAmerica Courier Other _____

Receipt After-hours: Drop-off Date/Time _____ Storage Location _____

TestAmerica Cooler # TA Foam Box Client Cooler Box Other _____

Packing material used: Bubble Wrap Foam Plastic Bag None Other _____

COOLANT: Wet Ice Blue Ice Dry Ice Water None

1. Cooler temperature upon receipt ☐ See Multiple Cooler Form
   IR GUN# IR-8 (CF +0 °C) Observed Cooler Temp. 3.0 °C Corrected Cooler Temp. 3.0 °C
   IR GUN #36 (CF -0.3°C) Observed Cooler Temp. _____ °C Corrected Cooler Temp. _____ °C
   ~~IR GUN # 627 (CF -1.3°C) Observed Cooler Temp. _____ °C Corrected Cooler Temp. _____ °C~~

2. Were tamper/custody seals on the outside of the cooler(s)? If Yes Quantity 1	(Yes)	No
-Were the seals on the outside of the cooler(s) signed & dated?	(Yes)	No NA
-Were tamper/custody seals on the bottle(s) or bottle kits (LLHg/MeHg)?	Yes	(No)
-Were tamper/custody seals intact and uncompromised?	(Yes)	No NA
3. Shippers' packing slip attached to the cooler(s)?	(Yes)	No
4. Did custody papers accompany the sample(s)?	(Yes)	No
5. Were the custody papers relinquished & signed in the appropriate place?	(Yes)	No
6. Was/were the person(s) who collected the samples clearly identified on the COC?	Yes	(No)
7. Did all bottles arrive in good condition (Unbroken)?	(Yes)	No
8. Could all bottle labels be reconciled with the COC?	(Yes)	No
9. Were correct bottle(s) used for the test(s) indicated?	(Yes)	No
10. Sufficient quantity received to perform indicated analyses?	(Yes)	No
11. Are these work share samples?	Yes	(No)
If yes, Questions 12-16 have been checked at the originating laboratory.		
12. Were all preserved sample(s) at the correct pH upon receipt?	Yes	No NA pH Strip Lot# **HC740840**
13. Were VOAs on the COC?	Yes	No
14. Were air bubbles >6 mm in any VOA vials? ● ⬅ Larger than this.	Yes	No NA
15. Was a VOA trip blank present in the cooler(s)? Trip Blank Lot # _____	Yes	No
16. Was a LL Hg or Me Hg trip blank present? _____	Yes	No

Tests that are not checked for pH by Receiving:

VOAs
Oil and Grease
TOC

Contacted PM _____ Date _____ by _____ via Verbal Voice Mail Other

Concerning _____

17. CHAIN OF CUSTODY & SAMPLE DISCREPANCIES Samples processed by:

_____

_____

_____

_____

_____

18. SAMPLE CONDITION

Sample(s) _____ were received after the recommended holding time had expired.

Sample(s) _____ were received in a broken container.

Sample(s) _____ were received with bubble >6 mm in diameter. (Notify PM)

19. SAMPLE PRESERVATION

Sample(s) _____ were further preserved in the laboratory.

Time preserved: _____ Preservative(s) added/Lot number(s): _____

Login Sample Receipt Checklist

Client: Cardno GS, Inc

Job Number: 280-111549-1

Login Number: 111549
List Number: 1
Creator: Dunlap, Krista M

List Source: TestAmerica Denver

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	