

Bench-scale Treatment Study of Produced Water from the Southern San Juan Basin New Mexico

Kanalıs Group

December 1, 2022

**Volume 2:
Appendices to Volume1
Complete Data Sets for Produced Water Testing and Greenhouse Growth Study**

Prepared for:



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Appendix A-1

Hall Report 1: Pre-treated Source Water Test Results



Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL 505-345-3975 FAX 505-345-4107
Website clients.hallenvironmental.com

March 26, 2021

Nyle Khan

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

FAX

RE: NM DW Testing

OrderNo.: 2102894

Dear Nyle Khan:

Hall Environmental Analysis Laboratory received 2 sample(s) on 2/19/2021 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results, it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifiers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0901

Sincerely,

A handwritten signature in black ink, appearing to read "Andy Freeman", is written over a white background.

Andy Freeman

Laboratory Manager

4901 Hawkins NE

Albuquerque, NM 87109

Hall Environmental Analysis Laboratory, Inc.

Analytical Report

Lab Order **2102894**

Date Reported: **3/26/2021**

CLIENT: [REDACTED]

Client Sample ID: Eagle Springs

Project: NM DW Testing

Collection Date: 2/19/2021 9:57:00 AM

Lab ID: 2102894-001

Matrix: AQUEOUS

Received Date: 2/19/2021 1:10:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015M/D: DIESEL RANGE						Analyst: mb
Diesel Range Organics (DRO)	ND	1.0		mg/L	1	2/23/2021 8:31:04 AM
Motor Oil Range Organics (MRO)	ND	5.0		mg/L	1	2/23/2021 8:31:04 AM
Surr: DNOP	118	63.7-164		%Rec	1	2/23/2021 8:31:04 AM
EPA METHOD 8015D: GASOLINE RANGE						Analyst: CCM
Gasoline Range Organics (GRO)	0.17	0.050		mg/L	1	2/20/2021 2:47:00 PM
Surr: BFB	99.3	66.7-119		%Rec	1	2/20/2021 2:47:00 PM
EPA METHOD 300.0: ANIONS						Analyst: CAS
Fluoride	3.2	2.0		mg/L	20	2/19/2021 4:56:03 PM
Chloride	890	100	*	mg/L	200	2/22/2021 8:09:39 PM
Nitrogen, Nitrite (As N)	ND	2.0		mg/L	20	2/19/2021 4:56:03 PM
Bromide	0.51	0.10		mg/L	1	2/19/2021 4:19:00 PM
Nitrogen, Nitrate (As N)	ND	0.10		mg/L	1	2/19/2021 4:19:00 PM
Phosphorus, Orthophosphate (As P)	ND	10		mg/L	20	2/19/2021 4:56:03 PM
Sulfate	6400	100	*	mg/L	200	2/22/2021 8:09:39 PM
EPA METHOD 200.7: METALS						Analyst: ELS
Aluminum	ND	0.020		mg/L	1	2/24/2021 9:55:47 AM
Barium	0.032	0.0030		mg/L	1	2/24/2021 9:55:47 AM
Boron	3.5	0.20		mg/L	5	2/24/2021 9:57:18 AM
Calcium	210	5.0		mg/L	5	2/24/2021 9:57:18 AM
Chromium	ND	0.0060		mg/L	1	2/24/2021 9:55:47 AM
Iron	1.2	0.25	*	mg/L	5	2/24/2021 9:57:18 AM
Magnesium	10	1.0		mg/L	1	2/24/2021 9:55:47 AM
Manganese	0.074	0.0020	*	mg/L	1	2/24/2021 9:55:47 AM
Nickel	ND	0.010		mg/L	1	2/24/2021 9:55:47 AM
Potassium	23	1.0		mg/L	1	2/24/2021 9:55:47 AM
Silver	ND	0.0050		mg/L	1	2/24/2021 9:55:47 AM
Sodium	3200	50		mg/L	50	2/24/2021 10:04:14 AM
Zinc	ND	0.010		mg/L	1	2/24/2021 9:55:47 AM
EPA 200.8: METALS						Analyst: bcv
Antimony	ND	0.0010		mg/L	1	3/4/2021 10:34:59 AM
Arsenic	0.015	0.0010	*	mg/L	1	3/4/2021 10:34:59 AM
Beryllium	ND	0.0010		mg/L	1	3/4/2021 12:57:52 PM
Cadmium	ND	0.00050		mg/L	1	3/4/2021 10:34:59 AM
Copper	ND	0.0010		mg/L	1	3/4/2021 10:34:59 AM
Lead	ND	0.00050		mg/L	1	3/4/2021 10:34:59 AM
Selenium	ND	0.0010		mg/L	1	3/4/2021 12:57:52 PM
Thallium	ND	0.00025		mg/L	1	3/4/2021 10:34:59 AM

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

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	D	Sample Diluted Due to Matrix
	H	Holding times for preparation or analysis exceeded
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	PQL	Practical Quantitative Limit
	S	% Recovery outside of range due to dilution or matrix

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Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA 200.8: METALS						Analyst: bcv
Uranium	ND	0.0025		mg/L	5	3/4/2021 1:05:04 PM
EPA METHOD 245.1: MERCURY						Analyst: ags
Mercury	ND	0.00020		mg/L	1	2/23/2021 2:20:59 PM
EPA METHOD 8270C: SEMIVOLATILES						Analyst: DAM
Acenaphthene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Acenaphthylene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Aniline	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Anthracene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Azobenzene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Benz(a)anthracene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Benzo(a)pyrene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Benzo(b)fluoranthene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Benzo(g,h,i)perylene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Benzo(k)fluoranthene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Benzoic acid	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Benzyl alcohol	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Bis(2-chloroethoxy)methane	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Bis(2-chloroethyl)ether	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Bis(2-chloroisopropyl)ether	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Bis(2-ethylhexyl)phthalate	ND	10		µg/L	1	3/1/2021 12:38:50 PM
4-Bromophenyl phenyl ether	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Butyl benzyl phthalate	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Carbazole	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
4-Chloro-3-methylphenol	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
4-Chloroaniline	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
2-Chloronaphthalene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
2-Chlorophenol	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
4-Chlorophenyl phenyl ether	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Chrysene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Di-n-butyl phthalate	ND	10		µg/L	1	3/1/2021 12:38:50 PM
Di-n-octyl phthalate	ND	10		µg/L	1	3/1/2021 12:38:50 PM
Dibenz(a,h)anthracene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Dibenzofuran	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
1,2-Dichlorobenzene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
1,3-Dichlorobenzene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
1,4-Dichlorobenzene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
3,3'-Dichlorobenzidine	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Diethyl phthalate	ND	10		µg/L	1	3/1/2021 12:38:50 PM

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	D	Sample Diluted Due to Matrix
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	S	% Recovery outside of range due to dilution or matrix

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Lab ID: 2102894-001

Matrix: AQUEOUS

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Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 8270C: SEMIVOLATILES						Analyst: DAM
Dimethyl phthalate	ND	10		µg/L	1	3/1/2021 12:38:50 PM
2,4-Dichlorophenol	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
2,4-Dimethylphenol	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
4,6-Dinitro-2-methylphenol	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
2,4-Dinitrophenol	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
2,4-Dinitrotoluene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
2,6-Dinitrotoluene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Fluoranthene	ND	10		µg/L	1	3/1/2021 12:38:50 PM
Fluorene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Hexachlorobenzene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Hexachlorobutadiene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Hexachlorocyclopentadiene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Hexachloroethane	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Indeno(1,2,3-cd)pyrene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Isophorone	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
1-Methylnaphthalene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
2-Methylnaphthalene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
2-Methylphenol	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
3+4-Methylphenol	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
N-Nitrosodi-n-propylamine	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
N-Nitrosodimethylamine	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
N-Nitrosodiphenylamine	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Naphthalene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
2-Nitroaniline	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
3-Nitroaniline	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
4-Nitroaniline	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Nitrobenzene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
2-Nitrophenol	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
4-Nitrophenol	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Pentachlorophenol	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Phenanthrene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Phenol	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Pyrene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Pyridine	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
1,2,4-Trichlorobenzene	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
2,4,5-Trichlorophenol	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
2,4,6-Trichlorophenol	ND	5.0		µg/L	1	3/1/2021 12:38:50 PM
Surr: 2-Fluorophenol	8.05	15-88.8	S	%Rec	1	3/1/2021 12:38:50 PM
Surr: Phenol-d5	27.2	15-71.9		%Rec	1	3/1/2021 12:38:50 PM

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Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 8270C: SEMIVOLATILES						Analyst: DAM
Surr: 2,4,6-Tribromophenol	2.66	15-97.4	S	%Rec	1	3/1/2021 12:38:50 PM
Surr: Nitrobenzene-d5	78.8	15-117		%Rec	1	3/1/2021 12:38:50 PM
Surr: 2-Fluorobiphenyl	84.0	15-100		%Rec	1	3/1/2021 12:38:50 PM
Surr: 4-Terphenyl-d14	104	15-120		%Rec	1	3/1/2021 12:38:50 PM
EPA METHOD 8260B: VOLATILES						Analyst: JMR
Benzene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
Toluene	2.2	1.0		µg/L	1	2/23/2021 2:18:33 PM
Ethylbenzene	1.6	1.0		µg/L	1	2/23/2021 2:18:33 PM
Methyl tert-butyl ether (MTBE)	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
1,2,4-Trimethylbenzene	2.2	1.0		µg/L	1	2/23/2021 2:18:33 PM
1,3,5-Trimethylbenzene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
1,2-Dichloroethane (EDC)	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
1,2-Dibromoethane (EDB)	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
Naphthalene	ND	2.0		µg/L	1	2/23/2021 2:18:33 PM
1-Methylnaphthalene	ND	4.0		µg/L	1	2/23/2021 2:18:33 PM
2-Methylnaphthalene	ND	4.0		µg/L	1	2/23/2021 2:18:33 PM
Acetone	15	10		µg/L	1	2/23/2021 2:18:33 PM
Bromobenzene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
Bromodichloromethane	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
Bromoform	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
Bromomethane	ND	3.0		µg/L	1	2/23/2021 2:18:33 PM
2-Butanone	ND	10		µg/L	1	2/23/2021 2:18:33 PM
Carbon disulfide	ND	10		µg/L	1	2/23/2021 2:18:33 PM
Carbon Tetrachloride	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
Chlorobenzene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
Chloroethane	ND	2.0		µg/L	1	2/23/2021 2:18:33 PM
Chloroform	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
Chloromethane	ND	3.0		µg/L	1	2/23/2021 2:18:33 PM
2-Chlorotoluene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
4-Chlorotoluene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
cis-1,2-DCE	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
cis-1,3-Dichloropropene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
1,2-Dibromo-3-chloropropane	ND	2.0		µg/L	1	2/23/2021 2:18:33 PM
Dibromochloromethane	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
Dibromomethane	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
1,2-Dichlorobenzene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
1,3-Dichlorobenzene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
1,4-Dichlorobenzene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
Dichlorodifluoromethane	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM

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1,1-Dichloroethane	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
1,1-Dichloroethene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
1,2-Dichloropropane	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
1,3-Dichloropropane	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
2,2-Dichloropropane	ND	2.0		µg/L	1	2/23/2021 2:18:33 PM
1,1-Dichloropropene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
Hexachlorobutadiene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
2-Hexanone	ND	10		µg/L	1	2/23/2021 2:18:33 PM
Isopropylbenzene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
4-Isopropyltoluene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
4-Methyl-2-pentanone	ND	10		µg/L	1	2/23/2021 2:18:33 PM
Methylene Chloride	ND	3.0		µg/L	1	2/23/2021 2:18:33 PM
n-Butylbenzene	ND	3.0		µg/L	1	2/23/2021 2:18:33 PM
n-Propylbenzene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
sec-Butylbenzene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
Styrene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
tert-Butylbenzene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
1,1,1,2-Tetrachloroethane	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
1,1,2,2-Tetrachloroethane	ND	2.0		µg/L	1	2/23/2021 2:18:33 PM
Tetrachloroethene (PCE)	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
trans-1,2-DCE	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
trans-1,3-Dichloropropene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
1,2,3-Trichlorobenzene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
1,2,4-Trichlorobenzene	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
1,1,1-Trichloroethane	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
1,1,2-Trichloroethane	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
Trichloroethene (TCE)	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
Trichlorofluoromethane	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
1,2,3-Trichloropropane	ND	2.0		µg/L	1	2/23/2021 2:18:33 PM
Vinyl chloride	ND	1.0		µg/L	1	2/23/2021 2:18:33 PM
Xylenes, Total	4.9	1.5		µg/L	1	2/23/2021 2:18:33 PM
Surr: 1,2-Dichloroethane-d4	90.7	70-130		%Rec	1	2/23/2021 2:18:33 PM
Surr: 4-Bromofluorobenzene	97.1	70-130		%Rec	1	2/23/2021 2:18:33 PM
Surr: Dibromofluoromethane	97.1	70-130		%Rec	1	2/23/2021 2:18:33 PM
Surr: Toluene-d8	101	70-130		%Rec	1	2/23/2021 2:18:33 PM

SM2510B: SPECIFIC CONDUCTANCE

Analyst: **JRR**

Conductivity	15000	50	µmhos/c	5	2/25/2021 11:14:28 AM
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SM2320B: ALKALINITY

Analyst: **MH**

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:	* Value exceeds Maximum Contaminant Level
D	Sample Diluted Due to Matrix
H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit
PQL	Practical Quantitative Limit
S	% Recovery outside of range due to dilution or matrix

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

Hall Environmental Analysis Laboratory, Inc.

Analytical Report

Lab Order **2102894**

Date Reported: **3/26/2021**

CLIENT: [REDACTED]

Client Sample ID: Eagle Springs

Project: NM DW Testing

Collection Date: 2/19/2021 9:57:00 AM

Lab ID: 2102894-001

Matrix: AQUEOUS

Received Date: 2/19/2021 1:10:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
SM2320B: ALKALINITY						Analyst: MH
Bicarbonate (As CaCO ₃)	146.6	20.00		mg/L Ca	1	2/22/2021 3:11:27 PM
Carbonate (As CaCO ₃)	ND	2.000		mg/L Ca	1	2/22/2021 3:11:27 PM
Total Alkalinity (as CaCO ₃)	146.6	20.00		mg/L Ca	1	2/22/2021 3:11:27 PM
SM2540C MOD: TOTAL DISSOLVED SOLIDS						Analyst: MH
Total Dissolved Solids	10200	20.0	*	mg/L	1	2/24/2021 8:40:00 AM

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

- * Value exceeds Maximum Contaminant Level
- D Sample Diluted Due to Matrix
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- PQL Practical Quantitative Limit
- S % Recovery outside of range due to dilution or matrix

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- J Analyte detected below quantitation limits
- P Sample pH Not In Range
- RL Reporting Limit

Hall Environmental Analysis Laboratory, Inc.

Analytical Report

Lab Order **2102894**

Date Reported: 3/26/2021

CLIENT: [REDACTED]

Client Sample ID: Trip Blank

Project: NM DW Testing

Collection Date:

Lab ID: 2102894-002

Matrix: TRIP BLANK

Received Date: 2/19/2021 1:10:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 8260B: VOLATILES						Analyst: JMR
Benzene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
Toluene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
Ethylbenzene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
Methyl tert-butyl ether (MTBE)	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
1,2,4-Trimethylbenzene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
1,3,5-Trimethylbenzene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
1,2-Dichloroethane (EDC)	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
1,2-Dibromoethane (EDB)	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
Naphthalene	ND	2.0		µg/L	1	2/23/2021 2:47:19 PM
1-Methylnaphthalene	ND	4.0		µg/L	1	2/23/2021 2:47:19 PM
2-Methylnaphthalene	ND	4.0		µg/L	1	2/23/2021 2:47:19 PM
Acetone	ND	10		µg/L	1	2/23/2021 2:47:19 PM
Bromobenzene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
Bromodichloromethane	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
Bromoform	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
Bromomethane	ND	3.0		µg/L	1	2/23/2021 2:47:19 PM
2-Butanone	ND	10		µg/L	1	2/23/2021 2:47:19 PM
Carbon disulfide	ND	10		µg/L	1	2/23/2021 2:47:19 PM
Carbon Tetrachloride	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
Chlorobenzene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
Chloroethane	ND	2.0		µg/L	1	2/23/2021 2:47:19 PM
Chloroform	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
Chloromethane	ND	3.0		µg/L	1	2/23/2021 2:47:19 PM
2-Chlorotoluene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
4-Chlorotoluene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
cis-1,2-DCE	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
cis-1,3-Dichloropropene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
1,2-Dibromo-3-chloropropane	ND	2.0		µg/L	1	2/23/2021 2:47:19 PM
Dibromochloromethane	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
Dibromomethane	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
1,2-Dichlorobenzene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
1,3-Dichlorobenzene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
1,4-Dichlorobenzene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
Dichlorodifluoromethane	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
1,1-Dichloroethane	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
1,1-Dichloroethene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
1,2-Dichloropropane	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
1,3-Dichloropropane	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
2,2-Dichloropropane	ND	2.0		µg/L	1	2/23/2021 2:47:19 PM

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

- * Value exceeds Maximum Contaminant Level
- D Sample Diluted Due to Matrix
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- PQL Practical Quantitative Limit
- S % Recovery outside of range due to dilution or matrix

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- J Analyte detected below quantitation limits
- P Sample pH Not In Range
- RL Reporting Limit

Hall Environmental Analysis Laboratory, Inc.

Analytical Report

Lab Order **2102894**

Date Reported: 3/26/2021

CLIENT: [REDACTED]

Client Sample ID: Trip Blank

Project: NM DW Testing

Collection Date:

Lab ID: 2102894-002

Matrix: TRIP BLANK

Received Date: 2/19/2021 1:10:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 8260B: VOLATILES						Analyst: JMR
1,1-Dichloropropene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
Hexachlorobutadiene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
2-Hexanone	ND	10		µg/L	1	2/23/2021 2:47:19 PM
Isopropylbenzene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
4-Isopropyltoluene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
4-Methyl-2-pentanone	ND	10		µg/L	1	2/23/2021 2:47:19 PM
Methylene Chloride	ND	3.0		µg/L	1	2/23/2021 2:47:19 PM
n-Butylbenzene	ND	3.0		µg/L	1	2/23/2021 2:47:19 PM
n-Propylbenzene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
sec-Butylbenzene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
Styrene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
tert-Butylbenzene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
1,1,1,2-Tetrachloroethane	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
1,1,2,2-Tetrachloroethane	ND	2.0		µg/L	1	2/23/2021 2:47:19 PM
Tetrachloroethene (PCE)	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
trans-1,2-DCE	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
trans-1,3-Dichloropropene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
1,2,3-Trichlorobenzene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
1,2,4-Trichlorobenzene	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
1,1,1-Trichloroethane	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
1,1,2-Trichloroethane	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
Trichloroethene (TCE)	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
Trichlorofluoromethane	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
1,2,3-Trichloropropane	ND	2.0		µg/L	1	2/23/2021 2:47:19 PM
Vinyl chloride	ND	1.0		µg/L	1	2/23/2021 2:47:19 PM
Xylenes, Total	ND	1.5		µg/L	1	2/23/2021 2:47:19 PM
Surr: 1,2-Dichloroethane-d4	88.2	70-130		%Rec	1	2/23/2021 2:47:19 PM
Surr: 4-Bromofluorobenzene	100	70-130		%Rec	1	2/23/2021 2:47:19 PM
Surr: Dibromofluoromethane	97.2	70-130		%Rec	1	2/23/2021 2:47:19 PM
Surr: Toluene-d8	101	70-130		%Rec	1	2/23/2021 2:47:19 PM

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:	*	Value exceeds Maximum Contaminant Level
	D	Sample Diluted Due to Matrix
	H	Holding times for preparation or analysis exceeded
	ND	Not Detected at the Reporting Limit
	PQL	Practical Quantitative Limit
	S	% Recovery outside of range due to dilution or matrix

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

March 26, 2021

Hall Environmental Analysis Laboratory

Sample Delivery Group: L1320608

Samples Received: 02/26/2021

Project Number:

Description:

Report To: Jackie Bolte

¹ Cp

² Tc

³ Ss

⁴ Cn

⁵ Sr

⁶ Qc

⁷ Gl

⁸ Al

⁹ Sc

Entire Report Reviewed By:



John Hawkins
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.

Pace Analytical National

12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

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¹ Cp
² Tc
³ Ss
⁴ Cn
⁵ Sr
⁶ Qc
⁷ Gl
⁸ Al
⁹ Sc

SAMPLE SUMMARY

210289-001F EAGLE SPRINGS L1320608-01 Non-Potable Water

Collected by

Collected date/time

Received date/time

02/19/21 09:57

02/26/21 10:20

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method 900	WG1629596	1	03/09/21 13:08	03/10/21 17:12	JMR	Mt. Ju iet, TN

¹Cp

²Tc

³Ss

210289-001G EAGLE SPRINGS L1320608-02 Non-Potable Water

Collected by

Collected date/time

Received date/time

02/19/21 09:57

02/26/21 10:20

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method 904	WG1635388	1	03/17/21 11:41	03/22/21 09:25	JMR	Mt. Ju iet, TN
Radiochemistry by Method SM7500Ra B M	WG1634705	1	03/15/21 14:26	03/16/21 16 08	RRE	Mt. Ju iet, TN

⁴Cn

⁵Sr

⁶Qc

⁷Gl

⁸Al

⁹Sc

CASE NARRATIVE

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All radiochemical sample results for solids are reported on a dry weight basis with the exception of tritium, carbon-14 and radon, unless wet weight was requested by the client. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



John Hawkins
Project Manager

¹Cp

²Tc

³Ss

⁴Cn

⁵Sr

⁶Qc

⁷Gl

⁸Al

⁹Sc

Radiochemistry by Method 900

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
GROSS ALPHA	-4.15	<u>U</u>	18.6	30.8	03/10/2021 17:12	WG1629596
GROSS BETA	-7.74	<u>U</u>	30.3	45.5	03/10/2021 17:12	WG1629596

¹Cp²Tc³Ss⁴Cn⁵Sr⁶Qc⁷Gl⁸Al⁹Sc

Radiochemistry by Method 904

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
RADIUM-228	3.61		0.415	0.71	03/22/2021 09:25	WG1635388
(T) Barium	102			62.0-143	03/22/2021 09:25	WG1635388
(T) Yttrium	105			79.0-136	03/22/2021 09:25	WG1635388

Radiochemistry by Method SM7500Ra B M

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
RADIUM-226	3.48		0.843	0.436	03/16/2021 16:08	WG1634705
(T) Barium-133	71.4			30.0-143	03/16/2021 16:08	WG1634705

¹ Cp² Tc³ Ss⁴ Cn⁵ Sr⁶ Qc⁷ Gl⁸ Al⁹ Sc

Method Blank (MB)

(MB) R3629708-5 03/10/21 17:12

Analyte	MB Result pCi/l	MB Qualifier	MB MDA pCi/l
GROSS ALPHA	0.0448	U	0.466
GROSS BETA	-0.750	U	1.26

L1318552-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1318552-01 03/10/21 17:12 • (DUP) R3629708-4 03/10/21 13:49

Analyte	Original Resu t pCi/l	DUP Result pCi/l	Dilution	DUP RPD %	DUP RER	DUP Qua ifier	DUP RPD Limits %	DUP RER Limit
GROSS ALPHA	3.32	5.69	1	52.5	0.927		20	3
GROSS BETA	1.82	1.74	1	4.45	0.0333	J	20	3

Laboratory Control Sample (LCS)

(LCS) R3629708-1 03/10/21 13:49

Analyte	Spike Amount pCi/l	LCS Resu t pCi/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
GROSS ALPHA	15.0	14.9	99.1	80.0-120	
GROSS BETA	32.3	30.6	94.8	80.0-120	

L1318494-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1318494-01 03/10/21 13:49 • (MS) R3629708-2 03/10/21 13:49 • (MSD) R3629708-3 03/10/21 13:49

Analyte	Spike Amount pCi/l	Original Resu t pCi/l	MS Resu t pCi/l	MSD Result pCi/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qua ifier	RPD %	MS RER	RPD Limits %
GROSS ALPHA	18.8	0.898	15.7	15.8	78.9	79.5	1	70.0-130			0.697		20
GROSS BETA	40.4	-0.948	43.0	46.8	106	116	1	70.0-130			8.33		20

¹Cp

²Tc

³Ss

⁴Cn

⁵Sr

⁶Qc

⁷Gl

⁸Al

⁹Sc

Method Blank (MB)

(MB) R3634683-1 03/22/21 09:25

Analyte	MB Result pCi/l	MB Qualifier	MB MDA pCi/l
Radium-228	-0.442	U	0.455
(T) Barium	105		
(T) Yttrium	102		

1
Cp

2
Tc

3
Ss

4
Cn

5
Sr

6
Qc

7
Gl

8
Al

9
Sc

L1320778-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1320778-01 03/22/21 09:25 • (DUP) R3634683-5 03/22/21 09:25

Analyte	Original Resu t pCi/l	DUP Result pCi/l	Dilution	DUP RPD %	DUP RER	DUP Qua ifier	DUP RPD Limits %	DUP RER Limit
Radium-228	1.06	0.761	1	33.0	0.503	J	20	3
(T) Barium	96.8	99.3						
(T) Yttrium	110	109						

Laboratory Control Sample (LCS)

(LCS) R3634683-2 03/22/21 09:25

Analyte	Spike Amount pCi/l	LCS Resu t pCi/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Radium-228	5.00	5.66	113	80.0-120	
(T) Barium			99.4		
(T) Yttrium			110		

L1320780-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1320780-01 03/22/21 09:25 • (MS) R3634683-3 03/22/21 09:25 • (MSD) R3634683-4 03/22/21 09:25

Analyte	Spike Amount pCi/l	Original Resu t pCi/l	MS Resu t pCi/l	MSD Result pCi/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qua ifier	RPD %	MS RER	RPD Limits %
Radium-228	10.0	1.27	11.6	12.1	103	108	1	70.0-130			4.15		20
(T) Barium		97.1			96.3	92.0							
(T) Yttrium		107			91.2	105							

Method Blank (MB)

(MB) R3633093-1 03/16/21 16:08

Analyte	MB Result pCi/l	MB Qualifier	MB MDA pCi/l
Radium-226	-0.00647	U	0.0815
(T) Barium-133	88.4		

L1324512-13 Original Sample (OS) • Duplicate (DUP)

(OS) L1324512-13 03/16/21 17:08 • (DUP) R3633093-5 03/16/21 16:08

Analyte	Original Resu t pCi/l	DUP Result pCi/l	Dilution	DUP RPD %	DUP RER	DUP Qua ifier	DUP RPD Limits %	DUP RER Limit
Radium-226	0.196	0.271	1	31.9	0.203	J	20	3
(T) Barium-133	76.1	82.3						

Laboratory Control Sample (LCS)

(LCS) R3633093-2 03/16/21 16:08

Analyte	Spike Amount pCi/l	LCS Resu t pCi/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Radium-226	5.02	5.47	109	80.0-120	
(T) Barium-133			94.1		

L1324512-12 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1324512-12 03/16/21 17:08 • (MS) R3633093-3 03/16/21 16:08 • (MSD) R3633093-4 03/16/21 16:08

Analyte	Spike Amount pCi/l	Original Resu t pCi/l	MS Resu t pCi/l	MSD Result pCi/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qua ifier	RPD %	MS RER	RPD Limits %
Radium-226	20.1	0.503	21.3	25.3	104	123	1	75.0-125			17.2		20
(T) Barium-133		76.9			95.2	88.9							

1Cp

2Tc

3Ss

4Cn

5Sr

6Qc

7Gl

8Al

9Sc

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDA	Minimum Detectable Activity.
Rec.	Recovery.
RER	Replicate Error Ratio.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(T)	Tracer - A radioisotope of known concentration added to a solution of chemically equivalent radioisotopes at a known concentration to assist in monitoring the yield of the chemical separation.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state "ND" (Not Detected) or "BDL" (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier Description

J	The identification of the analyte is acceptable; the reported value is an estimate.
U	Below Detectable Limits: Indicates that the analyte was not detected.

¹ Cp

² Tc

³ Ss

⁴ Cn

⁵ Sr

⁶ Qc

⁷ GI

⁸ AI

⁹ Sc

ACCREDITATIONS & LOCATIONS

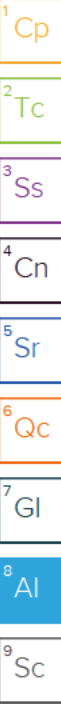
Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey--NELAP	TN002
California	2932	New Mexico ¹	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina ¹	DW21704
Georgia	NELAP	North Carolina ³	41
Georgia ¹	923	North Dakota	R-140
Idaho	TN00003	Ohio--VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LA000356
Kentucky ^{1 6}	KY90010	South Carolina	84004002
Kentucky ²	16	South Dakota	n/a
Louisiana	AI30792	Tennessee ^{1 4}	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas ⁵	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA -- ISO 17025	1461.01	AIHA-LAP, LLC EMLAP	100789
A2LA -- ISO 17025 ⁵	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA--Crypto	TN00003		

¹ Drinking Water ² Underground Storage Tanks ³ Aquatic Toxicity ⁴ Chemical/Microbiological ⁵ Mold ⁶ Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.



G241

SUB CONTRACTOR: Pace TN		COMPANY: PACE TN		PHONE: (800) 767-5859		FAX: (615) 758-5859	
ADDRESS: 12065 Lebanon Rd				ACCOUNT #:		EMAIL:	
CITY, STATE, ZIP: Mt. Juliet, TN 37122							
ITEM	SAMPLE	CLIENT SAMPLE ID	BOTTLE TYPE	MATRIX	COLLECTION DATE	# CONTAINERS	ANALYTICAL COMMENTS
1	2102894-001F	Eagle Springs	1LHDPEHNO	Aqueous	2/19/2021 9:57:00 AM	2	Gross Alpha/Beta GW <2 1320608-01
2	2102894-001G	Eagle Springs	1LHDPEHNO	Aqueous	2/19/2021 9:57:00 AM	2	Ra 226/228 GW <2 02

Sample Receipt Checklist

COC Seal Present/Intact: ☒ Y ☐ N If Applicable
 COC Signed/Accurate: ☒ Y ☐ N VOA Zero Headspace: ☐ Y ☒ N
 Bottles arrive intact: ☒ Y ☐ N Pres. Correct/Check: ☒ Y ☐ N
 Correct bottles used: ☒ Y ☐ N
 Sufficient volume sent: ☒ Y ☐ N
 RAD Screen <0.5 mR/hr: ☒ Y ☐ N

SPECIAL INSTRUCTIONS / COMMENTS:

Please include the LAB ID and the CLIENT SAMPLE ID on all final reports. Please e-mail results to lab@hallenvironmental.com. Please return all coolers and blue ice. Thank you.

Relinquished By: <i>[Signature]</i>	Date: 2/19/2021	Time: 1:53 PM	Received By: <i>Paula Miller</i>	Date: 2/24/21	Time: 10:20	REPORT TRANSMITTAL DESIRED: <input type="checkbox"/> HARDCOPY (extra cost) <input type="checkbox"/> FAX <input type="checkbox"/> EMAIL <input type="checkbox"/> ONLINE FOR LAB USE ONLY Temp of samples: 48-124.742 Attempt to Cool? Comments: <i>COCST</i>
Relinquished By:	Date:	Time:	Received By:	Date:	Time:	
Relinquished By:	Date:	Time:	Received By:	Date:	Time:	
TAT: Standard <input checked="" type="checkbox"/> RUSH <input type="checkbox"/> Next BD <input type="checkbox"/> 2nd BD <input type="checkbox"/> 3rd BD <input type="checkbox"/>						

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2102894

26-Mar-21

Client: XXXXXXXXXX
Project: NM DW Testing

Sample ID: MB-58277	SampType: MBLK	TestCode: EPA Method 200.7: Metals
Client ID: PBW	Batch ID: 58277	RunNo: 75498
Prep Date: 2/23/2021	Analysis Date: 2/24/2021	SeqNo: 2668198 Units: mg/L

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	ND	0.020								
Barium	ND	0.0030								
Boron	ND	0.040								
Calcium	ND	1.0								
Chromium	ND	0.0060								
Iron	ND	0.050								
Magnesium	ND	1.0								
Manganese	ND	0.0020								
Nickel	ND	0.010								
Potassium	ND	1.0								
Silver	ND	0.0050								
Sodium	ND	1.0								
Zinc	ND	0.010								

Sample ID: LLCS-58277	SampType: LCSLL	TestCode: EPA Method 200.7: Metals
Client ID: BatchQC	Batch ID: 58277	RunNo: 75498
Prep Date: 2/23/2021	Analysis Date: 2/24/2021	SeqNo: 2668200 Units: mg/L

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	ND	0.020	0.01000	0	135	50	150			
Barium	ND	0.0030	0.002000	0	129	50	150			
Boron	0.043	0.040	0.04000	0	106	50	150			
Calcium	ND	1.0	0.5000	0	104	50	150			
Chromium	ND	0.0060	0.006000	0	97.7	50	150			
Iron	ND	0.050	0.02000	0	123	50	150			
Magnesium	ND	1.0	0.5000	0	102	50	150			
Manganese	0.0021	0.0020	0.002000	0	105	50	150			
Nickel	ND	0.010	0.005000	0	118	50	150			
Potassium	ND	1.0	0.5000	0	98.2	50	150			
Sodium	ND	1.0	0.5000	0	106	50	150			
Zinc	0.012	0.010	0.01000	0	116	50	150			

Sample ID: LCS-58277	SampType: LCS	TestCode: EPA Method 200.7: Metals
Client ID: LCSW	Batch ID: 58277	RunNo: 75498
Prep Date: 2/23/2021	Analysis Date: 2/24/2021	SeqNo: 2668202 Units: mg/L

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	0.57	0.020	0.5000	0	113	85	115			
Barium	0.52	0.0030	0.5000	0	105	85	115			
Boron	0.56	0.040	0.5000	0	111	85	115			

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2102894

26-Mar-21

Client: XXXXXXXXXX
Project: NM DW Testing

Sample ID: LCS-58277	SampType: LCS		TestCode: EPA Method 200.7: Metals							
Client ID: LCSW	Batch ID: 58277		RunNo: 75498							
Prep Date: 2/23/2021	Analysis Date: 2/24/2021		SeqNo: 2668202		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	51	1.0	50.00	0	101	85	115			
Chromium	0.53	0.0060	0.5000	0	105	85	115			
Iron	0.50	0.050	0.5000	0	101	85	115			
Magnesium	51	1.0	50.00	0	102	85	115			
Manganese	0.51	0.0020	0.5000	0	102	85	115			
Nickel	0.51	0.010	0.5000	0	102	85	115			
Potassium	52	1.0	50.00	0	104	85	115			
Silver	0.12	0.0050	0.1000	0	116	85	115			S
Sodium	52	1.0	50.00	0	104	85	115			
Zinc	0.52	0.010	0.5000	0	104	85	115			

Sample ID: LLCS-58277	SampType: LCSLL		TestCode: EPA Method 200.7: Metals							
Client ID: BatchQC	Batch ID: 58277		RunNo: 75498							
Prep Date: 2/23/2021	Analysis Date: 2/24/2021		SeqNo: 2668237		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Silver	0.0050	0.0050	0.005000	0	101	50	150			

Sample ID: MB-58277	SampType: MBLK		TestCode: EPA Method 200.7: Metals							
Client ID: PBW	Batch ID: 58277		RunNo: 75525							
Prep Date: 2/23/2021	Analysis Date: 2/25/2021		SeqNo: 2669608		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Silver	ND	0.0050								

Sample ID: LLCS-58277	SampType: LCSLL		TestCode: EPA Method 200.7: Metals							
Client ID: BatchQC	Batch ID: 58277		RunNo: 75525							
Prep Date: 2/23/2021	Analysis Date: 2/25/2021		SeqNo: 2669609		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Silver	0.0057	0.0050	0.005000	0	113	50	150			

Sample ID: LCS-58277	SampType: LCS		TestCode: EPA Method 200.7: Metals							
Client ID: LCSW	Batch ID: 58277		RunNo: 75525							
Prep Date: 2/23/2021	Analysis Date: 2/25/2021		SeqNo: 2669610		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Silver	0.10	0.0050	0.1000	0	104	85	115			

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2102894

26-Mar-21

Client: XXXXXXXXXX
Project: NM DW Testing

Sample ID: MB-58277	SampType: MBLK	TestCode: EPA 200.8: Metals
Client ID: PBW	Batch ID: 58277	RunNo: 75535
Prep Date: 2/23/2021	Analysis Date: 2/25/2021	SeqNo: 2669885 Units: mg/L

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Antimony	ND	0.0010								
Arsenic	ND	0.0010								
Beryllium	ND	0.0010								
Cadmium	ND	0.00050								
Copper	ND	0.0010								
Lead	ND	0.00050								
Selenium	ND	0.0010								
Thallium	ND	0.00025								
Uranium	ND	0.00050								

Sample ID: MSLLCS-58277	SampType: LCSLL	TestCode: EPA 200.8: Metals
Client ID: BatchQC	Batch ID: 58277	RunNo: 75535
Prep Date: 2/23/2021	Analysis Date: 2/25/2021	SeqNo: 2669886 Units: mg/L

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Antimony	ND	0.0010	0.001000	0	79.1	50	150			
Arsenic	ND	0.0010	0.001000	0	84.4	50	150			
Beryllium	ND	0.0010	0.001000	0	89.7	50	150			
Cadmium	ND	0.00050	0.0005000	0	98.9	50	150			
Copper	ND	0.0010	0.001000	0	97.1	50	150			
Lead	ND	0.00050	0.0005000	0	98.7	50	150			
Selenium	0.0010	0.0010	0.001000	0	103	50	150			
Uranium	ND	0.00050	0.0005000	0	92.5	50	150			

Sample ID: MSLCS-58277	SampType: LCS	TestCode: EPA 200.8: Metals
Client ID: LCSW	Batch ID: 58277	RunNo: 75535
Prep Date: 2/23/2021	Analysis Date: 2/25/2021	SeqNo: 2669887 Units: mg/L

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Antimony	0.025	0.0010	0.02500	0	101	85	115			
Arsenic	0.025	0.0010	0.02500	0	98.2	85	115			
Beryllium	0.026	0.0010	0.02500	0	104	85	115			
Cadmium	0.012	0.00050	0.01250	0	99.8	85	115			
Copper	0.024	0.0010	0.02500	0	97.2	85	115			
Lead	0.012	0.00050	0.01250	0	97.0	85	115			
Selenium	0.024	0.0010	0.02500	0	95.0	85	115			
Thallium	0.012	0.00025	0.01250	0	97.1	85	115			
Uranium	0.012	0.00050	0.01250	0	95.3	85	115			

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2102894

26-Mar-21

Client: XXXXXXXXXX
Project: NM DW Testing

Sample ID: MSLLCS-TL-58277		SampType: LCSLL		TestCode: EPA 200.8: Metals						
Client ID: BatchQC		Batch ID: 58277		RunNo: 75535						
Prep Date: 2/23/2021		Analysis Date: 2/25/2021		SeqNo: 2669893		Units: mg/L				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Thallium	ND	0.00025	0.0002500	0	94.9	50	150			

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2102894

26-Mar-21

Client: XXXXXXXXXX
Project: NM DW Testing

Sample ID: MB-58270		SampType: MBLK		TestCode: EPA Method 245.1: Mercury						
Client ID: PBW		Batch ID: 58270		RunNo: 75476						
Prep Date: 2/23/2021		Analysis Date: 2/23/2021		SeqNo: 2667246		Units: mg/L				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	ND	0.00020								

Sample ID: LL LCS-58270		SampType: LCSLL		TestCode: EPA Method 245.1: Mercury						
Client ID: BatchQC		Batch ID: 58270		RunNo: 75476						
Prep Date: 2/23/2021		Analysis Date: 2/23/2021		SeqNo: 2667247		Units: mg/L				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	ND	0.00020	0.0001500	0	73.4	50	150			

Sample ID: LCS-58270		SampType: LCS		TestCode: EPA Method 245.1: Mercury						
Client ID: LCSW		Batch ID: 58270		RunNo: 75476						
Prep Date: 2/23/2021		Analysis Date: 2/23/2021		SeqNo: 2667248		Units: mg/L				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.0048	0.00020	0.005000	0	96.5	85	115			

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2102894

26-Mar-21

Client: XXXXXXXXXX
Project: NM DW Testing

Sample ID: MB	SampType: mblk	TestCode: EPA Method 300.0: Anions								
Client ID: PBW	Batch ID: R75434	RunNo: 75434								
Prep Date:	Analysis Date: 2/19/2021	SeqNo: 2665600		Units: mg/L						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	ND	0.10								
Nitrogen, Nitrite (As N)	ND	0.10								
Bromide	ND	0.10								
Nitrogen, Nitrate (As N)	ND	0.10								
Phosphorus, Orthophosphate (As P)	ND	0.50								

Sample ID: LCS	SampType: lcs	TestCode: EPA Method 300.0: Anions								
Client ID: LCSW	Batch ID: R75434	RunNo: 75434								
Prep Date:	Analysis Date: 2/19/2021	SeqNo: 2665601		Units: mg/L						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	0.51	0.10	0.5000	0	102	90	110			
Nitrogen, Nitrite (As N)	0.98	0.10	1.000	0	98.3	90	110			
Bromide	2.5	0.10	2.500	0	98.4	90	110			
Nitrogen, Nitrate (As N)	2.5	0.10	2.500	0	101	90	110			
Phosphorus, Orthophosphate (As P)	4.7	0.50	5.000	0	94.7	90	110			

Sample ID: 2102894-001DMS	SampType: ms	TestCode: EPA Method 300.0: Anions								
Client ID: Eagle Springs	Batch ID: R75434	RunNo: 75434								
Prep Date:	Analysis Date: 2/19/2021	SeqNo: 2665627		Units: mg/L						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Nitrite (As N)	0.81	0.10	1.000	0	80.7	75.5	113			
Bromide	2.8	0.10	2.500	0.5126	92.5	85.9	106			
Nitrogen, Nitrate (As N)	2.3	0.10	2.500	0.03540	92.0	86.8	110			

Sample ID: 2102894-001DMSD	SampType: msd	TestCode: EPA Method 300.0: Anions								
Client ID: Eagle Springs	Batch ID: R75434	RunNo: 75434								
Prep Date:	Analysis Date: 2/19/2021	SeqNo: 2665628		Units: mg/L						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Nitrite (As N)	0.81	0.10	1.000	0	80.6	75.5	113	0.149	20	
Bromide	2.9	0.10	2.500	0.5126	95.0	85.9	106	2.19	20	
Nitrogen, Nitrate (As N)	2.3	0.10	2.500	0.03540	92.4	86.8	110	0.440	20	

Sample ID: MB	SampType: mblk	TestCode: EPA Method 300.0: Anions								
Client ID: PBW	Batch ID: R75454	RunNo: 75454								
Prep Date:	Analysis Date: 2/22/2021	SeqNo: 2666659		Units: mg/L						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2102894

26-Mar-21

Client: XXXXXXXXXX
Project: NM DW Testing

Sample ID: MB	SampType: mblk	TestCode: EPA Method 300.0: Anions								
Client ID: PBW	Batch ID: R75454	RunNo: 75454								
Prep Date:	Analysis Date: 2/22/2021	SeqNo: 2666659	Units: mg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	ND	0.50								
Sulfate	ND	0.50								

Sample ID: LCS	SampType: lcs	TestCode: EPA Method 300.0: Anions								
Client ID: LCSW	Batch ID: R75454	RunNo: 75454								
Prep Date:	Analysis Date: 2/22/2021	SeqNo: 2666660	Units: mg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	4.8	0.50	5.000	0	95.7	90	110			
Sulfate	9.9	0.50	10.00	0	98.7	90	110			

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2102894

26-Mar-21

Client: XXXXXXXXXX
Project: NM DW Testing

Sample ID: MB-58232	SampType: MBLK	TestCode: EPA Method 8015M/D: Diesel Range								
Client ID: PBW	Batch ID: 58232	RunNo: 75467								
Prep Date: 2/22/2021	Analysis Date: 2/23/2021	SeqNo: 2667073			Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	ND	1.0								
Motor Oil Range Organics (MRO)	ND	5.0								
Surr: DNOP	1.1		1.000		112	63.7	164			

Sample ID: LCS-58232	SampType: LCS	TestCode: EPA Method 8015M/D: Diesel Range								
Client ID: LCSW	Batch ID: 58232	RunNo: 75467								
Prep Date: 2/22/2021	Analysis Date: 2/23/2021	SeqNo: 2667074			Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	5.3	1.0	5.000	0	105	70	130			
Surr: DNOP	0.54		0.5000		108	63.7	164			

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2102894

26-Mar-21

Client: XXXXXXXXXX
Project: NM DW Testing

Sample ID: 2.5 GRO LCS	SampType: LCS		TestCode: EPA Method 8015D: Gasoline Range							
Client ID: LCSW	Batch ID: R75423		RunNo: 75423							
Prep Date:	Analysis Date: 2/19/2021		SeqNo: 2665188		Units: %Rec					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: BFB	21		20.00		103	66.7	119			

Sample ID: MB	SampType: MBLK		TestCode: EPA Method 8015D: Gasoline Range							
Client ID: PBW	Batch ID: R75423		RunNo: 75423							
Prep Date:	Analysis Date: 2/19/2021		SeqNo: 2665189		Units: %Rec					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: BFB	18		20.00		91.9	66.7	119			

Sample ID: 2.5 ug GRO lcs	SampType: LCS		TestCode: EPA Method 8015D: Gasoline Range							
Client ID: LCSW	Batch ID: R75442		RunNo: 75442							
Prep Date:	Analysis Date: 2/20/2021		SeqNo: 2665893		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	0.51	0.050	0.5000	0	102	72.5	114			
Surr: BFB	20		20.00		100	66.7	119			

Sample ID: MB	SampType: MBLK		TestCode: EPA Method 8015D: Gasoline Range							
Client ID: PBW	Batch ID: R75442		RunNo: 75442							
Prep Date:	Analysis Date: 2/20/2021		SeqNo: 2665894		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	0.050								
Surr: BFB	19		20.00		93.3	66.7	119			

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2102894

26-Mar-21

Client: XXXXXXXXXX
Project: NM DW Testing

Sample ID: 100ng lcs	SampType: LCS			TestCode: EPA Method 8260B: VOLATILES						
Client ID: LCSW	Batch ID: R75496			RunNo: 75496						
Prep Date:	Analysis Date: 2/23/2021			SeqNo: 2668162			Units: µg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	19	1.0	20.00	0	92.7	70	130			
Toluene	19	1.0	20.00	0	96.5	70	130			
Chlorobenzene	20	1.0	20.00	0	101	70	130			
1,1-Dichloroethene	18	1.0	20.00	0	89.6	70	130			
Trichloroethene (TCE)	16	1.0	20.00	0	78.5	70	130			
Surr: 1,2-Dichloroethane-d4	9.3		10.00		92.8	70	130			
Surr: 4-Bromofluorobenzene	9.5		10.00		94.5	70	130			
Surr: Dibromofluoromethane	9.1		10.00		90.7	70	130			
Surr: Toluene-d8	10		10.00		102	70	130			

Sample ID: mb1	SampType: MBLK			TestCode: EPA Method 8260B: VOLATILES						
Client ID: PBW	Batch ID: R75496			RunNo: 75496						
Prep Date:	Analysis Date: 2/23/2021			SeqNo: 2668163			Units: µg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Methyl tert-butyl ether (MTBE)	ND	1.0								
1,2,4-Trimethylbenzene	ND	1.0								
1,3,5-Trimethylbenzene	ND	1.0								
1,2-Dichloroethane (EDC)	ND	1.0								
1,2-Dibromoethane (EDB)	ND	1.0								
Naphthalene	ND	2.0								
1-Methylnaphthalene	ND	4.0								
2-Methylnaphthalene	ND	4.0								
Acetone	ND	10								
Bromobenzene	ND	1.0								
Bromodichloromethane	ND	1.0								
Bromoform	ND	1.0								
Bromomethane	ND	3.0								
2-Butanone	ND	10								
Carbon disulfide	ND	10								
Carbon Tetrachloride	ND	1.0								
Chlorobenzene	ND	1.0								
Chloroethane	ND	2.0								
Chloroform	ND	1.0								
Chloromethane	ND	3.0								
2-Chlorotoluene	ND	1.0								

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2102894

26-Mar-21

Client: XXXXXXXXXX
Project: NM DW Testing

Sample ID: mb1	SampType: MBLK	TestCode: EPA Method 8260B: VOLATILES								
Client ID: PBW	Batch ID: R75496	RunNo: 75496								
Prep Date:	Analysis Date: 2/23/2021	SeqNo: 2668163	Units: µg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
4-Chlorotoluene	ND	1.0								
cis-1,2-DCE	ND	1.0								
cis-1,3-Dichloropropene	ND	1.0								
1,2-Dibromo-3-chloropropane	ND	2.0								
Dibromochloromethane	ND	1.0								
Dibromomethane	ND	1.0								
1,2-Dichlorobenzene	ND	1.0								
1,3-Dichlorobenzene	ND	1.0								
1,4-Dichlorobenzene	ND	1.0								
Dichlorodifluoromethane	ND	1.0								
1,1-Dichloroethane	ND	1.0								
1,1-Dichloroethene	ND	1.0								
1,2-Dichloropropane	ND	1.0								
1,3-Dichloropropane	ND	1.0								
2,2-Dichloropropane	ND	2.0								
1,1-Dichloropropene	ND	1.0								
Hexachlorobutadiene	ND	1.0								
2-Hexanone	ND	10								
Isopropylbenzene	ND	1.0								
4-Isopropyltoluene	ND	1.0								
4-Methyl-2-pentanone	ND	10								
Methylene Chloride	ND	3.0								
n-Butylbenzene	ND	3.0								
n-Propylbenzene	ND	1.0								
sec-Butylbenzene	ND	1.0								
Styrene	ND	1.0								
tert-Butylbenzene	ND	1.0								
1,1,1,2-Tetrachloroethane	ND	1.0								
1,1,2,2-Tetrachloroethane	ND	2.0								
Tetrachloroethene (PCE)	ND	1.0								
trans-1,2-DCE	ND	1.0								
trans-1,3-Dichloropropene	ND	1.0								
1,2,3-Trichlorobenzene	ND	1.0								
1,2,4-Trichlorobenzene	ND	1.0								
1,1,1-Trichloroethane	ND	1.0								
1,1,2-Trichloroethane	ND	1.0								
Trichloroethene (TCE)	ND	1.0								
Trichlorofluoromethane	ND	1.0								
1,2,3-Trichloropropane	ND	2.0								

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2102894

26-Mar-21

Client: XXXXXXXXXX
Project: NM DW Testing

Sample ID: mb1	SampType: MBLK	TestCode: EPA Method 8260B: VOLATILES								
Client ID: PBW	Batch ID: R75496	RunNo: 75496								
Prep Date:	Analysis Date: 2/23/2021	SeqNo: 2668163	Units: µg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Vinyl chloride	ND	1.0								
Xylenes, Total	ND	1.5								
Surr: 1,2-Dichloroethane-d4	8.7		10.00		86.9	70	130			
Surr: 4-Bromofluorobenzene	10		10.00		103	70	130			
Surr: Dibromofluoromethane	9.6		10.00		95.9	70	130			
Surr: Toluene-d8	10		10.00		101	70	130			

Qualifiers:

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E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2102894

26-Mar-21

Client: XXXXXXXXXX
Project: NM DW Testing

Sample ID: mb-58272	SampType: MBLK	TestCode: EPA Method 8270C: Semivolatiles								
Client ID: PBW	Batch ID: 58272	RunNo: 75611								
Prep Date: 2/23/2021	Analysis Date: 3/1/2021	SeqNo: 2673469	Units: µg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Acenaphthene	ND	5.0								
Acenaphthylene	ND	5.0								
Aniline	ND	5.0								
Anthracene	ND	5.0								
Azobenzene	ND	5.0								
Benz(a)anthracene	ND	5.0								
Benzo(a)pyrene	ND	5.0								
Benzo(b)fluoranthene	ND	5.0								
Benzo(g,h,i)perylene	ND	5.0								
Benzo(k)fluoranthene	ND	5.0								
Benzoic acid	ND	5.0								
Benzyl alcohol	ND	5.0								
Bis(2-chloroethoxy)methane	ND	5.0								
Bis(2-chloroethyl)ether	ND	5.0								
Bis(2-chloroisopropyl)ether	ND	5.0								
Bis(2-ethylhexyl)phthalate	ND	10								
4-Bromophenyl phenyl ether	ND	5.0								
Butyl benzyl phthalate	ND	5.0								
Carbazole	ND	5.0								
4-Chloro-3-methylphenol	ND	5.0								
4-Chloroaniline	ND	5.0								
2-Chloronaphthalene	ND	5.0								
2-Chlorophenol	ND	5.0								
4-Chlorophenyl phenyl ether	ND	5.0								
Chrysene	ND	5.0								
Di-n-butyl phthalate	ND	10								
Di-n-octyl phthalate	ND	10								
Dibenz(a,h)anthracene	ND	5.0								
Dibenzofuran	ND	5.0								
1,2-Dichlorobenzene	ND	5.0								
1,3-Dichlorobenzene	ND	5.0								
1,4-Dichlorobenzene	ND	5.0								
3,3'-Dichlorobenzidine	ND	5.0								
Diethyl phthalate	ND	10								
Dimethyl phthalate	ND	10								
2,4-Dichlorophenol	ND	5.0								
2,4-Dimethylphenol	ND	5.0								
4,6-Dinitro-2-methylphenol	ND	5.0								
2,4-Dinitrophenol	ND	5.0								

Qualifiers:

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D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2102894

26-Mar-21

Client: XXXXXXXXXX
Project: NM DW Testing

Sample ID: mb-58272	SampType: MBLK	TestCode: EPA Method 8270C: Semivolatiles								
Client ID: PBW	Batch ID: 58272	RunNo: 75611								
Prep Date: 2/23/2021	Analysis Date: 3/1/2021	SeqNo: 2673469	Units: µg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
2,4-Dinitrotoluene	ND	5.0								
2,6-Dinitrotoluene	ND	5.0								
Fluoranthene	ND	10								
Fluorene	ND	5.0								
Hexachlorobenzene	ND	5.0								
Hexachlorobutadiene	ND	5.0								
Hexachlorocyclopentadiene	ND	5.0								
Hexachloroethane	ND	5.0								
Indeno(1,2,3-cd)pyrene	ND	5.0								
Isophorone	ND	5.0								
1-Methylnaphthalene	ND	5.0								
2-Methylnaphthalene	ND	5.0								
2-Methylphenol	ND	5.0								
3+4-Methylphenol	ND	5.0								
N-Nitrosodi-n-propylamine	ND	5.0								
N-Nitrosodimethylamine	ND	5.0								
N-Nitrosodiphenylamine	ND	5.0								
Naphthalene	ND	5.0								
2-Nitroaniline	ND	5.0								
3-Nitroaniline	ND	5.0								
4-Nitroaniline	ND	5.0								
Nitrobenzene	ND	5.0								
2-Nitrophenol	ND	5.0								
4-Nitrophenol	ND	5.0								
Pentachlorophenol	ND	5.0								
Phenanthrene	ND	5.0								
Phenol	ND	5.0								
Pyrene	ND	5.0								
Pyridine	ND	5.0								
1,2,4-Trichlorobenzene	ND	5.0								
2,4,5-Trichlorophenol	ND	5.0								
2,4,6-Trichlorophenol	ND	5.0								
Surr: 2-Fluorophenol	90		200.0		45.2	15	88.8			
Surr: Phenol-d5	71		200.0		35.4	15	71.9			
Surr: 2,4,6-Tribromophenol	93		200.0		46.5	15	97.4			
Surr: Nitrobenzene-d5	57		100.0		56.7	15	117			
Surr: 2-Fluorobiphenyl	55		100.0		55.4	15	100			
Surr: 4-Terphenyl-d14	96		100.0		95.7	15	120			

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2102894

26-Mar-21

Client: XXXXXXXXXX
Project: NM DW Testing

Sample ID: lcs-58272	SampType: LCS			TestCode: EPA Method 8270C: Semivolatiles						
Client ID: LCSW	Batch ID: 58272			RunNo: 75611						
Prep Date: 2/23/2021	Analysis Date: 3/1/2021			SeqNo: 2673470		Units: µg/L				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Acenaphthene	70	5.0	100.0	0	70.5	23.1	103			
4-Chloro-3-methylphenol	130	5.0	200.0	0	67.4	27.5	113			
2-Chlorophenol	140	5.0	200.0	0	68.1	17.9	103			
1,4-Dichlorobenzene	58	5.0	100.0	0	58.1	15	79.9			
2,4-Dinitrotoluene	61	5.0	100.0	0	61.5	22.9	97.2			
N-Nitrosodi-n-propylamine	61	5.0	100.0	0	61.0	34.1	104			
4-Nitrophenol	100	5.0	200.0	0	52.0	20	78.8			
Pentachlorophenol	140	5.0	200.0	0	69.1	26.8	97.6			
Phenol	86	5.0	200.0	0	42.8	15	66.2			
Pyrene	97	5.0	100.0	0	97.1	41.2	114			
1,2,4-Trichlorobenzene	57	5.0	100.0	0	57.1	15	88.2			
Surr: 2-Fluorophenol	87		200.0		43.4	15	88.8			
Surr: Phenol-d5	67		200.0		33.3	15	71.9			
Surr: 2,4,6-Tribromophenol	130		200.0		66.9	15	97.4			
Surr: Nitrobenzene-d5	58		100.0		58.2	15	117			
Surr: 2-Fluorobiphenyl	62		100.0		61.7	15	100			
Surr: 4-Terphenyl-d14	92		100.0		91.5	15	120			

Sample ID: lcsd-58272	SampType: LCS			TestCode: EPA Method 8270C: Semivolatiles						
Client ID: LCSS02	Batch ID: 58272			RunNo: 75611						
Prep Date: 2/23/2021	Analysis Date: 3/1/2021			SeqNo: 2673471		Units: µg/L				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Acenaphthene	56	5.0	100.0	0	56.0	23.1	103	22.8	52.7	
4-Chloro-3-methylphenol	110	5.0	200.0	0	55.3	27.5	113	19.7	45.2	
2-Chlorophenol	120	5.0	200.0	0	58.2	17.9	103	15.7	51.8	
1,4-Dichlorobenzene	49	5.0	100.0	0	49.0	15	79.9	16.9	59.6	
2,4-Dinitrotoluene	51	5.0	100.0	0	51.4	22.9	97.2	17.9	46.5	
N-Nitrosodi-n-propylamine	50	5.0	100.0	0	50.1	34.1	104	19.5	47.7	
4-Nitrophenol	91	5.0	200.0	0	45.3	20	78.8	13.8	42.6	
Pentachlorophenol	120	5.0	200.0	0	58.6	26.8	97.6	16.6	48.7	
Phenol	78	5.0	200.0	0	38.8	15	66.2	9.97	47.1	
Pyrene	86	5.0	100.0	0	85.7	41.2	114	12.5	26.6	
1,2,4-Trichlorobenzene	48	5.0	100.0	0	48.4	15	88.2	16.3	52.5	
Surr: 2-Fluorophenol	71		200.0		35.4	15	88.8	0	0	
Surr: Phenol-d5	57		200.0		28.6	15	71.9	0	0	
Surr: 2,4,6-Tribromophenol	110		200.0		54.1	15	97.4	0	0	
Surr: Nitrobenzene-d5	47		100.0		46.6	15	117	0	0	
Surr: 2-Fluorobiphenyl	45		100.0		45.5	15	100	0	0	

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2102894

26-Mar-21

Client: XXXXXXXXXX
Project: NM DW Testing

Sample ID: lcsd-58272	SampType: LCSD	TestCode: EPA Method 8270C: Semivolatiles								
Client ID: LCSS02	Batch ID: 58272	RunNo: 75611								
Prep Date: 2/23/2021	Analysis Date: 3/1/2021	SeqNo: 2673471	Units: µg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: 4-Terphenyl-d14	77		100.0		76.8	15	120	0	0	

Sample ID: mb-58459	SampType: MBLK	TestCode: EPA Method 8270C: Semivolatiles								
Client ID: PBW	Batch ID: 58459	RunNo: 75795								
Prep Date: 3/3/2021	Analysis Date: 3/8/2021	SeqNo: 2681657	Units: %Rec							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: 2-Fluorophenol	93		200.0		46.4	15	88.8			
Surr: Phenol-d5	71		200.0		35.7	15	71.9			
Surr: 2,4,6-Tribromophenol	120		200.0		59.3	15	97.4			
Surr: Nitrobenzene-d5	59		100.0		59.3	15	117			
Surr: 2-Fluorobiphenyl	54		100.0		53.6	15	100			
Surr: 4-Terphenyl-d14	77		100.0		76.6	15	120			

Sample ID: lcs-58459	SampType: LCS	TestCode: EPA Method 8270C: Semivolatiles								
Client ID: LCSW	Batch ID: 58459	RunNo: 75795								
Prep Date: 3/3/2021	Analysis Date: 3/8/2021	SeqNo: 2681658	Units: %Rec							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: 2-Fluorophenol	100		200.0		52.0	15	88.8			
Surr: Phenol-d5	86		200.0		43.0	15	71.9			
Surr: 2,4,6-Tribromophenol	190		200.0		94.0	15	97.4			
Surr: Nitrobenzene-d5	69		100.0		69.4	15	117			
Surr: 2-Fluorobiphenyl	72		100.0		72.4	15	100			
Surr: 4-Terphenyl-d14	90		100.0		90.3	15	120			

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2102894

26-Mar-21

Client: XXXXXXXXXX
Project: NM DW Testing

Sample ID: Ics-1 99.5uS eC	SampType: Ics		TestCode: SM2510B: Specific Conductance							
Client ID: LCSW	Batch ID: R75552		RunNo: 75552							
Prep Date:	Analysis Date: 2/25/2021		SeqNo: 2670482		Units: µmhos/cm					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Conductivity	100	10	99.50	0	102	85	115			

Sample ID: 2102894-001D DUP	SampType: DUP		TestCode: SM2510B: Specific Conductance							
Client ID: Eagle Springs	Batch ID: R75552		RunNo: 75552							
Prep Date:	Analysis Date: 2/25/2021		SeqNo: 2670510		Units: µmhos/cm					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Conductivity	16000	50						5.97	20	

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2102894

26-Mar-21

Client: XXXXXXXXXX
Project: NM DW Testing

Sample ID: mb-1 alk	SampType: mblk	TestCode: SM2320B: Alkalinity								
Client ID: PBW	Batch ID: R75456	RunNo: 75456								
Prep Date:	Analysis Date: 2/22/2021	SeqNo: 2666766	Units: mg/L CaCO3							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20.00								

Sample ID: lcs-1 alk	SampType: lcs	TestCode: SM2320B: Alkalinity								
Client ID: LCSW	Batch ID: R75456	RunNo: 75456								
Prep Date:	Analysis Date: 2/22/2021	SeqNo: 2666767	Units: mg/L CaCO3							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	72.92	20.00	80.00	0	91.2	90	110			

Sample ID: 2102894-001D DUP	SampType: dup	TestCode: SM2320B: Alkalinity								
Client ID: Eagle Springs	Batch ID: R75456	RunNo: 75456								
Prep Date:	Analysis Date: 2/22/2021	SeqNo: 2666771	Units: mg/L CaCO3							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	144.5	20.00						1.48	20	

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2102894

26-Mar-21

Client: XXXXXXXXXX
Project: NM DW Testing

Sample ID: MB-58254	SampType: MBLK	TestCode: SM2540C MOD: Total Dissolved Solids								
Client ID: PBW	Batch ID: 58254	RunNo: 75493								
Prep Date: 2/22/2021	Analysis Date: 2/24/2021	SeqNo: 2668079 Units: mg/L								
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	ND	20.0								

Sample ID: LCS-58254	SampType: LCS	TestCode: SM2540C MOD: Total Dissolved Solids								
Client ID: LCSW	Batch ID: 58254	RunNo: 75493								
Prep Date: 2/22/2021	Analysis Date: 2/24/2021	SeqNo: 2668080 Units: mg/L								
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	1010	20.0	1000	0	101	80	120			

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

Sample Log-In Check List

Client Name: [REDACTED]

Work Order Number: 2102894

RcptNo: 1

Received By: **Andy Freeman**

2/19/2021 1:10:00 PM

Completed By: **Erin Melendrez**

2/19/2021 1:41:04 PM

Reviewed By:

Chain of Custody

1. Is Chain of Custody complete? Yes ☒ No ☐ Not Present ☐
2. How was the sample delivered? Client

[Log In](#)

- | | | | |
|--|---|--|--|
| 3. Was an attempt made to cool the samples? | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> | NA <input type="checkbox"/> |
| 4. Were all samples received at a temperature of $>0^{\circ}\text{C}$ to 6.0°C | Yes <input type="checkbox"/> | No <input checked="" type="checkbox"/> | NA <input type="checkbox"/> |
| <u>Samples were collected the same day and chilled.</u> | | | |
| 5. Sample(s) in proper container(s)? | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> | |
| 6. Sufficient sample volume for indicated test(s)? | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> | |
| 7. Are samples (except VOA and ONG) properly preserved? | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> | |
| 8. Was preservative added to bottles? | Yes <input type="checkbox"/> | No <input checked="" type="checkbox"/> | NA <input type="checkbox"/> |
| 9. Received at least 1 vial with headspace $<1/4"$ for AQ VOA? | Yes <input type="checkbox"/> | No <input checked="" type="checkbox"/> | NA <input checked="" type="checkbox"/> |
| 10. Were any sample containers received broken? | Yes <input type="checkbox"/> | No <input checked="" type="checkbox"/> | |
| 11. Does paperwork match bottle labels?
(Note discrepancies on chain of custody) | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> | |
| 12. Are matrices correctly identified on Chain of Custody? | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> | |
| 13. Is it clear what analyses were requested? | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> | |
| 14. Were all holding times able to be met?
(If no, notify customer for authorization.) | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> | |
- # of preserved bottles checked for pH: 6
(<2)

Adjusted? ☒

Checked by: me

of preserved bottles checked for pH: (6) (<2 or >12 unless noted)

Checked by: *CSM* 2/19/21

Special Handling (if applicable)

15. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☒

Person Notified: _____ Date: _____
By Whom: _____ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding: _____
Client Instructions: _____

16. Additional remarks:

17. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	29.3	Good				

Client: [REDACTED]
 Mailing Address: [REDACTED]
 Phone: [REDACTED]
 Email: [REDACTED]
 QAV: [REDACTED]
☐ \$ [REDACTED]

☐ Standard ☐ Rush

NM DW Testing

Project Manager:

Nyle Khan

On Ice: ☒ Yes ☐ No

Cooler Temp (including CF): 29.3-0 = 29.3 (°C)

Container
Type and #Preservative
Type

HEAL No.

FILE NO.
2107894

-DDI

-007

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

BTEX / MTBE / TMB's (8021)

TPH:8015D(GRO / DRO / MRO)

8081 Pesticides/8082 PCB's

EDB (Method 504.1)

PAHs by 8310 or 8270SIMS

RCRA 8 Metals

Cl, F, Br, NO₃, NO₂, PO₄, SO₄

3260 (VOA)

3270 (Semi-VOA)

Total Coliform (Present/Absent)



See Attach List

Accreditation: ☐ Az Compliance

☐ NELAC ☐ Other☐ EDD (Type)[illegible]

Date: 2/19	Time: 13:10	Relinquished by: <i>Daniel Deane</i>
---------------	----------------	---

Date:	Time:	Relinquished by:
-------	-------	------------------

Received by:	Via:	Date	Time
		2/19/21	1310

Received by:	Via:	Date	Time
--------------	------	------	------

Remarks:	
----------	--

ON Ice. of 2/19/21

Sample due to arrive today.



Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: clients.hallenvironmental.com

QUOTATION

Quote#: 2137

Date: 2/17/2021

Appendix A-2

Hall Report 2: Pretreated Toray710 RO Filtered Water Results



Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL 505-345-3975 FAX 505-345-4107
Website clients.hallenvironmental.com

February 09, 2022

Nyle Khan

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

FAX:

RE: Eagle Springs

OrderNo.: 2201113

Dear Nyle Khan:

Hall Environmental Analysis Laboratory received 1 sample(s) on 1/4/2022 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results, it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifiers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0901

Sincerely,

A handwritten signature in black ink, appearing to read 'Andy Freeman'.

Andy Freeman

Laboratory Manager

4901 Hawkins NE

Albuquerque, NM 87109

Hall Environmental Analysis Laboratory, Inc.

Analytical Report

Lab Order 2201113

Date Reported: 2/9/2022

CLIENT: [REDACTED]

Client Sample ID: Eagle Springs

Project: Eagle Springs

Collection Date: 1/4/2022 12:30:00 PM

Lab ID: 2201113-001

Matrix: AQUEOUS

Received Date: 1/4/2022 4:11:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 504.1: EDB/DBCP						Analyst: JME
1,2-Dibromo-3-chloropropane	ND	0.019		µg/L	1	1/12/2022 3:31:17 PM
1,2-Dibromoethane	ND	0.0095		µg/L	1	1/12/2022 3:31:17 PM
EPA METHOD 300.0: ANIONS						Analyst: LRN
Fluoride	0.17	0.10		mg/L	1	1/5/2022 1:12:28 PM
Chloride	29	10		mg/L	20	1/5/2022 1:49:41 PM
Nitrogen, Nitrite (As N)	ND	0.10		mg/L	1	1/5/2022 1:12:28 PM
Nitrogen, Nitrate (As N)	ND	0.10		mg/L	1	1/5/2022 1:12:28 PM
Sulfate	82	10		mg/L	20	1/5/2022 1:49:41 PM
EPA METHOD 200.7: DISSOLVED METALS						Analyst: ELS
Aluminum	ND	0.020		mg/L	1	1/6/2022 2:05:36 PM
Barium	0.0031	0.0020		mg/L	1	1/6/2022 2:05:36 PM
Beryllium	ND	0.0020		mg/L	1	1/6/2022 2:05:36 PM
Boron	2.0	0.20		mg/L	5	1/6/2022 2:07:14 PM
Cadmium	ND	0.0020		mg/L	1	1/6/2022 2:05:36 PM
Chromium	ND	0.0060		mg/L	1	1/6/2022 2:05:36 PM
Cobalt	ND	0.0060		mg/L	1	1/6/2022 2:05:36 PM
Copper	ND	0.0060		mg/L	1	1/6/2022 2:05:36 PM
Iron	ND	0.020		mg/L	1	1/6/2022 2:05:36 PM
Manganese	ND	0.0020		mg/L	1	1/6/2022 2:05:36 PM
Molybdenum	ND	0.0080		mg/L	1	1/6/2022 2:05:36 PM
Nickel	ND	0.010		mg/L	1	1/6/2022 2:05:36 PM
Silver	ND	0.0050		mg/L	1	1/6/2022 2:05:36 PM
Zinc	0.030	0.010		mg/L	1	1/6/2022 2:05:36 PM
EPA METHOD 200.7: METALS						Analyst: ELS
Aluminum	ND	0.020		mg/L	1	1/6/2022 1:45:10 PM
Barium	0.0031	0.0030		mg/L	1	1/6/2022 1:45:10 PM
Beryllium	ND	0.0020		mg/L	1	1/6/2022 1:45:10 PM
Cadmium	ND	0.0020		mg/L	1	1/6/2022 1:45:10 PM
Chromium	ND	0.0060		mg/L	1	1/6/2022 1:45:10 PM
Iron	ND	0.050		mg/L	1	1/6/2022 1:45:10 PM
Manganese	ND	0.0020		mg/L	1	1/6/2022 1:45:10 PM
Silver	ND	0.0050		mg/L	1	1/6/2022 1:45:10 PM
Zinc	0.021	0.010		mg/L	1	1/6/2022 1:45:10 PM
EPA 200.8: METALS						Analyst: DBK
Antimony	ND	0.0010		mg/L	1	1/10/2022 4:33:04 PM
Arsenic	0.0021	0.0010		mg/L	1	1/10/2022 2:43:11 PM
Copper	ND	0.0010		mg/L	1	1/10/2022 2:43:11 PM

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:	*	Value exceeds Maximum Contaminant Level
	D	Sample Diluted Due to Matrix
	H	Holding times for preparation or analysis exceeded
	ND	Not Detected at the Reporting Limit
	PQL	Practical Quantitative Limit
	S	% Recovery outside of range due to dilution or matrix interference

B	Analyte detected in the associated Method Blank
E	Estimated value
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

Hall Environmental Analysis Laboratory, Inc.

Analytical Report

Lab Order 2201113

Date Reported: 2/9/2022

CLIENT: [REDACTED]

Client Sample ID: Eagle Springs

Project: Eagle Springs

Collection Date: 1/4/2022 12:30:00 PM

Lab ID: 2201113-001

Matrix: AQUEOUS

Received Date: 1/4/2022 4:11:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA 200.8: METALS						Analyst: DBK
Selenium	ND	0.0010		mg/L	1	1/10/2022 2:43:11 PM
Thallium	ND	0.00025		mg/L	1	1/10/2022 2:43:11 PM
Uranium	ND	0.00050		mg/L	1	1/10/2022 2:43:11 PM
EPA 200.8: DISSOLVED METALS						Analyst: bcv
Antimony	ND	0.0010		mg/L	1	1/17/2022 12:35:20 PM
Arsenic	0.0018	0.0010		mg/L	1	1/14/2022 5:11:07 PM
Lead	ND	0.00050		mg/L	1	1/14/2022 5:11:07 PM
Selenium	ND	0.0010		mg/L	1	1/14/2022 5:11:07 PM
Thallium	ND	0.00025		mg/L	1	1/14/2022 5:11:07 PM
Uranium	ND	0.00050		mg/L	1	1/14/2022 5:11:07 PM
EPA METHOD 245.1: MERCURY						Analyst: VP
Mercury	ND	0.00020		mg/L	1	1/17/2022 1:08:20 PM
SM 9223B TOTAL COLIFORM						Analyst: dms
Total Coliform	Present	0		P/A	1	1/6/2022 3:38:00 PM
E. Coli	Absent	0		P/A	1	1/6/2022 3:38:00 PM
EPA METHOD 8270SIM						Analyst: DAM
Naphthalene	ND	0.10		µg/L	1	1/12/2022 7:10:00 PM
1-Methylnaphthalene	ND	0.10		µg/L	1	1/12/2022 7:10:00 PM
2-Methylnaphthalene	ND	0.10		µg/L	1	1/12/2022 7:10:00 PM
Benzo(a)pyrene	ND	0.070		µg/L	1	1/12/2022 7:10:00 PM
Atrazine	ND	1.5		µg/L	1	1/12/2022 7:10:00 PM
Pentachlorophenol	ND	0.10		µg/L	1	1/12/2022 7:10:00 PM
Surr: Nitrobenzene-d5	59.5	21.9-89.8		%Rec	1	1/12/2022 7:10:00 PM
Surr: 2,4,6-Tribromophenol	47.2	23.4-71.6		%Rec	1	1/12/2022 7:10:00 PM
Surr: 2-Fluorobiphenyl	62.5	15-84.5		%Rec	1	1/12/2022 7:10:00 PM
Surr: 4-Terphenyl-d14	108	73.1-152		%Rec	1	1/12/2022 7:10:00 PM
PURGEABLE ORGANICS BY EPA 524						Analyst: RAA
Benzene	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM
Carbon tetrachloride	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM
Chlorobenzene	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM
cis-1,2-Dichloroethene	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM
1,2-Dichlorobenzene	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM
1,4-Dichlorobenzene	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM
1,2-Dichloroethane	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM
1,1-Dichloroethene	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM
1,2-Dichloropropane	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM
Ethy benzene	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:	*	Value exceeds Maximum Contaminant Level
	D	Sample Diluted Due to Matrix
	H	Holding times for preparation or analysis exceeded
	ND	Not Detected at the Reporting Limit
	PQL	Practical Quantitative Limit
	S	% Recovery outside of range due to dilution or matrix interference

B	Analyte detected in the associated Method Blank
E	Estimated value
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

Hall Environmental Analysis Laboratory, Inc.

Analytical Report

Lab Order 2201113

Date Reported: 2/9/2022

CLIENT: [REDACTED]

Client Sample ID: Eagle Springs

Project: Eagle Springs

Collection Date: 1/4/2022 12:30:00 PM

Lab ID: 2201113-001

Matrix: AQUEOUS

Received Date: 1/4/2022 4:11:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
PURGEABLE ORGANICS BY EPA 524						Analyst: RAA
Methylene chloride	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM
Styrene	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM
Tetrachloroethene	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM
Toluene	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM
trans-1,2-Dichloroethene	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM
1,2,4-Trichlorobenzene	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM
1,1,1-Trichloroethane	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM
1,1,2-Trichloroethane	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM
Trichloroethene	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM
Vinyl chloride	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM
Total Xylenes	ND	0.50	P	µg/L	1	1/12/2022 11:38:00 AM
Surr: 1,2-Dichlorobenzene-d4	98.3	70-130	P	%Rec	1	1/12/2022 11:38:00 AM
Surr: 4-Bromofluorobenzene	91.7	70-130	P	%Rec	1	1/12/2022 11:38:00 AM
EPA METHOD 8260B: VOLATILES						Analyst: CCM
Benzene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
Toluene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
Ethy benzene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
Methyl tert-butyl ether (MTBE)	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
1,2,4-Trimethylbenzene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
1,3,5-Trimethylbenzene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
1,2-Dichloroethane (EDC)	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
1,2-Dibromoethane (EDB)	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
Naphthalene	ND	2.0		µg/L	1	1/6/2022 12:40:00 AM
1-Methylnaphthalene	ND	4.0		µg/L	1	1/6/2022 12:40:00 AM
2-Methylnaphthalene	ND	4.0		µg/L	1	1/6/2022 12:40:00 AM
Acetone	ND	10		µg/L	1	1/6/2022 12:40:00 AM
Bromobenzene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
Bromodichloromethane	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
Bromoform	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
Bromomethane	ND	3.0		µg/L	1	1/6/2022 12:40:00 AM
2-Butanone	ND	10		µg/L	1	1/6/2022 12:40:00 AM
Carbon disulfide	ND	10		µg/L	1	1/6/2022 12:40:00 AM
Carbon Tetrachloride	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
Chlorobenzene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
Chloroethane	ND	2.0		µg/L	1	1/6/2022 12:40:00 AM
Chloroform	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
Chloromethane	ND	3.0		µg/L	1	1/6/2022 12:40:00 AM
2-Chlorotoluene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
4-Chlorotoluene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:	*	Value exceeds Maximum Contaminant Level
	D	Sample Diluted Due to Matrix
	H	Holding times for preparation or analysis exceeded
	ND	Not Detected at the Reporting Limit
	PQL	Practical Quantitative Limit
	S	% Recovery outside of range due to dilution or matrix interference

B	Analyte detected in the associated Method Blank
E	Estimated value
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

Hall Environmental Analysis Laboratory, Inc.

Analytical Report

Lab Order 2201113

Date Reported: 2/9/2022

CLIENT: [REDACTED]

Client Sample ID: Eagle Springs

Project: Eagle Springs

Collection Date: 1/4/2022 12:30:00 PM

Lab ID: 2201113-001

Matrix: AQUEOUS

Received Date: 1/4/2022 4:11:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 8260B: VOLATILES						Analyst: CCM
cis-1,2-DCE	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
cis-1,3-Dichloropropene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
1,2-Dibromo-3-chloropropane	ND	2.0		µg/L	1	1/6/2022 12:40:00 AM
Dibromochloromethane	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
Dibromomethane	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
1,2-Dichlorobenzene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
1,3-Dichlorobenzene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
1,4-Dichlorobenzene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
Dichlorodifluoromethane	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
1,1-Dichloroethane	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
1,1-Dichloroethene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
1,2-Dichloropropane	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
1,3-Dichloropropane	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
2,2-Dichloropropane	ND	2.0		µg/L	1	1/6/2022 12:40:00 AM
1,1-Dichloropropene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
Hexachlorobutadiene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
2-Hexanone	ND	10		µg/L	1	1/6/2022 12:40:00 AM
Isopropylbenzene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
4-Isopropyltoluene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
4-Methyl-2-pentanone	ND	10		µg/L	1	1/6/2022 12:40:00 AM
Methylene Chloride	ND	3.0		µg/L	1	1/6/2022 12:40:00 AM
n-Butylbenzene	ND	3.0		µg/L	1	1/6/2022 12:40:00 AM
n-Propyl benzene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
sec-Butylbenzene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
Styrene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
tert-Butylbenzene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
1,1,1,2-Tetrachloroethane	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
1,1,2,2-Tetrachloroethane	ND	2.0		µg/L	1	1/6/2022 12:40:00 AM
Tetrachloroethene (PCE)	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
trans-1,2-DCE	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
trans-1,3-Dichloropropene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
1,2,3-Trichlorobenzene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
1,2,4-Trichlorobenzene	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
1,1,1-Trichloroethane	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
1,1,2-Trichloroethane	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
Trichloroethene (TCE)	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
Trichlorofluoromethane	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM
1,2,3-Trichloropropane	ND	2.0		µg/L	1	1/6/2022 12:40:00 AM
Vinyl chloride	ND	1.0		µg/L	1	1/6/2022 12:40:00 AM

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:	*	Value exceeds Maximum Contaminant Level
	D	Sample Diluted Due to Matrix
	H	Holding times for preparation or analysis exceeded
	ND	Not Detected at the Reporting Limit
	PQL	Practical Quantitative Limit
	S	% Recovery outside of range due to dilution or matrix interference

B	Analyte detected in the associated Method Blank
E	Estimated value
J	Analyte detected below quantitation limits
P	Sample pH Not In Range
RL	Reporting Limit

Hall Environmental Analysis Laboratory, Inc.

Analytical Report

Lab Order 2201113

Date Reported: 2/9/2022

CLIENT: [REDACTED]

Client Sample ID: Eagle Springs

Project: Eagle Springs

Collection Date: 1/4/2022 12:30:00 PM

Lab ID: 2201113-001

Matrix: AQUEOUS

Received Date: 1/4/2022 4:11:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 8260B: VOLATILES						Analyst: CCM
Xylenes, Total	ND	1.5		µg/L	1	1/6/2022 12:40:00 AM
Surr: 1,2-Dichloroethane-d4	103	70-130		%Rec	1	1/6/2022 12:40:00 AM
Surr: 4-Bromofluorobenzene	102	70-130		%Rec	1	1/6/2022 12:40:00 AM
Surr: Dibromofluoromethane	107	70-130		%Rec	1	1/6/2022 12:40:00 AM
Surr: Toluene-d8	97.4	70-130		%Rec	1	1/6/2022 12:40:00 AM
TOTAL PHENOLICS BY SW-846 9067						Analyst: JPM
Phenolics	ND	5.0		µg/L	1	1/13/2022 8:38:00 AM
SM 2540 C: TOTAL DISSOLVED SOLIDS						Analyst: KS
Total Dissolved Solids	224	20.0		mg/L	1	1/12/2022 11:55:00 AM
SM4500-H+B / 9040C: PH						Analyst: LRN
pH	7.67		H	pH units	1	1/6/2022 2:03:51 PM

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:	*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
	D	Sample Diluted Due to Matrix	E	Estimated value
	H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
	ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
	PQL	Practical Quantitative Limit	RL	Reporting Limit
	S	% Recovery outside of range due to dilution or matrix interference		

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Lab Federal ID#:	See Below	Lab/Sample Number:	MCA0118-01
Date Received:	01/07/2022	Date Reported by Lab:	02/02/2022
Compliance Sample:		Replacement Sample:	
Collect Date:	01/04/2022	Collection Time:	12:30
Sample Type:			
PWS#:		PWS Name:	Hall Environmental Analysis Lab
Sample Point/ Location:	2201113-001F (Eagle Spring)	Tag#/Facility ID:	
Contact Name:	Andy Freeman	Contact Phone:	<i>See Signature Page</i>
Lab Federal ID#:	ID00013		

Public Drinking Water System Analysis Report

Synthetic Organic Chemical (SOC) Analysis Report:

FRDS	Analyte	Result	Units	MCL	MRL	Analyzed	Analyst	Method	Qualifier
2034	Glyphosate	ND	ug/L	700	5 00	1/10/22 17:47	BKP	EPA 547	
2005	Endrin	ND	ug/L	2	0.0100	1/14/22 18:56	GPB	EPA 505	
2010	Lindane (BHC-Gamma)	ND	ug/L	0.2	0.0200	1/14/22 18:56	GPB	EPA 505	
2015	Methoxychlor	ND	ug/L	40	0.100	1/14/22 18:56	GPB	EPA 505	
2020	Toxaphene	ND	ug/L	3	1 00	1/14/22 18:56	GPB	EPA 505	
2065	Heptachlor	ND	ug/L	0.4	0.0400	1/14/22 18:56	GPB	EPA 505	
2067	Heptachlor epoxide	ND	ug/L	0.2	0.0200	1/14/22 18:56	GPB	EPA 505	
2383	PCBs	ND	ug/L	0.5	0.500	1/14/22 18:56	GPB	EPA 505	
2959	Chlordane	ND	ug/L	2	0.200	1/14/22 18:56	GPB	EPA 505	

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Lab Federal ID#:	See Below	Lab/Sample Number:	MCA0118-02
Date Received:	01/07/2022	Date Reported by Lab:	02/02/2022
Compliance Sample:		Replacement Sample:	
Collect Date:	01/04/2022	Collection Time:	12:30
Sample Type:			
PWS#:		PWS Name:	Hall Environmental Analysis Lab
Sample Point/ Location:	2201113-001G (Eagle Spring)	Tag#/Facility ID:	
Contact Name:	Andy Freeman	Contact Phone:	<i>See Signature Page</i>
Lab Federal ID#:	ID00013		

Public Drinking Water System Analysis Report

Synthetic Organic Chemical (SOC) Analysis Report:

FRDS	Analyte	Result	Units	MCL	MRL	Analyzed	Analyst	Method	Qualifier
2036	Oxamyl (Vydate)	ND	ug/L	200	2.00	1/12/22 2:16	BKP	EPA 531.2	
2046	Carbofuran	ND	ug/L	40	0.900	1/12/22 2:16	BKP	EPA 531.2	

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Lab Federal ID#:	See Below	Lab/Sample Number:	MCA0118-03
Date Received:	01/07/2022	Date Reported by Lab:	02/02/2022
Compliance Sample:		Replacement Sample:	
Collect Date:	01/04/2022	Collection Time:	12:30
Sample Type:			
PWS#:		PWS Name:	Hall Environmental Analysis Lab
Sample Point/ Location:	2201113-001H (Eagle Spring)	Tag#/Facility ID:	
Contact Name:	Andy Freeman	Contact Phone:	<i>See Signature Page</i>
Lab Federal ID#:	ID00013		

Public Drinking Water System Analysis Report

Synthetic Organic Chemical (SOC) Analysis Report:

FRDS	Analyte	Result	Units	MCL	MRL	Analyzed	Analyst	Method	Qualifier
2035	Di(2-ethylhexyl)adipate	ND	ug/L	400	0.600	1/13/22 7:38	BMM	EPA 525.2	
2037	Simazine	ND	ug/L	4	0.0700	1/13/22 7:38	BMM	EPA 525.2	
2039	Di(2-ethylhexyl)phthalate	ND	ug/L	6	0.600	1/13/22 7:38	BMM	EPA 525.2	
2042	Hexachlorocyclopentadiene	ND	ug/L	50	0.100	1/13/22 7:38	BMM	EPA 525.2	
2050	Atrazine	ND	ug/L	3	0.100	1/13/22 7:38	BMM	EPA 525.2	
2051	Alachlor (Lasso)	ND	ug/L	2	0.200	1/13/22 7:38	BMM	EPA 525.2	
2274	Hexachlorobenzene	ND	ug/L	1	0.100	1/13/22 7:38	BMM	EPA 525.2	
2306	Benzo[a]pyrene	ND	ug/L	0.2	0.0200	1/13/22 7:38	BMM	EPA 525.2	

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Lab Federal ID#:	See Below	Lab/Sample Number:	MCA0118-04
Date Received:	01/07/2022	Date Reported by Lab:	02/02/2022
Compliance Sample:		Replacement Sample:	
Collect Date:	01/04/2022	Collection Time:	12:30
Sample Type:			
PWS#:		PWS Name:	Hall Environmental Analysis Lab
Sample Point/ Location:	2201113-001I (Eagle Spring)	Tag#/Facility ID:	
Contact Name:	Andy Freeman	Contact Phone:	<i>See Signature Page</i>
Lab Federal ID#:	ID00013		

Public Drinking Water System Analysis Report

Synthetic Organic Chemical (SOC) Analysis Report:

FRDS	Analyte	Result	Units	MCL	MRL	Analyzed	Analyst	Method	Qualifier
2033	Endothall	ND	ug/L	100	9 00	1/13/22 18:15	GPB	EPA 548.1	
2031	Dalapon	ND	ug/L	200	1 00	1/11/22 18:08	SAT	EPA 515.4	
2040	Picloram	ND	ug/L	500	0.100	1/11/22 18:08	SAT	EPA 515.4	
2041	Dinoseb	ND	ug/L	7	0.200	1/11/22 18:08	SAT	EPA 515.4	
2105	2,4-D	ND	ug/L	70	0.100	1/11/22 18:08	SAT	EPA 515.4	
2110	2,4,5-TP (Silvex)	ND	ug/L	50	0.200	1/11/22 18:08	SAT	EPA 515.4	
2326	Pentachlorophenol	ND	ug/L	1	0.0400	1/11/22 18:08	SAT	EPA 515.4	

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Lab Federal ID#:	See Below	Lab/Sample Number:	MCA0118-05
Date Received:	01/07/2022	Date Reported by Lab:	02/02/2022
Compliance Sample:		Replacement Sample:	
Collect Date:	01/04/2022	Collection Time:	12:30
Sample Type:			
PWS#:		PWS Name:	Hall Environmental Analysis Lab
Sample Point/ Location:	2201113-001J (Eagle Spring)	Tag#/Facility ID:	
Contact Name:	Andy Freeman	Contact Phone:	<i>See Signature Page</i>
Lab Federal ID#:	ID00013		

Public Drinking Water System Analysis Report

Synthetic Organic Chemical (SOC) Analysis Report:

FRDS	Analyte	Result	Units	MCL	MRL	Analyzed	Analyst	Method	Qualifier
2032	Diquat	ND	ug/L	20	0.400	1/31/22 20:35	taz	EPA 549.2	

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Lab Federal ID#:	See Below	Lab/Sample Number:	MCA0118-06
Date Received:	01/07/2022	Date Reported by Lab:	02/02/2022
Compliance Sample:		Replacement Sample:	
Collect Date:	01/04/2022	Collection Time:	12:30
Sample Type:			
PWS#:		PWS Name:	Hall Environmental Analysis Lab
Sample Point/ Location:	2201113-001K (Eagle Spring)	Tag#/Facility ID:	
Contact Name:	Andy Freeman	Contact Phone:	<i>See Signature Page</i>
Lab Federal ID#:	ID00013		

Public Drinking Water System Analysis Report

Inorganic Chemical (IOC) Analysis Report:

FRDS	Analyte	Result	Units	MCL	MRL	Analyzed	Analyst	Method	Qualifier
1905	Color	ND @ pH 7.56	Color Units	15	5 00	1/18/22 10:20	LAC	SM 2120 B	H3
1920	Odor (threshold #)	ND	T.O.N.	3	1 00	1/18/22 10:20	LAC	SM 2150 B	

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Lab Federal ID#:	See Below	Lab/Sample Number:	MCA0118-07
Date Received:	01/07/2022	Date Reported by Lab:	02/02/2022
Compliance Sample:		Replacement Sample:	
Collect Date:	01/04/2022	Collection Time:	12:30
Sample Type:			
PWS#:		PWS Name:	Hall Environmental Analysis Lab
Sample Point/ Location:	2201113-001L (Eagle Spring)	Tag#/Facility ID:	
Contact Name:	Andy Freeman	Contact Phone:	<i>See Signature Page</i>
Lab Federal ID#:	ID00013		

Public Drinking Water System Analysis Report

Inorganic Chemical (IOC) Analysis Report:

FRDS	Analyte	Result	Units	MCL	MRL	Analyzed	Analyst	Method	Qualifier
1927	Alkalinity as CaCO3	31.0 to pH 4.2	mg CaCO3/L		2.00	1/13/22 11:43	LAC	SM 2320 B	
1016	Calcium	4.83	mg/L		0.100	1/11/22 14:20	TEC	EPA 200.7	
1997	Langlier Index	-1.89			-20.0	1/13/22 11:43	LAC	Calculation	
1925	pH	7.49 @ 18.2°C	pH Units			1/13/22 11:43	LAC	SM 4500-H-B	H5
1930	Total Dissolved Solids	222	mg/L	500	50.0	1/11/22 14:25	LAC	SM 2540 C	
2905	Surfactants	ND	mg/kg 342.4MW		0.0500	1/10/22 14:18	TAZ	SM 5540 C	H3

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Lab Federal ID#:	See Below	Lab/Sample Number:	MCA0118-08
Date Received:	01/07/2022	Date Reported by Lab:	02/02/2022
Compliance Sample:		Replacement Sample:	
Collect Date:	01/04/2022	Collection Time:	12:30
Sample Type:			
PWS#:		PWS Name:	Hall Environmental Analysis Lab
Sample Point/ Location:	2201113-001M (Eagle Spring)	Tag#/Facility ID:	
Contact Name:	Andy Freeman	Contact Phone:	<i>See Signature Page</i>
Lab Federal ID#:	ID00013		

Public Drinking Water System Analysis Report

Inorganic Chemical (IOC) Analysis Report:

FRDS	Analyte	Result	Units	MCL	MRL	Analyzed	Analyst	Method	Qualifier
1024	Cyanide	ND	mg/L	0.2	0.0100	1/12/22 9:00	BKP	EPA 335.4	

Andy Freeman
Hall Environmental Analysis Lab
4901 Hawkins NE Suite D
Albuquerque, NM 87109
505-345-3975

Authorized Signature,



Justin Doty For Todd Taruscio, Laboratory Manager

H3	Sample was received past holding time.
H5	This test is specified to be performed in the field within 15 minutes of sampling; sample was received and analyzed past the regulatory holding time.
R7	LFB/LFBD RPD exceeded the laboratory acceptance limit. Recovery met acceptance criteria.
PQL	Practical Quantitation Limit
ND	Not Detected
MCL	EPA's Maximum Contaminant Level
Dry	Sample results reported on a dry weight basis
*	Not a certified analyte
RPD	Relative Percent Difference
%REC	Percent Recovery
Source	Sample that was spiked or duplicated.

This report shall not be reproduced except in full, without the written approval of the laboratory
The results reported related only to the samples indicated.

MCA0118



Due: 01/24/22

SUB CONTRACTOR	Anatek ID	COMPANY	Anatek Labs, Inc.	PHONE	(208) 883-2839	FAX	
ADDRESS	1282 Alturas Dr			ACCOUNT #		EMAIL	
CITY, STATE, ZIP	Moscow, ID 83843						

ITEM	SAMPLE	CLIENT SAMPLE ID	BOTTLE TYPE	MATRIX	COLLECTION DATE	# CONTAINERS	ANALYTICAL COMMENTS
1	2201113-001F	Eagle Spring	VOANA2520	Aqueous	1/4/2022 12:30:00 PM	2	Full SOC W/O EDB
2	2201113-001G	Eagle Spring	VOAC6H7KO	Aqueous	1/4/2022 12:30:00 PM	2	Full SOC W/O EDB
3	2201113-001H	Eagle Spring	1LAMGNASO	Aqueous	1/4/2022 12:30:00 PM	1	Full SOC W/O EDB
4	2201113-001I	Eagle Spring	500AMBNA2	Aqueous	1/4/2022 12:30:00 PM	1	Full SOC W/O EDB
5	2201113-001J	Eagle Spring	250 HDPE N	Aqueous	1/4/2022 12:30:00 PM	1	Full SOC W/O EDB
6	2201113-001K	Eagle Spring	1Lamber	Aqueous	1/4/2022 12:30:00 PM	1	Color Odor
7	2201113-001L	Eagle Spring	500HDPE	Aqueous	1/4/2022 12:30:00 PM	1	Corrosivity, Surfactants
8	2201113-001M	Eagle Spring	500AMBHDP	Aqueous	1/4/2022 12:30:00 PM	1	Cyanide in Drinking water

SPECIAL INSTRUCTIONS / COMMENTS:

Please include the LAB ID and the CLIENT SAMPLE ID on all final reports. Please e-mail results to lab@hallenvironmental.com. Please return all coolers and blue ice. Thank you.

Relinquished By: <i>CME</i>	Date: 1/5/2022	Time: 8:35 AM	Received By: <i>JF</i>	Date: 1/7/22	Time: 14:40	REPORT TRANSMITTAL DESIRED: <input type="checkbox"/> HARDCOPY (extra cost) <input type="checkbox"/> FAX <input type="checkbox"/> EMAIL <input type="checkbox"/> ONLINE
Relinquished By:	Date:	Time:	Received By:	Date:	Time:	
Relinquished By:	Date:	Time:	Received By:	Date:	Time:	FOR LAB USE ONLY Temp of samples _____ °C Attempt to Cool? _____ Comments: _____
TAT: Standard <input checked="" type="checkbox"/> RUSH <input type="checkbox"/> Next BD <input type="checkbox"/> 2nd BD <input type="checkbox"/> 3rd BD <input type="checkbox"/>						



Anatek Labs, Inc.

Sample Receipt and Preservation Form

MCA0118



Due: 01/24/22

Client Name: Hall Project:TAT: Normal RUSH: daysSamples Received From: FedEx UPS USPS Client Courier Other: Custody Seal on Cooler/Box: Yes No Custody Seals Intact: Yes No N/ANumber of Coolers/Boxes: 2 Type of Ice: Ice Packs Blue Ice Dry Ice NonePacking Material: Bubble Wrap Bags Foam/Peanuts None Other: Cooler Temp As Read (°C): 3.0 Cooler Temp Corrected (°C): Thermometer Used: IR-5

Comments:

Samples Received Intact? Yes No N/AChain of Custody Present? Yes No N/ASamples Received Within Hold Time? Yes No N/ASamples Properly Preserved? Yes No N/AVOC Vials Free of Headspace (<6mm)? Yes No N/AVOC Trip Blanks Present? Yes No N/ALabels and Chains Agree? Yes No N/ATotal Number of Sample Bottles Received: 10Chain of Custody Fully Completed? Yes No N/ACorrect Containers Received? Yes No N/AAnatek Bottles Used? Yes No Unknown

Record preservatives (and lot numbers, if known) for containers below:

ST-Glyphosate/Pest PCB-g 44mL x2 NaOH-Cn-p 500mL
 ST/PDC-Carbamates-g 44mL x2
 SS/HCl-SOL 525-g 1L
 ST-Endothall/Herb 515-g 500mL
 ST-Diquat-p 250mL

Notes, comments, etc. (also use this space if contacting the client - record names and date/time)

Color/Odor-g 1L
 Corrosivity/Surfactants-p 500mL

Received/Inspected By: JH Date/Time: 1/7/22 14:40

February 08, 2022

Andy Freeman
Hall Environmental
4901 Hawkins NE
Albuquerque, NM 87109

RE: Project: 2201113
Pace Project No.: 30458569

Dear Andy Freeman:

Enclosed are the analytical results for sample(s) received by the laboratory on January 07, 2022. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:

- Pace Analytical Services - Greensburg

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Karen L. Smetanka
karen.smetanka@pacelabs.com
(724)850-5600
Project Manager

Enclosures

cc: Ms. Jackie Ball, Hall Environmental
Michelle Garcia, Hall Environmental



REPORT OF LABORATORY ANALYSIS

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CERTIFICATIONS

Project: 2201113
Pace Project No.: 30458569

Pace Analytical Services Pennsylvania

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601

ANAB DOD-ELAP Rad Accreditation #: L2417

Alabama Certification #: 41590

Arizona Certification #: AZ0734

Arkansas Certification

California Certification #: 04222CA

Colorado Certification #: PA01547

Connecticut Certification #: PH-0694

Delaware Certification

EPA Region 4 DW Rad

Florida/TNI Certification #: E87683

Georgia Certification #: C040

Guam Certification

Florida: Cert E871149 SEKS WET

Hawaii Certification

Idaho Certification

Illinois Certification

Indiana Certification

Iowa Certification #: 391

Kansas/TNI Certification #: E-10358

Kentucky Certification #: KY90133

KY WW Permit #: KY0098221

KY WW Permit #: KY0000221

Louisiana DHH/TNI Certification #: LA180012

Louisiana DEQ/TNI Certification #: 4086

Maine Certification #: 2017020

Maryland Certification #: 308

Massachusetts Certification #: M-PA1457

Michigan/PADEP Certification #: 9991

Missouri Certification #: 235

Montana Certification #: Cert0082

Nebraska Certification #: NE-OS-29-14

Nevada Certification #: PA014572018-1

New Hampshire/TNI Certification #: 297617

New Jersey/TNI Certification #: PA051

New Mexico Certification #: PA01457

New York/TNI Certification #: 10888

North Carolina Certification #: 42706

North Dakota Certification #: R-190

Ohio EPA Rad Approval: #41249

Oregon/TNI Certification #: PA200002-010

Pennsylvania/TNI Certification #: 65-00282

Puerto Rico Certification #: PA01457

Rhode Island Certification #: 65-00282

South Dakota Certification

Tennessee Certification #: 02867

Texas/TNI Certification #: T104704188-17-3

Utah/TNI Certification #: PA014572017-9

USDA Soil Permit #: P330-17-00091

Vermont Dept. of Health: ID# VT-0282

Virgin Island/PADEP Certification

Virginia/VELAP Certification #: 460198

Washington Certification #: C868

West Virginia DEP Certification #: 143

West Virginia DHHR Certification #: 9964C

Wisconsin Approve List for Rad

Wyoming Certification #: 8TMS-L

REPORT OF LABORATORY ANALYSIS

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SAMPLE SUMMARY

Project: 2201113

Pace Project No.: 30458569

Lab ID	Sample ID	Matrix	Date Collected	Date Received
30458569001	2201113-001 / Eagle Spring	Water	01/04/22 12:30	01/07/22 10:30

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: 2201113
Pace Project No.: 30458569

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
30458569001	2201113-001 / Eagle Spring	EPA 900.0	RJS	2	PASI-PA
		EPA 903.1	MK1	1	PASI-PA
		EPA 904.0	VAL	1	PASI-PA

PASI-PA = Pace Analytical Services - Greensburg

REPORT OF LABORATORY ANALYSIS

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PROJECT NARRATIVE

Project: 2201113
Pace Project No.: 30458569

Method: EPA 900.0
Description: 900.0 Gross Alpha/Beta
Client: Hall Environmental
Date: February 08, 2022

General Information:

1 sample was analyzed for EPA 900.0 by Pace Analytical Services Greensburg. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:

The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:

All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:

All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:

All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

REPORT OF LABORATORY ANALYSIS

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PROJECT NARRATIVE

Project: 2201113
Pace Project No.: 30458569

Method: EPA 903.1
Description: 903.1 Radium 226
Client: Hall Environmental
Date: February 08, 2022

General Information:

1 sample was analyzed for EPA 903.1 by Pace Analytical Services Greensburg. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:

The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:

All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:

All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:

All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

REPORT OF LABORATORY ANALYSIS

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PROJECT NARRATIVE

Project: 2201113
Pace Project No.: 30458569

Method: EPA 904.0
Description: 904.0 Radium 228
Client: Hall Environmental
Date: February 08, 2022

General Information:

1 sample was analyzed for EPA 904.0 by Pace Analytical Services Greensburg. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:

The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:

All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:

All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:

All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

This data package has been reviewed for quality and completeness and is approved for release.

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: 2201113

Pace Project No.: 30458569

Sample: 2201113-001 / Eagle Spring **Lab ID:** 30458569001 Collected: 01/04/22 12:30 Received: 01/07/22 10:30 Matrix: Water

PWS: Site ID: Sample Type:

Comments:

- State of collection not listed on COC.
- Sampler name and signature not listed on COC.

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Pace Analytical Services - Greensburg						
Gross Alpha	EPA 900.0	-0.230 ± 0.880 (2.72) C:NA T:NA	pCi/L	02/03/22 06:55	12587-46-1	
Gross Beta	EPA 900.0	4.22 ± 1.39 (1.65) C:NA T:NA	pCi/L	02/03/22 06:55	12587-47-2	
Pace Analytical Services - Greensburg						
Radium-226	EPA 903.1	4.18 ± 1.29 (0.866) C:NA T:93%	pCi/L	01/28/22 13:52	13982-63-3	
Pace Analytical Services - Greensburg						
Radium-228	EPA 904.0	0.318 ± 0.276 (0.552) C:84% T:91%	pCi/L	01/26/22 14:07	15262-20-1	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL - RADIOCHEMISTRY

Project: 2201113
Pace Project No.: 30458569

QC Batch: 479184	Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1	Analysis Description: 903.1 Radium-226
	Laboratory: Pace Analytical Services - Greensburg

Associated Lab Samples: 30458569001

METHOD BLANK: 2315319 Matrix: Water

Associated Lab Samples: 30458569001

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.232 ± 0.361 (0.625) C:NA T:99%	pCi/L	01/28/22 13:52	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL - RADIOCHEMISTRY

Project: 2201113
Pace Project No.: 30458569

QC Batch: 479185	Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0	Analysis Description: 904.0 Radium 228
	Laboratory: Pace Analytical Services - Greensburg

Associated Lab Samples: 30458569001

METHOD BLANK: 2315320 Matrix: Water

Associated Lab Samples: 30458569001

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.0282 ± 0.242 (0.565) C:82% T:80%	pCi/L	01/26/22 14:04	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL - RADIOCHEMISTRY

Project: 2201113
Pace Project No.: 30458569

QC Batch: 480471	Analysis Method: EPA 900.0
QC Batch Method: EPA 900.0	Analysis Description: 900.0 Gross Alpha/Beta
	Laboratory: Pace Analytical Services - Greensburg

Associated Lab Samples: 30458569001

METHOD BLANK: 2321737 Matrix: Water

Associated Lab Samples: 30458569001

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Gross Alpha	-1.53 ± 0.657 (2.77) C:NA T:NA	pCi/L	02/02/22 07:59	
Gross Beta	-0.676 ± 0.559 (1.76) C:NA T:NA	pCi/L	02/02/22 07:59	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: 2201113
Pace Project No.: 30458569

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Reported results are not rounded until the final step prior to reporting. Therefore, calculated parameters that are typically reported as "Total" may vary slightly from the sum of the reported component parameters.

Act - Activity

Unc - Uncertainty: For Safe Drinking Water Act (SDWA) analyses, the reported Unc. is the calculated Count Uncertainty (95% confidence interval) using a coverage factor of 1.96. For all other matrices (non-SDWA), the reported Unc. is the calculated Expanded Uncertainty (aka Combined Standard Uncertainty, CSU), reported at the 95% confidence interval using a coverage factor of 1.96.

Gamma Spec: The Unc. reported for all gamma-spectroscopy analyses (EPA 901.1), is the calculated Expanded Uncertainty (CSU) at the 95.4% confidence interval, using a coverage factor of 2.0.

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

REPORT OF LABORATORY ANALYSIS

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CHAIN OF CUSTODY RECORD

PAGE: 1 OF: 1

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975
FAX: 505-345-4107
Website: clients.hallenvironmental.com

SUB CONTRACTOR: Pace-Greensburg		COMPANY: Pace Analytical Services, Inc.	PHONE: (724) 850-5600	FAX: (724) 850-5601			
ADDRESS: 1638 Roseytown Rd Ste 2,3,4		ACCOUNT #:	EMAIL:				
CITY, STATE, ZIP: Greensburg, PA 15601							
ITEM	SAMPLE	CLIENT SAMPLE ID	BOTTLE TYPE	MATRIX	COLLECTION DATE	# CONTAINERS	ANALYTICAL COMMENTS
1	2201113-001N	Eagle Spring	1LHDPEHNO	Aqueous	1/4/2022 12:30:00 PM	2	Ra 226/228
2	2201113-001O	Eagle Spring	1LHDPEHNO	Aqueous	1/4/2022 12:30:00 PM	2	Gross Alpha/Beta

WO# : 30458569



SPECIAL INSTRUCTIONS / COMMENTS:

Please include the LAB ID and the CLIENT SAMPLE ID on all final reports. Please e-mail results to lab@hallenvironmental.com. Please return all coolers and blue ice. Thank you.

Relinquished By: <u>OM</u>	Date: 1/5/2022	Time: 8:37 AM	Received By: <u>[Signature]</u>	Date: 1/16/22	Time: 10:30
Relinquished By:	Date:	Time:	Received By:	Date: 1/17/22	Time:
Relinquished By:	Date:	Time:	Received By:	Date:	Time:
TAT:	Standard <u>P</u>	RUSH	Next BD <input type="checkbox"/>	2nd BD <input type="checkbox"/>	3rd BD <input type="checkbox"/>
REPORT TRANSMITTAL DESIRED:			FOR LAB USE ONLY		
<input type="checkbox"/> HARD COPY (extra cost)			<input type="checkbox"/> FAX <input type="checkbox"/> EMAIL <input type="checkbox"/> ONLINE		
Temp of samples			°C Attempt to Cool ?		
Comments:					



Pace Greensburg Lab -Sample Container Count

Client

Site

Profile Number

Notes

1845

Sample Line Item	Matrix	AG1H	AG1S	AG1T	AG2U	AG3S	AG3U	AG5U	AG5T	BG1U	BG2U	BP1N	BP1U	BP2S	BP2U	BP3C	BP3N	BP3S	BP3U	DG9S	GCUB	VG9H	VG9T	VG9U	VOAK	WG9U	WGKU	ZPLC
1												4																
2																												
3																												
4																												
5																												
6																												
7																												
8																												
9																												
10																												
11																												
12																												

30458569

Container Codes

Glass		
GJN	1 Gallon Jug with HNO3	DG9S 40mL amber VOA vial H2SO4
AG5U	100mL amber glass unpreserved	VG9U 40mL clear VOA vial
AG5T	100mL amber glass Na Thiosulfate	VG9T 40mL clear VOA vial Na Thiosulfate
GJN	1 Gallon Jug	VG9H 40mL clear VOA vial HCl
AG1S	1L amber glass H2SO4	JG9U 4oz amber wide jar
AG1H	1L amber glass HCl	WGFU 4oz wide jar unpreserved
AG1T	1L amber glass Na Thiosulfate	BG2U 500mL clear glass unpreserved
BG1U	1L clear glass unpreserved	AG2U 500mL amber glass unpreserved
AG3S	250mL amber glass H2SO4	WGKU 8oz wide jar unpreserved
AG3U	250mL amber glass unpreserved	

Plastic / Misc.		
GCUB	1 Gallon Cubitainer	EZI 5g Encore
12GN	1/2 Gallon Cubitainer	VOAK Kit for Volatile Solid
SP5T	120mL Coliform Na Thiosulfate	I Wipe/Swab
BP1N	1L plastic HNO3	ZPLC Ziploc Bag
BP1U	1L plastic unpreserved	
BP3S	250mL plastic H2SO4	WT Water
BP3N	250mL plastic HNO3	SL Solid
BP3U	250mL plastic unpreserved	OL Non-aqueous liquid
BP3C	250mL plastic NAOH	WP Wipe
BP2S	500mL plastic H2SO4	
BP2U	500mL plastic unpreserved	

Pittsburgh Lab Sample Condition Upon Receipt



Client Name: Hall Environmental

Project # # 30458569

Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace Other _____

Tracking #: 9242 2964 4274

Label <u>DE</u>
LIMS Login <u>VL</u>

Custody Seal on Cooler/Box Present: ☒ yes ☐ no Seals intact: ☒ yes ☐ no

Thermometer Used _____ Type of Ice: Wet Blue None

Cooler Temperature _____ Observed Temp _____ °C Correction Factor: _____ °C Final Temp: _____ °C

Temp should be above freezing to 6°C

Comments:	Yes	No	N/A	pH paper Lot# <u>1002811</u>	Date and initials of person examining contents: <u>DE 1/16/22</u>
Chain of Custody Present:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.	
Chain of Custody Filled Out:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2.	
Chain of Custody Relinquished:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3.	
Sampler Name & Signature on COC:	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4.	
Sample Labels match COC:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5.	
-Includes date/time/ID Matrix: <u>WT</u>					
Samples Arrived within Hold Time:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.	
Short Hold Time Analysis (<72hr remaining):	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	7.	
Rush Turn Around Time Requested:	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	8.	
Sufficient Volume:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	9.	
Correct Containers Used:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10.	
-Pace Containers Used:	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
Containers Intact:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	11.	
Orthophosphate field filtered	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	12.	
Hex Cr Aqueous sample field filtered	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	13.	
Organic Samples checked for dechlorination:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	14.	
Filtered volume received for Dissolved tests	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	15.	
All containers have been checked for preservation.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	16.	
exceptions: VOA, coliform, TOC, O&G, Phenolics, Radon, Non-aqueous matrix					
All containers meet method preservation requirements.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Initial when completed <u>DE</u>	Date/time of preservation
				Lot # of added preservative	
Headspace in VOA Vials (>6mm):	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	17.	
Trip Blank Present:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	18.	
Trip Blank Custody Seals Present	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Rad Samples Screened < 0.5 mrem/hr	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Initial when completed <u>DE</u>	Date: <u>1/16/22</u> Survey Meter SN: <u>1563</u>

Client Notification/ Resolution:

Person Contacted: _____ Date/Time: _____ Contacted By: _____

Comments/ Resolution: _____

☐ A check in this box indicates that additional information has been stored in ereports.

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

*PM review is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: LLLCS	SampType: LCSLL		TestCode: EPA Method 200.7: Metals							
Client ID: BatchQC	Batch ID: A84993		RunNo: 84993							
Prep Date:	Analysis Date: 1/6/2022		SeqNo: 2990190		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	ND	0.020	0.01000	0	102	50	150			
Barium	ND	0.0030	0.002000	0	113	50	150			
Beryllium	ND	0.0020	0.002000	0	87.6	50	150			
Boron	0.041	0.040	0.04000	0	102	50	150			
Cadmium	0.0023	0.0020	0.002000	0	114	50	150			
Chromium	0.0061	0.0060	0.006000	0	102	50	150			
Cobalt	0.0061	0.0060	0.006000	0	102	50	150			
Copper	0.0062	0.0060	0.006000	0	103	50	150			
Iron	ND	0.050	0.02000	0	107	50	150			
Manganese	ND	0.0020	0.002000	0	99.0	50	150			
Molybdenum	ND	0.0080	0.008000	0	91.7	50	150			
Nickel	ND	0.010	0.005000	0	117	50	150			
Silver	ND	0.0050	0.005000	0	97.8	50	150			
Zinc	0.012	0.010	0.01000	0	121	50	150			

Sample ID: LCS	SampType: LCS		TestCode: EPA Method 200.7: Metals							
Client ID: LCSW	Batch ID: A84993		RunNo: 84993							
Prep Date:	Analysis Date: 1/6/2022		SeqNo: 2990192		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	0.52	0.020	0.5000	0	103	85	115			
Barium	0.49	0.0030	0.5000	0	98.0	85	115			
Beryllium	0.49	0.0020	0.5000	0	98.1	85	115			
Boron	0.51	0.040	0.5000	0	101	85	115			
Cadmium	0.49	0.0020	0.5000	0	97.2	85	115			
Chromium	0.49	0.0060	0.5000	0	97.5	85	115			
Cobalt	0.48	0.0060	0.5000	0	95.2	85	115			
Copper	0.46	0.0060	0.5000	0	93.0	85	115			
Iron	0.49	0.050	0.5000	0	97.9	85	115			
Manganese	0.47	0.0020	0.5000	0	94.9	85	115			
Molybdenum	0.49	0.0080	0.5000	0	98.8	85	115			
Nickel	0.47	0.010	0.5000	0	93.7	85	115			
Silver	0.097	0.0050	0.1000	0	97.0	85	115			
Zinc	0.49	0.010	0.5000	0	97.8	85	115			

Sample ID: MB	SampType: MBLK		TestCode: EPA Method 200.7: Metals							
Client ID: PBW	Batch ID: A84993		RunNo: 84993							
Prep Date:	Analysis Date: 1/6/2022		SeqNo: 2990221		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual

Qualifiers:

* Value exceeds Maximum Contaminant Level	B Analyte detected in the associated Method Blank
D Sample Diluted Due to Matrix	E Estimated value
H Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
ND Not Detected at the Reporting Limit	P Sample pH Not In Range
PQL Practical Quantitative Limit	RL Reporting Limit
S % Recovery outside of range due to dilution or matrix interference	

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: MB	SampType: MBLK		TestCode: EPA Method 200.7: Metals							
Client ID: PBW	Batch ID: A84993		RunNo: 84993							
Prep Date:	Analysis Date: 1/6/2022		SeqNo: 2990221		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	ND	0.020								
Barium	ND	0.0030								
Beryllium	ND	0.0020								
Boron	ND	0.040								
Cadmium	ND	0.0020								
Chromium	ND	0.0060								
Cobalt	ND	0.0060								
Copper	ND	0.0060								
Iron	ND	0.050								
Manganese	ND	0.0020								
Molybdenum	ND	0.0080								
Nickel	ND	0.010								
Silver	ND	0.0050								
Zinc	ND	0.010								

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix interference

B Analyte detected in the associated Method Blank
E Estimated value
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: MB	SampType: MBLK	TestCode: EPA Method 200.7: Dissolved Metals								
Client ID: PBW	Batch ID: A84993	RunNo: 84993								
Prep Date:	Analysis Date: 1/6/2022	SeqNo: 2990189 Units: mg/L								
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	ND	0.020								
Barium	ND	0.0020								
Beryllium	ND	0.0020								
Boron	ND	0.040								
Cadmium	ND	0.0020								
Chromium	ND	0.0060								
Cobalt	ND	0.0060								
Copper	ND	0.0060								
Iron	ND	0.020								
Manganese	ND	0.0020								
Molybdenum	ND	0.0080								
Nickel	ND	0.010								
Silver	ND	0.0050								
Zinc	ND	0.010								

Sample ID: LLLCS	SampType: LCSLL	TestCode: EPA Method 200.7: Dissolved Metals								
Client ID: BatchQC	Batch ID: A84993	RunNo: 84993								
Prep Date:	Analysis Date: 1/6/2022	SeqNo: 2990191 Units: mg/L								
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	ND	0.020	0.01000	0	102	50	150			
Barium	0.0023	0.0020	0.002000	0	113	50	150			
Beryllium	ND	0.0020	0.002000	0	87.6	50	150			
Boron	0.041	0.040	0.04000	0	102	50	150			
Cadmium	0.0023	0.0020	0.002000	0	114	50	150			
Chromium	0.0061	0.0060	0.006000	0	102	50	150			
Cobalt	0.0061	0.0060	0.006000	0	102	50	150			
Copper	0.0062	0.0060	0.006000	0	103	50	150			
Iron	0.021	0.020	0.02000	0	107	50	150			
Manganese	ND	0.0020	0.002000	0	99.0	50	150			
Molybdenum	ND	0.0080	0.008000	0	91.7	50	150			
Nickel	ND	0.010	0.005000	0	117	50	150			
Silver	ND	0.0050	0.005000	0	97.8	50	150			
Zinc	0.012	0.010	0.01000	0	121	50	150			

Sample ID: LCS	SampType: LCS	TestCode: EPA Method 200.7: Dissolved Metals								
Client ID: LCSW	Batch ID: A84993	RunNo: 84993								
Prep Date:	Analysis Date: 1/6/2022	SeqNo: 2990193 Units: mg/L								
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual

Qualifiers:

* Value exceeds Maximum Contaminant Level	B Analyte detected in the associated Method Blank
D Sample Diluted Due to Matrix	E Estimated value
H Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
ND Not Detected at the Reporting Limit	P Sample pH Not In Range
PQL Practical Quantitative Limit	RL Reporting Limit
S % Recovery outside of range due to dilution or matrix interference	

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: LCS	SampType: LCS		TestCode: EPA Method 200.7: Dissolved Metals							
Client ID: LCSW	Batch ID: A84993		RunNo: 84993							
Prep Date:	Analysis Date: 1/6/2022		SeqNo: 2990193		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	0.52	0.020	0.5000	0	103	85	115			
Barium	0.49	0.0020	0.5000	0	98.0	85	115			
Beryllium	0.49	0.0020	0.5000	0	98.1	85	115			
Boron	0.51	0.040	0.5000	0	101	85	115			
Cadmium	0.49	0.0020	0.5000	0	97.2	85	115			
Chromium	0.49	0.0060	0.5000	0	97.5	85	115			
Cobalt	0.48	0.0060	0.5000	0	95.2	85	115			
Copper	0.46	0.0060	0.5000	0	93.0	85	115			
Iron	0.49	0.020	0.5000	0	97.9	85	115			
Manganese	0.47	0.0020	0.5000	0	94.9	85	115			
Molybdenum	0.49	0.0080	0.5000	0	98.8	85	115			
Nickel	0.47	0.010	0.5000	0	93.7	85	115			
Silver	0.097	0.0050	0.1000	0	97.0	85	115			
Zinc	0.49	0.010	0.5000	0	97.8	85	115			

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Estimated value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix interference		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: MB		SampType: MBLK		TestCode: EPA 200.8: Metals						
Client ID: PBW		Batch ID: A85050		RunNo: 85050						
Prep Date:		Analysis Date: 1/10/2022		SeqNo: 2992301			Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	ND	0.0010								
Copper	ND	0.0010								
Selenium	ND	0.0010								
Thallium	ND	0.00025								
Uranium	ND	0.00050								

Sample ID: LLCS-TL		SampType: LCSLL		TestCode: EPA 200.8: Metals						
Client ID: BatchQC		Batch ID: A85050		RunNo: 85050						
Prep Date:		Analysis Date: 1/10/2022		SeqNo: 2992302		Units: mg/L				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Thallium	ND	0.00025	0.0002500	0	99.3	50	150			

Sample ID: LLCS		SampType: LCSLL		TestCode: EPA 200.8: Metals						
Client ID: BatchQC		Batch ID: A85050		RunNo: 85050						
Prep Date:		Analysis Date: 1/10/2022		SeqNo: 2992303			Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	ND	0.0010	0.001000	0	99.7	50	150			
Copper	0.0011	0.0010	0.001000	0	107	50	150			
Selenium	0.0011	0.0010	0.001000	0	110	50	150			
Uranium	0.00051	0.00050	0.0005000	0	101	50	150			

Sample ID: LCS		SampType: LCS		TestCode: EPA 200.8: Metals						
Client ID: LCSW		Batch ID: A85050		RunNo: 85050						
Prep Date:		Analysis Date: 1/10/2022		SeqNo: 2992304			Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	0.026	0.0010	0.02500	0	102	85	115			
Copper	0.026	0.0010	0.02500	0	102	85	115			
Selenium	0.026	0.0010	0.02500	0	104	85	115			
Thallium	0.013	0.00025	0.01250	0	100	85	115			
Uranium	0.013	0.00050	0.01250	0	102	85	115			

Sample ID: 2201113-001DMS		SampType: MS		TestCode: EPA 200.8: Metals						
Client ID: Eagle Springs		Batch ID: A85050		RunNo: 85050						
Prep Date:		Analysis Date: 1/10/2022		SeqNo: 2992309		Units: mg/L				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	0.028	0.0010	0.02500	0.002081	102	70	130			

Qualifiers:

* Value exceeds Maximum Contaminant Level	B Analyte detected in the associated Method Blank
D Sample Diluted Due to Matrix	E Estimated value
H Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
ND Not Detected at the Reporting Limit	P Sample pH Not In Range
PQL Practical Quantitative Limit	RL Reporting Limit
S % Recovery outside of range due to dilution or matrix interference	

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: 2201113-001DMS		SampType: MS			TestCode: EPA 200.8: Metals					
Client ID: Eagle Springs		Batch ID: A85050			RunNo: 85050					
Prep Date:		Analysis Date: 1/10/2022			SeqNo: 2992309		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Copper	0.025	0.0010	0.02500	0	99.7	70	130			
Selenium	0.027	0.0010	0.02500	0	110	70	130			
Thallium	0.013	0.00025	0.01250	0	103	70	130			
Uranium	0.013	0.00050	0.01250	0	108	70	130			

Sample ID: 2201113-001DMSD		SampType: MSD			TestCode: EPA 200.8: Metals					
Client ID:	Eagle Springs	Batch ID: A85050			RunNo: 85050					
Prep Date:		Analysis Date: 1/10/2022			SeqNo: 2992312		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	0.029	0.0010	0.02500	0.002081	109	70	130	6.42	20	
Copper	0.026	0.0010	0.02500	0	104	70	130	4.60	20	
Selenium	0.029	0.0010	0.02500	0	115	70	130	4.32	20	
Thallium	0.013	0.00025	0.01250	0	105	70	130	2.84	20	
Uranium	0.014	0.00050	0.01250	0	113	70	130	4.98	20	

Sample ID: MB		SampType: MBLK			TestCode: EPA 200.8: Metals					
Client ID: PBW		Batch ID: B85050			RunNo: 85050					
Prep Date:		Analysis Date: 1/10/2022			SeqNo: 2992339		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Antimony	ND	0.0010								

Sample ID: LL LCS		SampType: LCSLL		TestCode: EPA 200.8: Metals						
Client ID: BatchQC		Batch ID: B85050		RunNo: 85050						
Prep Date:		Analysis Date: 1/10/2022		SeqNo: 2992340		Units: mg/L				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Antimony	0.0011	0.0010	0.001000	0	105	50	150			

Sample ID: LCS		SampType: LCS		TestCode: EPA 200.8: Metals						
Client ID: LCSW		Batch ID: B85050		RunNo: 85050						
Prep Date:		Analysis Date: 1/10/2022		SeqNo: 2992341		Units: mg/L				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Antimony	0.026	0.0010	0.02500	0	102	85	115			

Qualifiers:

* Value exceeds Maximum Contaminant Level	B Analyte detected in the associated Method Blank
D Sample Diluted Due to Matrix	E Estimated value
H Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
ND Not Detected at the Reporting Limit	P Sample pH Not In Range
PQL Practical Quantitative Limit	RL Reporting Limit
S % Recovery outside of range due to dilution or matrix interference	

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: 2201113-001DMS	SampType: MS	TestCode: EPA 200.8: Metals
Client ID: Eagle Springs	Batch ID: B85050	RunNo: 85050
Prep Date:	Analysis Date: 1/10/2022	SeqNo: 2992345 Units: mg/L
Analyte	Result	PQL SPK value SPK Ref Val %REC LowLimit HighLimit %RPD RPDLimit Qual
Antimony	0.027	0.0010 0.02500 0.0006221 105 70 130

Sample ID: 2201113-001DMSD	SampType: MSD	TestCode: EPA 200.8: Metals
Client ID: Eagle Springs	Batch ID: B85050	RunNo: 85050
Prep Date:	Analysis Date: 1/10/2022	SeqNo: 2992346 Units: mg/L
Analyte	Result	PQL SPK value SPK Ref Val %REC LowLimit HighLimit %RPD RPDLimit Qual
Antimony	0.028	0.0010 0.02500 0.0006221 110 70 130 4.74 20

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Estimated value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix interference		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: MB	SampType: MBLK	TestCode: EPA 200.8: Dissolved Metals								
Client ID: PBW	Batch ID: A85189	RunNo: 85189								
Prep Date:	Analysis Date: 1/14/2022	SeqNo: 2996976 Units: mg/L								
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	ND	0.0010								
Lead	ND	0.00050								
Selenium	ND	0.0010								
Thallium	ND	0.00025								
Uranium	ND	0.00050								

Sample ID: LCSLL	SampType: LCSLL	TestCode: EPA 200.8: Dissolved Metals								
Client ID: BatchQC	Batch ID: A85189	RunNo: 85189								
Prep Date:	Analysis Date: 1/14/2022	SeqNo: 2996977 Units: mg/L								
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	0.0010	0.0010	0.001000	0	101	50	150			
Lead	0.00052	0.00050	0.0005000	0	103	50	150			
Selenium	0.0012	0.0010	0.001000	0	116	50	150			
Thallium	0.00051	0.00025	0.0005000	0	101	50	150			
Uranium	ND	0.00050	0.0005000	0	98.3	50	150			

Sample ID: LCS	SampType: LCS	TestCode: EPA 200.8: Dissolved Metals								
Client ID: LCSW	Batch ID: A85189	RunNo: 85189								
Prep Date:	Analysis Date: 1/14/2022	SeqNo: 2996978 Units: mg/L								
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	0.025	0.0010	0.02500	0	99.9	85	115			
Lead	0.013	0.00050	0.01250	0	100	85	115			
Selenium	0.026	0.0010	0.02500	0	106	85	115			
Thallium	0.013	0.00025	0.01250	0	100	85	115			
Uranium	0.012	0.00050	0.01250	0	97.1	85	115			

Sample ID: MB	SampType: MBLK	TestCode: EPA 200.8: Dissolved Metals								
Client ID: PBW	Batch ID: A85205	RunNo: 85205								
Prep Date:	Analysis Date: 1/17/2022	SeqNo: 2997738 Units: mg/L								
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Antimony	ND	0.0010								

Sample ID: LCSLL	SampType: LCSLL	TestCode: EPA 200.8: Dissolved Metals								
Client ID: BatchQC	Batch ID: A85205	RunNo: 85205								
Prep Date:	Analysis Date: 1/17/2022	SeqNo: 2997739 Units: mg/L								
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual

Qualifiers:

* Value exceeds Maximum Contaminant Level	B Analyte detected in the associated Method Blank
D Sample Diluted Due to Matrix	E Estimated value
H Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
ND Not Detected at the Reporting Limit	P Sample pH Not In Range
PQL Practical Quantitative Limit	RL Reporting Limit
S % Recovery outside of range due to dilution or matrix interference	

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: LCSLL	SampType: LCSLL	TestCode: EPA 200.8: Dissolved Metals
Client ID: BatchQC	Batch ID: A85205	RunNo: 85205
Prep Date:	Analysis Date: 1/17/2022	SeqNo: 2997739 Units: mg/L
Analyte	Result	PQL SPK value SPK Ref Val %REC LowLimit HighLimit %RPD RPDLimit Qual
Antimony	ND	0.0010 0.001000 0 87.8 50 150

Sample ID: LCS	SampType: LCS	TestCode: EPA 200.8: Dissolved Metals
Client ID: LCSW	Batch ID: A85205	RunNo: 85205
Prep Date:	Analysis Date: 1/17/2022	SeqNo: 2997740 Units: mg/L
Analyte	Result	PQL SPK value SPK Ref Val %REC LowLimit HighLimit %RPD RPDLimit Qual
Antimony	0.023	0.0010 0.02500 0 91.4 85 115

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Estimated value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix interference		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: MB-65046	SampType: MBLK	TestCode: EPA Method 245.1: Mercury
Client ID: PBW	Batch ID: 65046	RunNo: 85199
Prep Date: 1/17/2022	Analysis Date: 1/17/2022	SeqNo: 2997148 Units: mg/L
Analyte	Result	PQL SPK value SPK Ref Val %REC LowLimit HighLimit %RPD RPDLimit Qual
Mercury	ND	0.00020

Sample ID: LCSLL-65046	SampType: LCSLL	TestCode: EPA Method 245.1: Mercury
Client ID: BatchQC	Batch ID: 65046	RunNo: 85199
Prep Date: 1/17/2022	Analysis Date: 1/17/2022	SeqNo: 2997149 Units: mg/L
Analyte	Result	PQL SPK value SPK Ref Val %REC LowLimit HighLimit %RPD RPDLimit Qual
Mercury	ND	0.00020 0.0001500 0 97.6 50 150

Sample ID: LCS-65046	SampType: LCS	TestCode: EPA Method 245.1: Mercury
Client ID: LCSW	Batch ID: 65046	RunNo: 85199
Prep Date: 1/17/2022	Analysis Date: 1/17/2022	SeqNo: 2997150 Units: mg/L
Analyte	Result	PQL SPK value SPK Ref Val %REC LowLimit HighLimit %RPD RPDLimit Qual
Mercury	0.0052	0.00020 0.005000 0 103 85 115

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Estimated value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix interference		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: MB-64920	SampType: MBLK		TestCode: SM 2540 C: Total Dissolved Solids							
Client ID: PBW	Batch ID: 64920		RunNo: 85103							
Prep Date: 1/7/2022	Analysis Date: 1/12/2022		SeqNo: 2994364		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	ND	20.0								

Sample ID: LCS-64920	SampType: LCS		TestCode: SM 2540 C: Total Dissolved Solids							
Client ID: LCSW	Batch ID: 64920		RunNo: 85103							
Prep Date: 1/7/2022	Analysis Date: 1/12/2022		SeqNo: 2994365		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	1010	20.0	1000	0	101	80	120			

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix interference

B Analyte detected in the associated Method Blank
E Estimated value
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: MB	SampType: mblk	TestCode: EPA Method 300.0: Anions								
Client ID: PBW	Batch ID: R84955	RunNo: 84955								
Prep Date:	Analysis Date: 1/5/2022	SeqNo: 2989756 Units: mg/L								
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	ND	0.10								
Chloride	ND	0.50								
Nitrogen, Nitrite (As N)	ND	0.10								
Nitrogen, Nitrate (As N)	ND	0.10								
Sulfate	ND	0.50								

Sample ID: LCS	SampType: lcs	TestCode: EPA Method 300.0: Anions								
Client ID: LCSW	Batch ID: R84955	RunNo: 84955								
Prep Date:	Analysis Date: 1/5/2022	SeqNo: 2989757 Units: mg/L								
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	0.48	0.10	0.5000	0	96.1	90	110			
Chloride	4.8	0.50	5.000	0	96.2	90	110			
Nitrogen, Nitrite (As N)	0.97	0.10	1.000	0	97.5	90	110			
Nitrogen, Nitrate (As N)	2.6	0.10	2.500	0	102	90	110			
Sulfate	9.4	0.50	10.00	0	94.3	90	110			

Sample ID: 2201113-001CMS	SampType: ms	TestCode: EPA Method 300.0: Anions								
Client ID: Eagle Springs	Batch ID: R84955	RunNo: 84955								
Prep Date:	Analysis Date: 1/5/2022	SeqNo: 2989761 Units: mg/L								
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	0.61	0.10	0.5000	0.1719	87.1	79.7	110			
Nitrogen, Nitrite (As N)	0.94	0.10	1.000	0	94.1	83.4	105			
Nitrogen, Nitrate (As N)	2.6	0.10	2.500	0.01450	102	93.5	110			

Sample ID: 2201113-001CMSD	SampType: msd	TestCode: EPA Method 300.0: Anions								
Client ID: Eagle Springs	Batch ID: R84955	RunNo: 84955								
Prep Date:	Analysis Date: 1/5/2022	SeqNo: 2989762 Units: mg/L								
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	0.61	0.10	0.5000	0.1719	87.1	79.7	110	0.0542	20	
Nitrogen, Nitrite (As N)	0.94	0.10	1.000	0	93.7	83.4	105	0.437	20	
Nitrogen, Nitrate (As N)	2.6	0.10	2.500	0.01450	102	93.5	110	0.291	20	

Qualifiers:

* Value exceeds Maximum Contaminant Level	B Analyte detected in the associated Method Blank
D Sample Diluted Due to Matrix	E Estimated value
H Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
ND Not Detected at the Reporting Limit	P Sample pH Not In Range
PQL Practical Quantitative Limit	RL Reporting Limit
S % Recovery outside of range due to dilution or matrix interference	

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: MB-64981	SampType: MBLK	TestCode: EPA Method 504.1: EDB/DBCP								
Client ID: PBW	Batch ID: 64981	RunNo: 85109								
Prep Date: 1/12/2022	Analysis Date: 1/12/2022	SeqNo: 2994563	Units: µg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
1,2-Dibromo-3-chloropropane	ND	0.020								
1,2-Dibromoethane	ND	0.010								

Sample ID: MB-64981	SampType: MBLK	TestCode: EPA Method 504.1: EDB/DBCP								
Client ID: PBW	Batch ID: 64981	RunNo: 85109								
Prep Date: 1/12/2022	Analysis Date: 1/12/2022	SeqNo: 2994586	Units: µg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
1,2-Dibromo-3-chloropropane	ND	0.020								
1,2-Dibromoethane	ND	0.010								

Sample ID: LCS-64981	SampType: LCS	TestCode: EPA Method 504.1: EDB/DBCP								
Client ID: LCSW	Batch ID: 64981	RunNo: 85109								
Prep Date: 1/12/2022	Analysis Date: 1/12/2022	SeqNo: 2994587	Units: µg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
1,2-Dibromo-3-chloropropane	0.091	0.020	0.1000	0	90.6	70	130			
1,2-Dibromoethane	0.12	0.010	0.1000	0	120	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Estimated value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix interference		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: 62.5ng lcs	SampType: LCS		TestCode: PURGEABLE ORGANICS by EPA 524							
Client ID: LCSW	Batch ID: DW85133		RunNo: 85133							
Prep Date:	Analysis Date: 1/12/2022		SeqNo: 2995288		Units: µg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	2.7	0.50	2.500	0	109	70	130			
Carbon tetrachloride	2.4	0.50	2.500	0	97.2	70	130			
Chlorobenzene	2.6	0.50	2.500	0	103	70	130			
cis-1,2-Dichloroethene	2.6	0.50	2.500	0	104	70	130			
1,2-Dichlorobenzene	2.5	0.50	2.500	0	99.5	70	130			
1,4-Dichlorobenzene	2.5	0.50	2.500	0	100	70	130			
1,2-Dichloroethane	2.3	0.50	2.500	0	91.5	70	130			
1,1-Dichloroethene	2.5	0.50	2.500	0	98.9	70	130			
1,2-Dichloropropane	2.6	0.50	2.500	0	105	70	130			
Ethylbenzene	2.5	0.50	2.500	0	98.6	70	130			
Methylene chloride	2.6	0.50	2.500	0	103	70	130			
Styrene	2.5	0.50	2.500	0	99.6	70	130			
Tetrachloroethene	2.5	0.50	2.500	0	102	70	130			
Toluene	2.5	0.50	2.500	0	101	70	130			
trans-1,2-Dichloroethene	2.5	0.50	2.500	0	102	70	130			
1,2,4-Trichlorobenzene	2.2	0.50	2.500	0	87.4	70	130			
1,1,1-Trichloroethane	2.4	0.50	2.500	0	97.3	70	130			
1,1,2-Trichloroethane	2.6	0.50	2.500	0	106	70	130			
Trichloroethene	2.5	0.50	2.500	0	102	70	130			
Vinyl chloride	2.5	0.50	2.500	0	100	70	130			
Total Xylenes	7.7	0.50	7.500	0	102	70	130			
Surr: 1,2-Dichlorobenzene-d4	2.0		2.000		98.7	70	130			
Surr: 4-Bromofluorobenzene	2.0		2.000		101	70	130			

Sample ID: mb	SampType: MBLK		TestCode: PURGEABLE ORGANICS by EPA 524							
Client ID: PBW	Batch ID: DW85133		RunNo: 85133							
Prep Date:	Analysis Date: 1/12/2022		SeqNo: 2995289		Units: µg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	0.50								
Carbon tetrachloride	ND	0.50								
Chlorobenzene	ND	0.50								
cis-1,2-Dichloroethene	ND	0.50								
1,2-Dichlorobenzene	ND	0.50								
1,4-Dichlorobenzene	ND	0.50								
1,2-Dichloroethane	ND	0.50								
1,1-Dichloroethene	ND	0.50								
1,2-Dichloropropane	ND	0.50								
Ethylbenzene	ND	0.50								

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Estimated value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix interference		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: mb	SampType: MBLK		TestCode: PURGEABLE ORGANICS by EPA 524							
Client ID: PBW	Batch ID: DW85133		RunNo: 85133							
Prep Date:	Analysis Date: 1/12/2022		SeqNo: 2995289		Units: µg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Methylene chloride	ND	0.50								
Styrene	ND	0.50								
Tetrachloroethene	ND	0.50								
Toluene	ND	0.50								
trans-1,2-Dichloroethene	ND	0.50								
1,2,4-Trichlorobenzene	ND	0.50								
1,1,1-Trichloroethane	ND	0.50								
1,1,2-Trichloroethane	ND	0.50								
Trichloroethene	ND	0.50								
Vinyl chloride	ND	0.50								
Total Xylenes	ND	0.50								
Surr: 1,2-Dichlorobenzene-d4	1.9		2.000		96.6	70	130			
Surr: 4-Bromofluorobenzene	1.8		2.000		89.7	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Estimated value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix interference		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: 100ng lcs	SampType: LCS	TestCode: EPA Method 8260B: VOLATILES								
Client ID: LCSW	Batch ID: R84966	RunNo: 84966								
Prep Date:	Analysis Date: 1/5/2022	SeqNo: 2989808	Units: µg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	22	1.0	20.00	0	111	70	130			
Toluene	20	1.0	20.00	0	101	70	130			
Chlorobenzene	20	1.0	20.00	0	102	70	130			
1,1-Dichloroethene	20	1.0	20.00	0	101	70	130			
Trichloroethene (TCE)	22	1.0	20.00	0	108	70	130			
Surr: 1,2-Dichloroethane-d4	11		10.00		108	70	130			
Surr: 4-Bromofluorobenzene	10		10.00		102	70	130			
Surr: Dibromofluoromethane	11		10.00		111	70	130			
Surr: Toluene-d8	9.7		10.00		96.7	70	130			

Sample ID: mb	SampType: MBLK	TestCode: EPA Method 8260B: VOLATILES								
Client ID: PBW	Batch ID: R84966	RunNo: 84966								
Prep Date:	Analysis Date: 1/5/2022	SeqNo: 2989809	Units: µg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Methyl tert-butyl ether (MTBE)	ND	1.0								
1,2,4-Trimethylbenzene	ND	1.0								
1,3,5-Trimethylbenzene	ND	1.0								
1,2-Dichloroethane (EDC)	ND	1.0								
1,2-Dibromoethane (EDB)	ND	1.0								
Naphthalene	ND	2.0								
1-Methylnaphthalene	ND	4.0								
2-Methylnaphthalene	ND	4.0								
Acetone	ND	10								
Bromobenzene	ND	1.0								
Bromodichloromethane	ND	1.0								
Bromoform	ND	1.0								
Bromomethane	ND	3.0								
2-Butanone	ND	10								
Carbon disulfide	ND	10								
Carbon Tetrachloride	ND	1.0								
Chlorobenzene	ND	1.0								
Chloroethane	ND	2.0								
Chloroform	ND	1.0								
Chloromethane	ND	3.0								
2-Chlorotoluene	ND	1.0								

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Estimated value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix interference		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: mb	SampType: MBLK			TestCode: EPA Method 8260B: VOLATILES						
Client ID: PBW	Batch ID: R84966			RunNo: 84966						
Prep Date:	Analysis Date: 1/5/2022			SeqNo: 2989809	Units: µg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
4-Chlorotoluene	ND	1.0								
cis-1,2-DCE	ND	1.0								
cis-1,3-Dichloropropene	ND	1.0								
1,2-Dibromo-3-chloropropane	ND	2.0								
Dibromochloromethane	ND	1.0								
Dibromomethane	ND	1.0								
1,2-Dichlorobenzene	ND	1.0								
1,3-Dichlorobenzene	ND	1.0								
1,4-Dichlorobenzene	ND	1.0								
Dichlorodifluoromethane	ND	1.0								
1,1-Dichloroethane	ND	1.0								
1,1-Dichloroethene	ND	1.0								
1,2-Dichloropropane	ND	1.0								
1,3-Dichloropropane	ND	1.0								
2,2-Dichloropropane	ND	2.0								
1,1-Dichloropropene	ND	1.0								
Hexachlorobutadiene	ND	1.0								
2-Hexanone	ND	10								
Isopropylbenzene	ND	1.0								
4-Isopropyltoluene	ND	1.0								
4-Methyl-2-pentanone	ND	10								
Methylene Chloride	ND	3.0								
n-Butylbenzene	ND	3.0								
n-Propylbenzene	ND	1.0								
sec-Butylbenzene	ND	1.0								
Styrene	ND	1.0								
tert-Butylbenzene	ND	1.0								
1,1,1,2-Tetrachloroethane	ND	1.0								
1,1,2,2-Tetrachloroethane	ND	2.0								
Tetrachloroethene (PCE)	ND	1.0								
trans-1,2-DCE	ND	1.0								
trans-1,3-Dichloropropene	ND	1.0								
1,2,3-Trichlorobenzene	ND	1.0								
1,2,4-Trichlorobenzene	ND	1.0								
1,1,1-Trichloroethane	ND	1.0								
1,1,2-Trichloroethane	ND	1.0								
Trichloroethene (TCE)	ND	1.0								
Trichlorofluoromethane	ND	1.0								
1,2,3-Trichloropropane	ND	2.0								

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix interference

B Analyte detected in the associated Method Blank
E Estimated value
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: mb	SampType: MBLK		TestCode: EPA Method 8260B: VOLATILES							
Client ID: PBW	Batch ID: R84966		RunNo: 84966							
Prep Date:	Analysis Date: 1/5/2022		SeqNo: 2989809		Units: µg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Vinyl chloride	ND	1.0								
Xylenes, Total	ND	1.5								
Surr: 1,2-Dichloroethane-d4	11		10.00		110	70	130			
Surr: 4-Bromofluorobenzene	10		10.00		103	70	130			
Surr: Dibromofluoromethane	11		10.00		111	70	130			
Surr: Toluene-d8	9.8		10.00		97.8	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Estimated value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix interference		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: mb-64915	SampType: MBLK	TestCode: EPA Method 8270SIM								
Client ID: PBW	Batch ID: 64915	RunNo: 85114								
Prep Date: 1/7/2022	Analysis Date: 1/12/2022	SeqNo: 2994706	Units: µg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Naphthalene	ND	0.10								
1-Methylnaphthalene	ND	0.10								
2-Methylnaphthalene	ND	0.10								
Benzo(a)pyrene	ND	0.070								
Atrazine	ND	1.5								
Pentachlorophenol	ND	0.10								
Surr: Nitrobenzene-d5	2.9		4.000		71.5	21.9	89.8			
Surr: 2,4,6-Tribromophenol	5.4		8.000		67.0	23.4	71.6			
Surr: 2-Fluorobiphenyl	2.2		4.000		54.0	15	84.5			
Surr: 4-Terphenyl-d14	4.4		4.000		109	73.1	152			

Sample ID: lcs-64915	SampType: LCS	TestCode: EPA Method 8270SIM								
Client ID: LCSW	Batch ID: 64915	RunNo: 85114								
Prep Date: 1/7/2022	Analysis Date: 1/12/2022	SeqNo: 2994707	Units: µg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Naphthalene	1.4	0.10	2.000	0	69.0	26.5	90.9			
1-Methylnaphthalene	1.4	0.10	2.000	0	69.0	27.9	88.2			
2-Methylnaphthalene	1.3	0.10	2.000	0	67.0	29.2	87.5			
Benzo(a)pyrene	2.1	0.070	2.000	0	107	36.6	122			
Atrazine	2.0	1.5	2.000	0	102	32.5	135			
Pentachlorophenol	1.6	0.10	2.000	0	80.0	15	116			
Surr: Nitrobenzene-d5	4.8		5.000		96.8	21.9	89.8			S
Surr: 2,4,6-Tribromophenol	8.0		10.00		79.6	23.4	71.6			S
Surr: 2-Fluorobiphenyl	3.9		5.000		78.0	15	84.5			
Surr: 4-Terphenyl-d14	6.9		5.000		138	73.1	152			

Sample ID: lcsd-64915	SampType: LCSD	TestCode: EPA Method 8270SIM								
Client ID: LCSS02	Batch ID: 64915	RunNo: 85114								
Prep Date: 1/7/2022	Analysis Date: 1/12/2022	SeqNo: 2994708	Units: µg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Naphthalene	1.2	0.10	2.000	0	58.0	26.5	90.9	17.3	37.6	
1-Methylnaphthalene	1.2	0.10	2.000	0	59.0	27.9	88.2	15.6	33.1	
2-Methylnaphthalene	1.1	0.10	2.000	0	57.0	29.2	87.5	16.1	35.4	
Benzo(a)pyrene	2.1	0.070	2.000	0	106	36.6	122	0.939	22.4	
Atrazine	2.0	1.5	2.000	0	102	32.5	135	0	34.8	
Pentachlorophenol	1.7	0.10	2.000	0	83.0	15	116	3.68	53.3	
Surr: Nitrobenzene-d5	3.8		5.000		76.0	21.9	89.8	0	0	
Surr: 2,4,6-Tribromophenol	7.7		10.00		77.4	23.4	71.6	0	0	S

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Estimated value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix interference		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: lcscd-64915		SampType: LCSD		TestCode: EPA Method 8270SIM						
Client ID: LCSS02		Batch ID: 64915		RunNo: 85114						
Prep Date: 1/7/2022		Analysis Date: 1/12/2022		SeqNo: 2994708			Units: µg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: 2-Fluorobiphenyl	3.3		5.000		66.8	15	84.5	0	0	
Surr: 4-Terphenyl-d14	6.4		5.000		128	73.1	152	0	0	

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Estimated value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix interference		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: MB-64994	SampType: MBLK	TestCode: Total Phenolics by SW-846 9067								
Client ID: PBW	Batch ID: 64994	RunNo: 85130								
Prep Date: 1/13/2022	Analysis Date: 1/13/2022	SeqNo: 2995262 Units: µg/L								
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Phenolics	ND	5.0								

Sample ID: LCS-64994	SampType: LCS	TestCode: Total Phenolics by SW-846 9067								
Client ID: LCSW	Batch ID: 64994	RunNo: 85130								
Prep Date: 1/13/2022	Analysis Date: 1/13/2022	SeqNo: 2995263 Units: µg/L								
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Phenolics	15	5.0	20.00	0	73.7	58.1	107			

Sample ID: LCSD-64994	SampType: LCSD	TestCode: Total Phenolics by SW-846 9067								
Client ID: LCSS02	Batch ID: 64994	RunNo: 85130								
Prep Date: 1/13/2022	Analysis Date: 1/13/2022	SeqNo: 2995264 Units: µg/L								
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Phenolics	15	5.0	20.00	0	73.7	58.1	107	0	20	

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Estimated value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix interference		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2201113

09-Feb-22

Client: XXXXXXXXXX
Project: Eagle Springs

Sample ID: MB-64870		SampType: MBLK		TestCode: SM 9223B Total Coliform						
Client ID: PBW		Batch ID: 64870		RunNo: 85000						
Prep Date: 1/5/2022		Analysis Date: 1/6/2022		SeqNo: 2990586			Units: P/A			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Coliform	Absent	0								
E. Coli	Absent	0								

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix interference

B Analyte detected in the associated Method Blank
E Estimated value
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

Sample Log-In Check List

Client Name: XXXXXXXXXX

Work Order Number: 2201113

RcptNo: 1

Received By: Juan Rojas 1/4/2022 4:11:00 PM

Completed By: Cheyenne Cason 1/5/2022 8:16:39 AM

Reviewed By: DAD 1/5/22 @ 9:00

[Signature]

[Signature]

Chain of Custody

1. Is Chain of Custody complete? Yes ☒ No ☐ Not Present ☐
2. How was the sample delivered? Client

Log In

3. Was an attempt made to cool the samples? Yes ☐ No ☒ NA ☐
4. Were all samples received at a temperature of $>0^{\circ}\text{C}$ to 6.0°C ? Yes ☐ No ☒ NA ☐
5. Sample(s) in proper container(s)? Approved by client.
Yes ☒ No ☐
6. Sufficient sample volume for indicated test(s)? Yes ☒ No ☐
7. Are samples (except VOA and ONG) properly preserved? Yes ☒ No ☐
8. Was preservative added to bottles? Yes ☒ No ☐ NA ☐
9. Received at least 1 vial with headspace $<1/4"$ for AQ VOA? Yes ☐ No ☐ HNO₃, H₂SO₄ NA ☒
10. Were any sample containers received broken? Yes ☐ No ☒
11. Does paperwork match bottle labels? Yes ☒ No ☐
(Note discrepancies on chain of custody)
12. Are matrices correctly identified on Chain of Custody? Yes ☒ No ☐
13. Is it clear what analyses were requested? Yes ☒ No ☐
14. Were all holding times able to be met? Yes ☒ No ☐
(If no, notify customer for authorization.)

of preserved bottles checked for pH: 9 1
(≤ 2 or >12 unless noted)

Adjusted? yes

Checked by: Cue 1/5/22

Special Handling (if applicable)

15. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☒

Person Notified: _____ Date: _____
By Whom: _____ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding: _____
Client Instructions: _____

16. Additional remarks: Filter 1st # F52651

Poured off and Filtered ~125ml from unpreserved plastic and added ~0.4ml HNO₃ for dissolved metals analysis. Added ~2ml H₂SO₄ to unpreserved amber glass for Phenols analysis --

17. Cooler Information

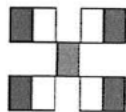
Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	14.2	Good	Not Present			
2	16.7	Good	Not Present			

[illegible]

Turn-Around Time:		<input type="checkbox"/> Standard <input type="checkbox"/> Rush	
Project Name:		Eaglesprings	
Project #:			
Project Manager:		Nyle Khan	
Sampler:			
On Ice:		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
# of Coolers:		2	
Cooler Temp (including CF):		13.9 HU.S = 14.2 (°C)	
Container Type and #	Preservative Type	16.4 HU.S = 16.7 HEAL No.	
		2202113	
		001	
		002	
Received by:	Via:	Date	Time
		1/4/21	16:11
Received by:	Via:	Date	Time

Chain-of-Custody Record

Client: [REDACTED]					
Mailing Address: [REDACTED]					
Phone # [REDACTED] email address [REDACTED]					
QA/QC Package: <input type="checkbox"/> Standard <input type="checkbox"/> Level 4 (Full Validation) Accreditation: <input type="checkbox"/> Az Compliance <input type="checkbox"/> NELAC <input type="checkbox"/> Other _____ <input type="checkbox"/> EDD (Type) _____					
Date	Time	Matrix	Sample Name		
01/04	12:30		Eaglesprings		
			Trip Blank		
Date:	Time:	Relinquished by:			
01/04	4:11pm	Daniel D.			
Date:	Time:	Relinquished by:			



**HALL ENVIRONMENTAL
ANALYSIS LABORATORY**

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

[illegible]

Remarks:

Temp Aprone

David Penn

2
Trip Blank

Received Broken case - 11/21/23

if necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

WQCC List (NM Code 20.6.2.3103)

- ✓ 3-40mL HCl VOAs
 - 8260_W: Volatile Organics
- ✓ ~~2-40mL Na₂S₂O₃ VOAs*~~
 - ~~504.1_W: EDB~~
- 4-1L glass amber unpreserved *Z*
 - ~~8082_LF: PCBs~~
 - 8270LF: Semi Volatile Organics
 - Naphthalene, 1-Methylnaphthalene, 2-Methylnaphthalene, Benzo(a)pyrene, Atrazine, Pentachlorophenol
- 1-1L glass amber H₂SO₄
 - 9067_W: Phenol*
- ✓ 1-500mL HDPE unpreserved
 - ~~300.0_W: Anions~~
 - ~~F, Cl, NO₃, SO₄, NO₂~~
 - ~~TDS_W: SM2540 C (Mod.)~~
 - ~~PH_W: SM4500-H⁺B/EPA 9040C~~
- ✓ 1-125mL HDP H₂SO₄
 - ~~300_W: Anions~~
 - ~~NO₃+NO₂ backup~~
- ✓ ~~1-250mL HDPE HNO₃~~
 - ~~245.1: Mercury~~
- 1-125mL HDP HNO₃ (filter and syringe)**
 - 200.7 DISS: Dissolved Metals by ICP
 - Al, Ba, Be, B, Cd, Cr, Co, Cu, Fe, Mn, Mo, Ni, Ag, Zn
 - 200.8 DISS: Dissolved Metals by ICP/MS
 - As, Sb, Pb, Se, Tl, U
- ✓ ~~2-1L HDPE HNO₃~~
 - ~~RADCM: Ra-226/228 by EPA 903.1/904.0~~
- ✓ 1-500mL plastic amber NaOH
 - ~~CN_TW: Total CN by EPA 335.4~~

Be sure to include Trip Blank for 504.1_W and 8260_W.

*Include an extra bottle for QC per set of 20 samples

**Filtering events after sample receipt, must be properly documented including the lot number of the filter(s) used.

This Document Has Been Approved for Use at HEAL on 9/23/21 by: AF and TES.

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NMED NEW WATER SOURCES

- ✓ **3-40mL ascorbic acid VOAs**
(w/ HCl dropper and instructions)
 - 524_W: Volatile Organics in DW
- ✓ **1-1L glass amber unpreserved**
 - COLOR: SM2120 B
 - ODOR: SM2150 B
- ✓ **1-120mL Na₂S₂O₃ (certified clean w/ seal)**
 - Coliform: SM9223 B
- ✓ **2-500mL HDPE unpreserved**
 - 1 Bottle Fraction C
 - 300_W: Anions
 - F, NO₃, NO₂, Cl, SO₄
 - 2540_C_NELAC: TDS by SM2540 C
 - PH_W: SM4500-H⁺ B/EPA 9040C
 - 1 Bottle Fraction L:
 - SURF: SM5540 C
 - CORR: Corrosivity by EPA 9045D
- ✓ **1-125mL HDP H₂SO₄**
 - 300_W: Anions
 - NO₂+NO₃ backup
- ✓ **1-250mL HDPE HNO₃**
 - 200.7: Metals by ICP
 - Al, Ba, Cd, Cr, Be, Fe, Mn, Ag, Zn
 - 200.8_COMPLIANCE: Metals ICP/MS
 - Sb, As, Cu, Se, Tl, U
 - 245.1: Mercury
- ✓ **1-500mL plastic amber NaOH**
 - CN_DW: Total CN in DW by EPA 335.4
(Fill amber halfway, shake then add NaOH then continue to fill)
- ✓ **4-1L HDPE HNO₃**
 - RADCM: Ra-226/228 by EPA 903.1/904.0
 - ALBETA: Gross Alpha/Beta by EPA 900.0
- ✓ **1 Full SOC list**
 - (See page 21.)

Be sure to include a Trip Blank for 524_W.

This Document Has Been Approved for Use at HEAL on 9/23/21 by: AF and TES.

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Appendix A-3

Hall (HEAL) Report 3: Pretreated Toray810 RO Single/Double Pass Filtered Water Results



Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL 505-345-3975 FAX 505-345-4107
Website clients.hallenvironmental.com

March 30, 2022

Nyle Khan

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

FAX

RE: Eagle Springs Seawater RO Test

OrderNo.: 2203907

Dear Nyle Khan:

Hall Environmental Analysis Laboratory received 2 sample(s) on 3/16/2022 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results, it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifiers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0901

Sincerely,

A handwritten signature in black ink, appearing to read "Andy Freeman", is written over a light blue horizontal line.

Andy Freeman

Laboratory Manager

4901 Hawkins NE

Albuquerque, NM 87109

Hall Environmental Analysis Laboratory, Inc.

Analytical Report

Lab Order 2203907

Date Reported: 3/30/2022

CLIENT: [REDACTED]

Client Sample ID: ES Pass #1 SWRO

Project: Eagle Springs Seawater RO Test

Collection Date: 3/16/2022 11:20:00 AM

Lab ID: 2203907-001

Matrix: AQUEOUS

Received Date: 3/16/2022 4:15:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015M/D: DIESEL RANGE						Analyst: SB
Diesel Range Organics (DRO)	ND	1.0		mg/L	1	3/22/2022 11:55:12 AM
Motor Oil Range Organics (MRO)	ND	5.0		mg/L	1	3/22/2022 11:55:12 AM
Surr: DNOP	129	43.2-147		%Rec	1	3/22/2022 11:55:12 AM
EPA METHOD 8015D: GASOLINE RANGE						Analyst: BRM
Gasoline Range Organics (GRO)	ND	0.050		mg/L	1	3/19/2022 3:12:00 PM
Surr: BFB	109	68.5-136		%Rec	1	3/19/2022 3:12:00 PM
EPA METHOD 300.0: ANIONS						Analyst: LRN
Fluoride	ND	0.10		mg/L	1	3/17/2022 11:10:44 AM
Chloride	7.1	0.50		mg/L	1	3/17/2022 11:10:44 AM
Nitrogen, Nitrite (As N)	ND	0.10		mg/L	1	3/17/2022 11:10:44 AM
Bromide	ND	0.10		mg/L	1	3/17/2022 11:10:44 AM
Nitrogen, Nitrate (As N)	ND	0.10		mg/L	1	3/17/2022 11:10:44 AM
Phosphorus, Orthophosphate (As P)	ND	0.50		mg/L	1	3/17/2022 11:10:44 AM
Sulfate	7.1	0.50		mg/L	1	3/17/2022 11:10:44 AM
EPA METHOD 200.7: METALS						Analyst: ELS
Boron	0.85	0.040		mg/L	1	3/22/2022 11:16:33 AM
Calcium	ND	1.0		mg/L	1	3/22/2022 11:16:33 AM
Magnesium	ND	1.0		mg/L	1	3/22/2022 11:16:33 AM
Potassium	ND	1.0		mg/L	1	3/22/2022 11:16:33 AM
Sodium	9.1	1.0		mg/L	1	3/22/2022 12:17:39 PM
SM2510B: SPECIFIC CONDUCTANCE						Analyst: MRA
Conductivity	58	10		µmhos/c	1	3/22/2022 9:40:52 PM
SM2320B: ALKALINITY						Analyst: MRA
Bicarbonate (As CaCO ₃)	ND	20.00		mg/L Ca	1	3/22/2022 9:40:52 PM
Carbonate (As CaCO ₃)	ND	2.000		mg/L Ca	1	3/22/2022 9:40:52 PM
Total Alkalinity (as CaCO ₃)	ND	20.00		mg/L Ca	1	3/22/2022 9:40:52 PM
SM2540C MOD: TOTAL DISSOLVED SOLIDS						Analyst: KS
Total Dissolved Solids	35.0	20.0		mg/L	1	3/24/2022 5:38:00 PM

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:	*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
	D	Sample Diluted Due to Matrix	E	Estimated value
	H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
	ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
	PQL	Practical Quantitative Limit	RL	Reporting Limit
	S	% Recovery outside of range due to dilution or matrix interference		

Hall Environmental Analysis Laboratory, Inc.

Analytical Report

Lab Order **2203907**Date Reported: **3/30/2022****CLIENT:** [REDACTED]**Client Sample ID:** ES Pass #2 SWRO**Project:** Eagle Springs Seawater RO Test**Collection Date:** 3/16/2022 11:20:00 AM**Lab ID:** 2203907-002**Matrix:** AQUEOUS**Received Date:** 3/16/2022 4:15:00 PM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
EPA METHOD 300.0: ANIONS						Analyst: LRN
Fluoride	ND	0.10		mg/L	1	3/17/2022 12:02:10 PM
Chloride	ND	0.50		mg/L	1	3/17/2022 12:02:10 PM
Nitrogen, Nitrite (As N)	ND	0.10		mg/L	1	3/17/2022 12:02:10 PM
Bromide	ND	0.10		mg/L	1	3/17/2022 12:02:10 PM
Nitrogen, Nitrate (As N)	ND	0.10		mg/L	1	3/17/2022 12:02:10 PM
Phosphorus, Orthophosphate (As P)	ND	0.50		mg/L	1	3/17/2022 12:02:10 PM
Sulfate	ND	0.50		mg/L	1	3/17/2022 12:02:10 PM
EPA METHOD 200.7: METALS						Analyst: ELS
Boron	0.34	0.040		mg/L	1	3/22/2022 11:19:45 AM
Calcium	ND	1.0		mg/L	1	3/22/2022 11:19:45 AM
Magnesium	ND	1.0		mg/L	1	3/22/2022 11:19:45 AM
Potassium	ND	1.0		mg/L	1	3/22/2022 11:19:45 AM
Sodium	ND	1.0		mg/L	1	3/22/2022 12:19:17 PM
SM2510B: SPECIFIC CONDUCTANCE						Analyst: MRA
Conductivity	ND	10		µmhos/c	1	3/22/2022 9:52:08 PM
SM2320B: ALKALINITY						Analyst: MRA
Bicarbonate (As CaCO ₃)	ND	20.00		mg/L Ca	1	3/22/2022 9:52:08 PM
Carbonate (As CaCO ₃)	ND	2.000		mg/L Ca	1	3/22/2022 9:52:08 PM
Total Alkalinity (as CaCO ₃)	ND	20.00		mg/L Ca	1	3/22/2022 9:52:08 PM
SM2540C MOD: TOTAL DISSOLVED SOLIDS						Analyst: KS
Total Dissolved Solids	ND	20.0		mg/L	1	3/24/2022 5:38:00 PM

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:	*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
	D	Sample Diluted Due to Matrix	E	Estimated value
	H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
	ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
	PQL	Practical Quantitative Limit	RL	Reporting Limit
	S	% Recovery outside of range due to dilution or matrix interference		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2203907

30-Mar-22

Client: XXXXXXXXXX
Project: Eagle Springs Seawater RO Test

Sample ID: MB	SampType: MBLK	TestCode: EPA Method 200.7: Metals								
Client ID: PBW	Batch ID: A86637	RunNo: 86637								
Prep Date:	Analysis Date: 3/22/2022	SeqNo: 3058540	Units: mg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Boron	ND	0.040								
Calcium	ND	1.0								
Magnesium	ND	1.0								
Potassium	ND	1.0								
Sodium	ND	1.0								

Sample ID: LL LCS	SampType: LCSLL	TestCode: EPA Method 200.7: Metals								
Client ID: BatchQC	Batch ID: A86637	RunNo: 86637								
Prep Date:	Analysis Date: 3/22/2022	SeqNo: 3058541	Units: mg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Boron	ND	0.040	0.04000	0	99.1	50	150			
Calcium	ND	1.0	0.5000	0	104	50	150			
Magnesium	ND	1.0	0.5000	0	97.8	50	150			
Potassium	ND	1.0	0.5000	0	95.3	50	150			
Sodium	ND	1.0	0.5000	0	120	50	150			

Sample ID: LCS	SampType: LCS	TestCode: EPA Method 200.7: Metals								
Client ID: LCSW	Batch ID: A86637	RunNo: 86637								
Prep Date:	Analysis Date: 3/22/2022	SeqNo: 3058542	Units: mg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Boron	0.54	0.040	0.5000	0	107	85	115			
Calcium	48	1.0	50.00	0	97.0	85	115			
Magnesium	47	1.0	50.00	0	94.9	85	115			
Potassium	47	1.0	50.00	0	94.6	85	115			
Sodium	46	1.0	50.00	0	92.4	85	115			

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix interference

B Analyte detected in the associated Method Blank
E Estimated value
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2203907

30-Mar-22

Client: XXXXXXXXXX
Project: Eagle Springs Seawater RO Test

Sample ID: MB		SampType: mblk		TestCode: EPA Method 300.0: Anions						
Client ID: PBW		Batch ID: R86573		RunNo: 86573						
Prep Date:		Analysis Date: 3/17/2022		SeqNo: 3055603		Units: mg/L				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual

Fluoride	ND	0.10								
Chloride	ND	0.50								
Nitrogen, Nitrite (As N)	ND	0.10								
Bromide	ND	0.10								
Nitrogen, Nitrate (As N)	ND	0.10								
Phosphorus, Orthophosphate (As P)	ND	0.50								
Sulfate	ND	0.50								

Sample ID: LCS		SampType: lcs		TestCode: EPA Method 300.0: Anions						
Client ID: LCSW		Batch ID: R86573		RunNo: 86573						
Prep Date:		Analysis Date: 3/17/2022		SeqNo: 3055607		Units: mg/L				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual

Fluoride	0.50	0.10	0.5000	0	99.1	90	110			
Chloride	4.7	0.50	5.000	0	93.4	90	110			
Nitrogen, Nitrite (As N)	0.97	0.10	1.000	0	97.2	90	110			
Bromide	2.4	0.10	2.500	0	97.6	90	110			
Nitrogen, Nitrate (As N)	2.5	0.10	2.500	0	100	90	110			
Phosphorus, Orthophosphate (As P)	4.5	0.50	5.000	0	90.8	90	110			
Sulfate	9.3	0.50	10.00	0	93.1	90	110			

Sample ID: 2203907-001CMS		SampType: ms		TestCode: EPA Method 300.0: Anions						
Client ID: ES Pass #1 SWRO		Batch ID: R86573		RunNo: 86573						
Prep Date:		Analysis Date: 3/17/2022		SeqNo: 3055615		Units: mg/L				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual

Fluoride	0.49	0.10	0.5000	0	97.7	79.7	110			
Chloride	12	0.50	5.000	7.143	101	86.3	114			
Nitrogen, Nitrite (As N)	0.95	0.10	1.000	0	94.8	83.4	105			
Bromide	2.4	0.10	2.500	0	95.5	91.2	106			
Nitrogen, Nitrate (As N)	2.5	0.10	2.500	0	98.1	93.5	110			
Phosphorus, Orthophosphate (As P)	4.4	0.50	5.000	0	88.7	80.1	109			
Sulfate	16	0.50	10.00	7.057	94.3	90.5	112			

Sample ID: 2203907-001CMSD		SampType: msd		TestCode: EPA Method 300.0: Anions						
Client ID: ES Pass #1 SWRO		Batch ID: R86573		RunNo: 86573						
Prep Date:		Analysis Date: 3/17/2022		SeqNo: 3055616		Units: mg/L				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual

Fluoride	0.49	0.10	0.5000	0	97.6	79.7	110	0.0820	20	
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Qualifiers:

* Value exceeds Maximum Contaminant Level	B Analyte detected in the associated Method Blank
D Sample Diluted Due to Matrix	E Estimated value
H Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
ND Not Detected at the Reporting Limit	P Sample pH Not In Range
PQL Practical Quantitative Limit	RL Reporting Limit
S % Recovery outside of range due to dilution or matrix interference	

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2203907

30-Mar-22

Client: XXXXXXXXXX
Project: Eagle Springs Seawater RO Test

Sample ID: 2203907-001CMSD		SampType: msd		TestCode: EPA Method 300.0: Anions						
Client ID: ES Pass #1 SWRO		Batch ID: R86573		RunNo: 86573						
Prep Date:		Analysis Date: 3/17/2022		SeqNo: 3055616		Units: mg/L				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	12	0.50	5.000	7.143	101	86.3	114	0.00410	20	
Nitrogen, Nitrite (As N)	0.95	0.10	1.000	0	95.0	83.4	105	0.148	20	
Bromide	2.4	0.10	2.500	0	95.6	91.2	106	0.0879	20	
Nitrogen, Nitrate (As N)	2.5	0.10	2.500	0	98.1	93.5	110	0.0245	20	
Phosphorus, Orthophosphate (As P)	4.4	0.50	5.000	0	88.9	80.1	109	0.227	20	
Sulfate	16	0.50	10.00	7.057	94.4	90.5	112	0.0728	20	

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix interference

B Analyte detected in the associated Method Blank
E Estimated value
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2203907

30-Mar-22

Client: XXXXXXXXXX
Project: Eagle Springs Seawater RO Test

Sample ID: MB-66291	SampType: MBLK	TestCode: EPA Method 8015M/D: Diesel Range								
Client ID: PBW	Batch ID: 66291	RunNo: 86643								
Prep Date: 3/21/2022	Analysis Date: 3/22/2022	SeqNo: 3059907	Units: mg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	ND	1.0								
Motor Oil Range Organics (MRO)	ND	5.0								
Surr: DNOP	0.62		0.5000		123	43.2	147			

Sample ID: LCS-66291	SampType: LCS	TestCode: EPA Method 8015M/D: Diesel Range								
Client ID: LCSW	Batch ID: 66291	RunNo: 86643								
Prep Date: 3/21/2022	Analysis Date: 3/22/2022	SeqNo: 3059908	Units: mg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	2.9	1.0	2.500	0	116	70	130			
Surr: DNOP	0.31		0.2500		122	43.2	147			

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix interference

B Analyte detected in the associated Method Blank
E Estimated value
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2203907

30-Mar-22

Client: XXXXXXXXXX
Project: Eagle Springs Seawater RO Test

Sample ID: 2.5ug gro lcs	SampType: LCS		TestCode: EPA Method 8015D: Gasoline Range							
Client ID: LCSW	Batch ID: A86605		RunNo: 86605							
Prep Date:	Analysis Date: 3/19/2022		SeqNo: 3057167		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	0.57	0.050	0.5000	0	115	80	120			
Surr: BFB	45		20.00		227	68.5	136			S

Sample ID: mb	SampType: MBLK		TestCode: EPA Method 8015D: Gasoline Range							
Client ID: PBW	Batch ID: A86605		RunNo: 86605							
Prep Date:	Analysis Date: 3/19/2022		SeqNo: 3057168		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	0.050								
Surr: BFB	21		20.00		107	68.5	136			

Sample ID: 2203907-001ams	SampType: MS		TestCode: EPA Method 8015D: Gasoline Range							
Client ID: ES Pass #1 SWRO	Batch ID: A86605		RunNo: 86605							
Prep Date:	Analysis Date: 3/19/2022		SeqNo: 3057170		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	0.60	0.050	0.5000	0	120	70	130			
Surr: BFB	46		20.00		232	68.5	136			S

Sample ID: 2203907-001amsd	SampType: MSD		TestCode: EPA Method 8015D: Gasoline Range							
Client ID: ES Pass #1 SWRO	Batch ID: A86605		RunNo: 86605							
Prep Date:	Analysis Date: 3/19/2022		SeqNo: 3057171		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	0.58	0.050	0.5000	0	115	70	130	4.49	20	
Surr: BFB	44		20.00		219	68.5	136	0	0	S

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Estimated value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix interference		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2203907

30-Mar-22

Client: XXXXXXXXXX
Project: Eagle Springs Seawater RO Test

Sample ID: 2203907-001c dup	SampType: dup	TestCode: SM2510B: Specific Conductance								
Client ID: ES Pass #1 SWRO	Batch ID: R86681	RunNo: 86681								
Prep Date:	Analysis Date: 3/22/2022	SeqNo: 3060532	Units: µmhos/cm							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Conductivity	58	10						0	20	

Sample ID: lcs-1 100.2uS eC	SampType: lcs	TestCode: SM2510B: Specific Conductance								
Client ID: LCSW	Batch ID: R86681	RunNo: 86681								
Prep Date:	Analysis Date: 3/22/2022	SeqNo: 3060544	Units: µmhos/cm							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Conductivity	110	10	100.0	0	108	85	115			

Sample ID: lcs-2 100.2uS eC	SampType: lcs	TestCode: SM2510B: Specific Conductance								
Client ID: LCSW	Batch ID: R86681	RunNo: 86681								
Prep Date:	Analysis Date: 3/22/2022	SeqNo: 3060570	Units: µmhos/cm							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Conductivity	100	10	100.2	0	104	85	115			

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Estimated value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix interference		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2203907

30-Mar-22

Client: XXXXXXXXXX
Project: Eagle Springs Seawater RO Test

Sample ID: mb-1 alk	SampType: mblk	TestCode: SM2320B: Alkalinity								
Client ID: PBW	Batch ID: R86681	RunNo: 86681								
Prep Date:	Analysis Date: 3/22/2022	SeqNo: 3060403		Units: mg/L CaCO3						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20.00								

Sample ID: lcs-1 alk	SampType: lcs	TestCode: SM2320B: Alkalinity								
Client ID: LCSW	Batch ID: R86681	RunNo: 86681								
Prep Date:	Analysis Date: 3/22/2022	SeqNo: 3060404		Units: mg/L CaCO3						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	73.08	20.00	80.00	0	91.4	90	110			

Sample ID: mb-2 alk	SampType: mblk	TestCode: SM2320B: Alkalinity								
Client ID: PBW	Batch ID: R86681	RunNo: 86681								
Prep Date:	Analysis Date: 3/22/2022	SeqNo: 3060426		Units: mg/L CaCO3						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20.00								

Sample ID: lcs-2 alk	SampType: lcs	TestCode: SM2320B: Alkalinity								
Client ID: LCSW	Batch ID: R86681	RunNo: 86681								
Prep Date:	Analysis Date: 3/22/2022	SeqNo: 3060427		Units: mg/L CaCO3						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	74.16	20.00	80.00	0	92.7	90	110			

Sample ID: 2203907-001C DUP	SampType: dup	TestCode: SM2320B: Alkalinity								
Client ID: ES Pass #1 SWRO	Batch ID: R86681	RunNo: 86681								
Prep Date:	Analysis Date: 3/22/2022	SeqNo: 3060432		Units: mg/L CaCO3						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20.00						0	20	

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix interference

B Analyte detected in the associated Method Blank
E Estimated value
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 2203907

30-Mar-22

Client: XXXXXXXXXX
Project: Eagle Springs Seawater RO Test

Sample ID: MB-66350	SampType: MBLK	TestCode: SM2540C MOD: Total Dissolved Solids								
Client ID: PBW	Batch ID: 66350	RunNo: 86728								
Prep Date: 3/23/2022	Analysis Date: 3/24/2022	SeqNo: 3062125	Units: mg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	ND	20.0								

Sample ID: LCS-66350	SampType: LCS	TestCode: SM2540C MOD: Total Dissolved Solids								
Client ID: LCSW	Batch ID: 66350	RunNo: 86728								
Prep Date: 3/23/2022	Analysis Date: 3/24/2022	SeqNo: 3062126	Units: mg/L							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	1020	20.0	1000	0	102	80	120			

Qualifiers:

* Value exceeds Maximum Contaminant Level
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix interference

B Analyte detected in the associated Method Blank
E Estimated value
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Limit

Sample Log-In Check List

Client Name: XXXXXXXXXX

Work Order Number: 2203907

RcptNo: 1

Received By: Juan Rojas 3/16/2022 4:15:00 PM

Completed By: Cheyenne Cason 3/16/2022 4:27:02 PM

Reviewed By: KPG 3/16/22

Chain of Custody

1. Is Chain of Custody complete? Yes ☒ No ☐ Not Present ☐
2. How was the sample delivered?

Log In

3. Was an attempt made to cool the samples? Yes ☒ No ☐ NA ☐
4. Were all samples received at a temperature of $>0^{\circ}\text{C}$ to 6.0°C ? Yes ☐ No ☒ NA ☐
5. Sample(s) in proper container(s)? Yes ☐ No ☒
6. Sufficient sample volume for indicated test(s)? Yes ☒ No ☐
7. Are samples (except VOA and ONG) properly preserved? Yes ☒ No ☐
8. Was preservative added to bottles? Yes ☒ No ☐ NA ☐
9. Received at least 1 vial with headspace $<1/4"$ for AQ VOA? Yes ☒ No ☐ HNO3 ☐
10. Were any sample containers received broken? Yes ☐ No ☒ NA ☐
11. Does paperwork match bottle labels? Yes ☒ No ☐ (Note discrepancies on chain of custody)
12. Are matrices correctly identified on Chain of Custody? Yes ☒ No ☐
13. Is it clear what analyses were requested? Yes ☒ No ☐
14. Were all holding times able to be met? Yes ☒ No ☐ (If no, notify customer for authorization.)

of preserved
bottles checked
for pH: 2

(2 or >12 unless noted)

Adjusted? yes

Checked by: JR 3/16/22

Special Handling (if applicable)

15. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☒

Person Notified: _____ Date: _____
By Whom: _____ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding: _____
Client Instructions: _____

16. Additional remarks:

Poured off from unpreserved plastic jugs for all samples and all fractions, added ~ 0.5 ml HNO3 to 001D for metals analysis, added ~ 0.5 ml HNO3 to 002B for metals analysis -- JR 3/16/22

17. Cooler Information

Cooler No	Temp $^{\circ}\text{C}$	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	24.6	Good	Not Present			

HALL ENVIRONMENTAL ANALYSIS LABORATORY


www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

Remarks: Temp	Approve	Dan Du	3/16/23
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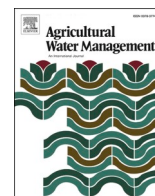
Received by:	Via:	Date	Time
	CDO	3/16/22	16:15
Received by:	Via:	Date	Time

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

[illegible]

Appendix B

Plant Growth and Soil Analysis: Final Published Results



Irrigation with desalinated and raw produced waters: Effects on soil properties, and germination and growth of five forages

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ABSTRACT

Produced water is generated during oil and gas production in copious amounts daily in the United States. With increasing water shortfalls in arid and semi-arid regions, it could be a valuable source of water for irrigation purposes after treatment. The present study examined the effects of irrigation with produced waters on five perennials cool season forage, species western wheatgrass (*Pascopyrum smithii*), alfalfa (*Medicago sativa*), meadow bromegrass (*Bromus biebersteinii*), Russian wildrye (*Psathyrostachys junceus*), and tall fescue (*Schedonorus arundinaceus*). The forages were grown in a greenhouse, in loamy soil, and irrigated with desalinated reverse osmosis RO (231 mg/l), diluted RAW (1400 mg/l), RAW produced (8610 mg/l), and tap (427 mg/l) water. All forages were harvested three times at an interval of \approx 90 days after 30 days germination period. Tall fescue germinated (100 %) and grew well under all four treatments. The higher biomass was with alfalfa, tall fescue, wheatgrass, bromegrass, and Russian wildrye, respectively. Evapotranspiration (ET) of the five species decreased with increasing soil and irrigation water salinity. Na, Cl, and B ions concentrations were 10.7, 13.6, and 42.3 mg/l, respectively in wheatgrass; 24.7, 17, and 14.5 mg/l, respectively in alfalfa; 27.7, 25.6, and 92.5 mg/l, respectively in bromegrass; 18, 14.6, and 59.6 mg/l, respectively in Russian wildrye; and 33, 35, and 207.5 mg/l, respectively in tall fescue, in plant tissues obtained after the second harvest. In soil, Na and B ions concentrations were 1173, 2.1 mg/l, respectively in wheatgrass pots; 1047, 1.7 mg/l, respectively in alfalfa pots; 874.6, 1.4 mg/l, respectively in bromegrass pots; 782, 1.6 mg/l, respectively in Russian wildrye pots; and 1974, 3.17 mg/l, respectively in tall fescue pots. Plant biomass decreased with increasing salinity; however, plants continued to grow even after the third harvest. Utilizing desalinated and diluted produced waters as a valuable source of water for irrigation after treatment could alleviate water demand in arid oil producing regions of the world.

1. Introduction

The search for alternative water sources for agricultural purposes due to continued drought and reduction in fresh water supplies has become mandatory in arid areas to save water for human consumption. Oil and gas industries generate large volumes (around 630 – 840 billion gallons/year) of water during extraction processes, and the largest by-product called “produced water” (Clark and Veil, 2009; Veil, 2011). This valuable source of water has been investigated as a useful source of irrigation in drylands in the US (Pica et al., 2017; Echchel et al., 2020).

In the US, west of the 98th meridian, the federal National Pollutant Discharge Elimination System (NPDES) exemption allows the use of produced water for agricultural irrigation if oil and grease are less than

35 mg/L (McLaughlin et al., 2020). Reusing saline waters including produced water to irrigate croplands can contribute to food security (Flores et al., 2015). However, salt content of produced water could be extremely high; therefore, long-term irrigation would cause decline in soil fertility and crop productivity and increase groundwater contamination (Echchel et al., 2020). High salinity, organic matter load, and toxic organic compounds are some of the main pollutant constituents in produced water that have to be accounted for prior to the reuse as an irrigation source (Pica et al., 2017). Treatment of the produced water to remove organics, microbial contaminants and heavy metals, prior to use will also be required.

Ben Ali et al. (2021); (2020) illustrated that irrigation with RO concentrate (5600 mg/l) negatively impacted soil properties and plant

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growth. Reduction in pecan (*Carya illinoensis*) chlorophyll, height, and growth was the results of irrigation with 5600 mg/l saline water (Ben Ali et al., 2020). Previous studies reported small decreases in halophytic species biomass irrigated with saline water (5600 – 7000 mg/l) (Flores et al., 2016; Ozturk et al., 2018). Decreases in tomato growth and yield were reported due to irrigation with 2800 mg/l saline water (Yang et al., 2020; Farooq et al., 2021). Accumulation of Na and Cl caused reductions in plant height, chlorophyll content and leaf area of *Dichroa febrifuga*, *H. macrophylla*, and *D. febrifuga* irrigated due to the irrigation with saline water of concentrations ranging from 3500 to 7000 mg/l (Sun et al., 2022).

Changes in soil properties have to be monitored on a regular basis when produced water is utilized for irrigation. Burkhardt et al. (2015) reported increasing accumulation of Na and other salts in the soil with increasing concentration of produced water. Other studies conducted in arid areas have reported that produced water quality was responsible for increases in soil salinity and sodicity that negatively affected the soil structure and soil hydraulic properties (Biggs et al., 2012; Burkhardt et al., 2015), consequently, decreasing crop productivity (Yang et al., 2020; Echchelhel et al., 2020).

Pica et al. (2017) reported decreases in Rapeseed (*Brassica napus* L.) and switchgrass (*Panicum virgatum* L.) growth when irrigated with produced water (up to 21,000 mg/l salinity). Plant growth and consequently biomass production can be inhibited when soil salinity increase due to irrigation with produced water (Munns, 2005). Burkhardt et al. (2015) reported a decline in wormwood and switchgrass growth with increases in produced water concentration due to high Na content (≈ 1156 mg/l). A dilution to less than 1000 mg/l of row-produced water was utilized to irrigate greenhouse tomatoes (Martel-Valles et al., 2014). The feasibility of utilizing produced water in crop irrigation is related to its ion and organics. To that end, desalination of produced water to acceptable levels of various plants could be a viable solution.

HPOC, LLC is one of the oil and gas companies that produces substantial amounts of produced water during oil explorations. The company provided produced water (source water) of a salinity of about 8600 mg/l. In the state of New Mexico, produced water salinity is highly variable and can range from 8000 mg/l to 250,000 mg/l. In the present study, we created a salinity gradient of irrigation waters from 230 mg/l to 8600 mg/l to irrigate five forages species. The objectives of this study were to: (i) investigate the effects of produced water on seed germination and plants growth parameters, and (ii) monitor the changes in the soil properties due to irrigation with produced water.

2. Materials and methods

2.1. Experimental design and treatments

Two harvests (from 22 May 2021–15 December 2021) were conducted in the Fabian Garcia Science Center greenhouse in Las Cruces, NM, USA (32.2805° N and 106.770° W; elevation 1186 m). An extended third harvest continued from December 15, 2021, to February 27, 2022, to confirm the viability of the experiment. For each experimental harvest, the experimental unit was a pot (15 cm deep and 15 cm in diameter) packed with air-dried and sieved through a 2 mm sieve loamy soil (52.56 % sand, 22.72 % silt, 24.72 % clay) with a bulk density of 1.43 g/cm³. Three produced water treatments with total dissolved solids (TDS) of 231 mg/l RO water (desalinated using reverse osmosis, RO), 1400 mg/l diluted RAW (RAW produced water diluted with city water), 8610 mg/l RAW produced water (source water), and 427 mg/l tap (or city) water (Table 1) were arranged in a completely randomized design with four replicates. The RAW produced water or source water was provided by HPOC and was first run through a carbon filter then desalinated using RO at the Brackish Groundwater National Desalination Research Facility (BGNDRF), Alamogordo, New Mexico. All treatment waters are shown in Table 1, which also provides pH, sodium adsorption ratio (SAR), total dissolved solids (TDS), and concentrations of some ions.

Table 1

Ion concentrations (mg/l), SAR, and pH in four treatment waters.

Treatment waters	TDS mg/l	Mg mg/l	Ca mg/l	Na mg/l	SAR	Cl mg/l	pH
RO	231	0.48	13.16	67.49	4.83	36.2	8.2
Tap	427	8.25	40.77	58.22	1.93	56.0	7.4
Diluted RAW	1400	8.91	54.56	360.94	10.81	141.0	8.3
RAW	8610	9.61	172.84	3425.80	65.81	856.0	8.3

Note: RO is the raw water desalinated using reverse osmosis (231 mg/l). Tap water = 427 mg/l. Diluted RAW produced water = 1400 mg/l. RAW produced water = 8610 mg/l. TDS = total dissolved solids. SAR = Sodium adsorption ratio

2.2. Plant selection

Western wheatgrass (*Pascopyrum smithii*), alfalfa (*Medicago sativa*), meadow brome (*Bromus biebersteinii*), Russian wildrye (*Psathyrostachys junceus*), and tall fescue (*Schedonorus arundinaceus*) seeds were selected for the study because they are broadly adapted to grow in the colder climates of northern New Mexico. In a completely randomized design, these five forage species were arranged in four replicates and irrigated with four water treatments in 80 pots (5 * 4 = 80) in each harvest. Randomization was achieved by generating random numbers using Microsoft Excel (2013). Prior to sowing, seeds were subjected to water –test to check for seed viability. Twenty-five seeds per pot of each species were planted in the top 2 cm of the soil. The pots with the seedlings were irrigated with the four treatments from the beginning of the experiment. Depending on soil moisture content, plants were irrigated five to six times every month. Germination percentage was calculated 30 days after seeding. Plants were harvested on September 22, 2021, for the first harvest, December 15, 2021, for the second harvest, and February 27, 2021, for the extended third harvest.

2.3. Evapotranspiration

Evapotranspiration (ET) was determined using a water balance equation; (Shukla, 2014).

$$ET = IR + R - \Delta S - RO - DP \quad (1)$$

where IR is the depth of irrigation (cm), R is rainfall (cm; R = 0), ΔS is the change in soil water storage between irrigations (cm; assumed = 0), RO is runoff (cm; RO = 0), and DP is the deep percolation (cm; leachate collected from the bottom of pots). Irrigations were made at a management allowed depletion of about 50 %.

2.4. Plant measurements

Each month, plant heights (from the base of the stem to the tip of the shoot), chlorophyll content, and leaf temperature were measured during the two harvests of the experiment using a tape measure, SPAD meter, and IR thermometer, respectively. The exact number of plants were allowed to grow for three months with no thinning during each harvest. At the end of each harvest, shoots were harvested and fresh weights were recorded. The shoots were dried in the oven at 65° C for 48 h, and dry weights were recorded for biomass calculation. Dried shoots were ground and packed in small storage bags and sent to Ag Source Laboratory, Lincoln, Nebraska for chemical analysis along with irrigation water and leachate samples.

2.5. Soil bulk density and chemical analysis

Core samples were collected from each of the pots under irrigation salinity treatments at the end of the experiment. Soil bulk density was determined using cores (Blake and Hartge, 1986). Loose soil samples were collected from the pots, air-dried, mixed and sieved through a 2

mm sieve, prior to shipping them to the Ag Source Laboratories, Lincoln, Nebraska for chemical analysis.

Sodium adsorption ratio (SAR) was calculated based on (Robbins, 1983) using the following equation:

$$SAR = \frac{(Na^{+1})}{\sqrt{\frac{(Ca^{+2}) + (Mg^{+2})}{2}}} \quad (2)$$

where [Na] is sodium ion concentration (meq/l), [Ca] is calcium ion concentration (meq/l), and [Mg] is magnesium ion concentration (meq/l).

2.6. Statistical analysis

The experimental design was a completely randomized design with four replications. All statistical analyses were performed using SAS software, v 9.4. Differences due to treatments on plant germination and growth were determined using one-way analysis of variance (ANOVA) and means were separated using the least significant difference (LSD). An alpha level of 0.05 was used to determine statistical significance.

3. Results

3.1. Greenhouse meteorology

Greenhouse temperatures ranged from 15.1 to 46.9 °C prior to first harvest, 13.4–33.5 °C before the second harvest, and 13.7–28.4 °C prior to the third harvest (Fig. 1). Relative humidity in the greenhouse ranged from 10 % to 88 %, 12 – 80 %, and 16.4–50.2 % for the three harvests, respectively (Fig. 1). Daily light integral (DLI) is important for

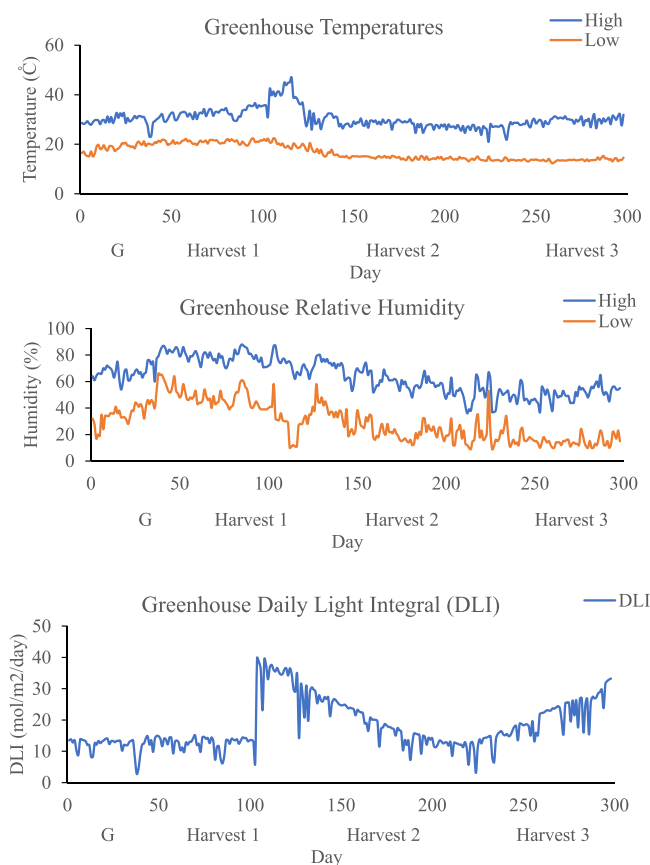


Fig. 1. Greenhouse data from May 22, 2021, to December 15, 2021, for temperature (°C), relative humidity (%), and daily light integral (mol/m²/day). G = Germination.

Table 2
Mean and standard error of seed germination (%) and two harvests of dry biomass (g) of five forages under irrigation with produced water.

Plant ID	Treatment TDS mg/l	Seed germination (%)	Dry biomass 1 (g)	Dry biomass 2 (g)	Cumulative biomass (g)
		Mean ± SE			
Wheatgrass	231	49 ± 3.70 a	0.79 ± 0.20 a	1.01 ± 0.08 b	1.80 ± 0.28 a
	427	17 ± 5.00 b	0.79 ± 0.04 a	1.28 ± 0.07 a	2.07 ± 0.11 a
	1400	23 ± 6.10 b	0.77 ± 0.08 a	1.34 ± 0.04 a	2.11 ± 0.09 a
	8610	NA	NA	NA	NA
Alfalfa	231	98 ± 2.00 a	3.76 ± 0.04 ab	4.59 ± 0.43 b	8.36 ± 0.98 b
	427	88 ± 6.90 a	5.11 ± 0.57 a	8.73 ± 0.24 a	13.84 ± 0.44 a
	1400	50 ± 17.10 b	2.18 ± 0.56 b	4.82 ± 0.44 b	7.00 ± 0.58 b
	8610	NA	NA	NA	NA
Bromegrass	231	86 ± 0.14 a	0.49 ± 0.12 b	0.87 ± 0.02 b	1.36 ± 0.10 a
	427	100 ± 0.00 a	0.91 ± 0.09 a	1.19 ± 0.10 a	2.10 ± 0.18 a
	1400	100 ± 0.00 a	0.99 ± 0.47 a	0.94 ± 0.07 b	1.94 ± 0.47 a
	8610	100 ± 0.00 a	NA	NA	NA
Russian wildrye	231	7 ± 1.90 b	0.60 ± 0.05 a	0.69 ± 0.09 a	1.29 ± 0.13 a
	427	18 ± 3.80 a	0.62 ± 0.12 a	1.10 ± 0.30 a	1.72 ± 0.24 a
	1400	9 ± 4.10 ab	0.52 ± 0.08 a	0.92 ± 0.03 a	1.45 ± 0.05 a
	8610	NA	NA	NA	NA
Tall fescue	231	100 ± 0.00 a	0.59 ± 0.09 ab	1.17 ± 0.16 a	1.76 ± 0.19 b
	427	100 ± 0.00 a	1.25 ± 0.38 a	1.81 ± 0.08 a	3.07 ± 0.46 a
	1400	100 ± 0.00 a	1.16 ± 0.27 a	1.86 ± 0.39 a	3.02 ± 0.57 a
	8610	93 ± 7.00 a	0.30 ± 0.05 b	1.20 ± 0.30 a	1.50 ± 0.26 b

Note: RO = 231 mg/l. Tap = 427 mg/l. Diluted RAW = 1400 mg/l. RAW = 8610 mg/l. TDS = total dissolved solids. Means within columns with same letter are not significant at $\alpha \leq 0.05$. NA = not available.

plant growth, development, yield and quality. DLI was 16.21, 19.82, and 18.63 mol/m²/day for the three harvests respectively (Fig. 1). At day 104 of the experiment period, greenhouse shade was removed which explained the increase in DLI at that time.

3.2. Seed germination

Table 2 shows the germination percentage of the five forage species. Only bromegrass and tall fescue germinated in RAW water (Table 2). Bromegrass had an 86 % germination in RO water but 100 % in RAW water; however, plants did not survive beyond the first month of

irrigation with RAW water (Table 2). A similar germination trend was observed for Alfalfa irrigated with RO and tap water; however, germination was 50 % in diluted RAW (Table 2). Russian wildrye had the lowest germination percentages in RO, tap, and diluted RAW followed by wheatgrass species (Table 2). Among the five forage species, tall fescue germinated well with all the irrigation treatments. Wheatgrass, alfalfa, and Russian wildrye germination significantly decreased with increases in salinity but none germinated in the soil irrigated with RAW water (Table 2).

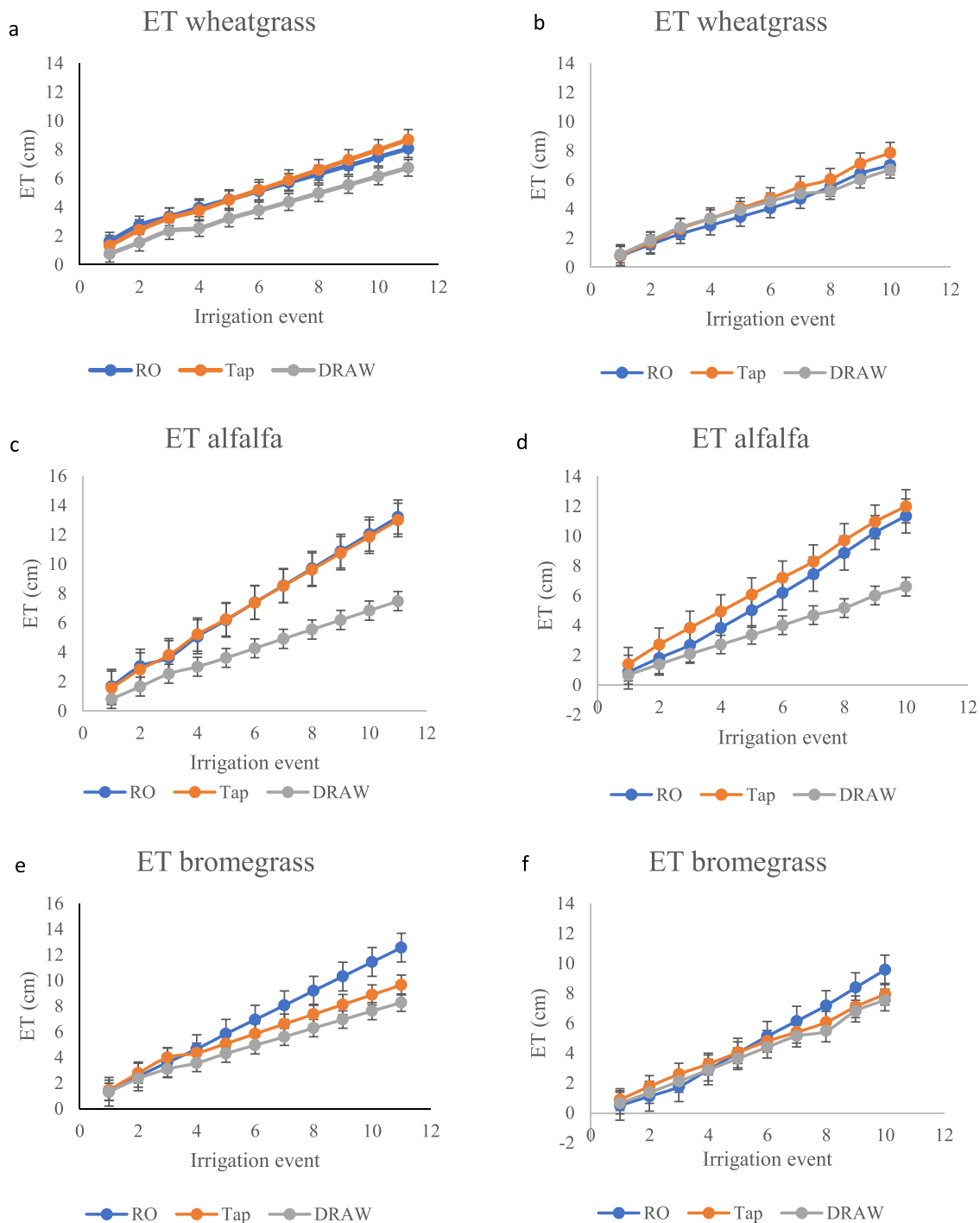


Fig. 2. Cumulative evapotranspiration ET (cm) of wheatgrass a,b, alfalfa c, d, bromegrass e, f, Russian wildrye g, h, and Tall fescue i, j irrigated with produced water during the two harvests. RO = 231 mg/l. Tap = 427 mg/l. Diluted RAW = 1400 mg/l. RAW = 8610 mg/l.

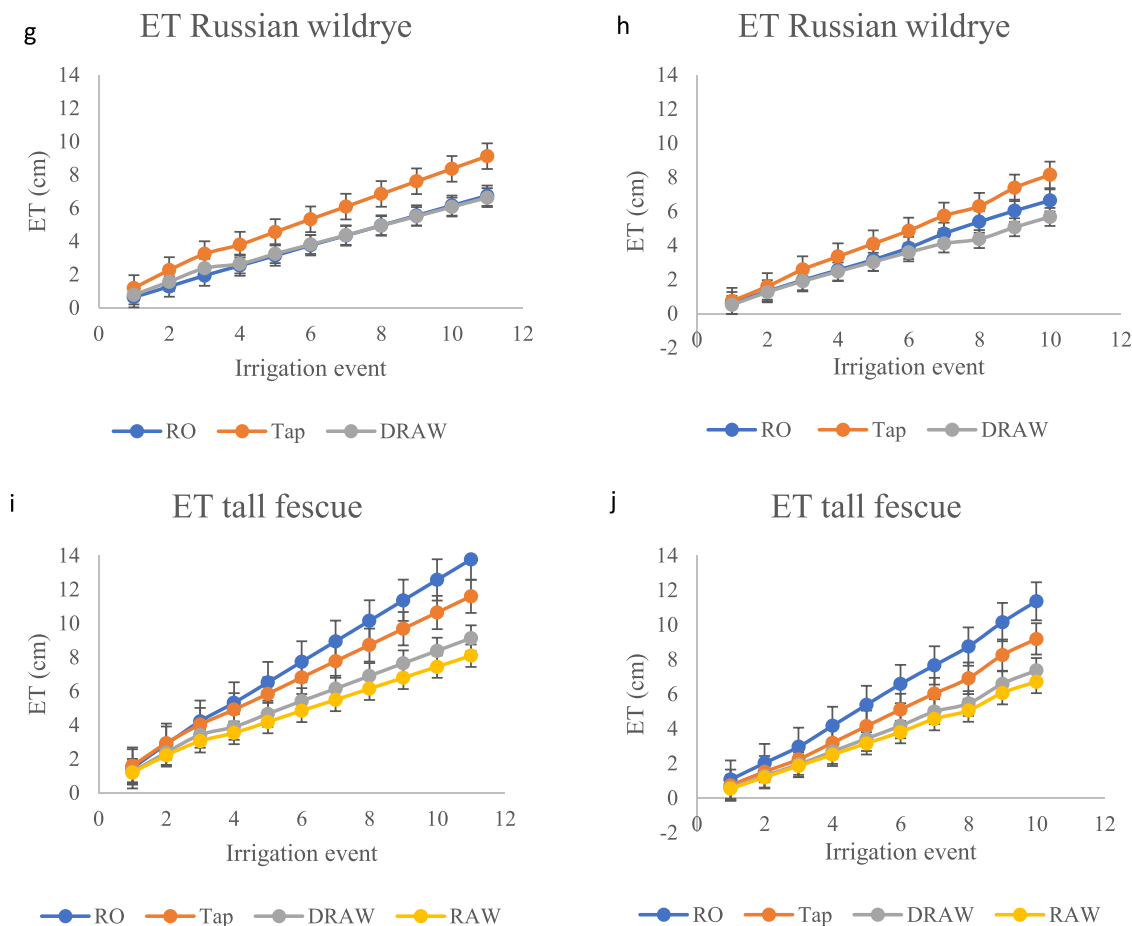


Fig. 2. (continued).

3.3. Plant dry biomass

Forage species dry biomass of the first harvest (biomass 1), and the second harvest (biomass 2) are presented in (Table 2). Wheatgrass dry biomass was similar in all the irrigation treatments in the first harvest (Table 2). In the second harvest, however, increase in dry biomass in all the three treatments was observed compared to the first harvest and the greater increase was in diluted RAW water followed by tap water (Table 2). Alfalfa dry biomass decreased in diluted RAW compared with tap water in the first harvest (Table 2). Increases in alfalfa dry biomass in all three treatments can be observed whereas alfalfa dry biomass in RO and diluted RAW water remained the lowest compared with tap water in the second harvest (Table 2). No differences were found in bromegrass dry biomass between the three treatments in the first harvest (Table 2). All three treatments showed increases in dry biomass in the second harvest while dry biomass was lower in RO and diluted RAW water, respectively, compared with tap water (Table 2). Russian wildrye dry biomass showed no differences in the first and the second harvests while the dry biomass increased in all treatments in the second harvest compared with first harvest (Table 2). In the first harvest, tall fescue dry biomass significantly decreased in RAW water compared with tap water; however, in the second harvest, all dry biomass increased with no significant differences observed (Table 2). Diluted RAW and RAW irrigation decreased wheatgrass, alfalfa, bromegrass, and tall fescue dry biomass. There were no statistically differences in cumulative biomass among the treatments for wheatgrass, bromegrass, and Russian wildrye (Table 2). However, the cumulative tall fescue biomass was lower in RO and RAW irrigated pots than other treatments. For alfalfa, the cumulative biomass was lower for RO and diluted RAW irrigated pots than other city or tap water (Table 2).

3.4. Evapotranspiration

Fig. 2a to j shows the cumulative ET for wheatgrass (western), alfalfa, bromegrass, Russian wildrye, and tall fescue. The results illustrated decreases in cumulative ET for all the five forages in diluted RAW and RAW (Fig. 2). As treatment salinity increased, wheatgrass, alfalfa, bromegrass, Russian wildrye, and tall fescue ET decreased for both harvests (Fig. 2). Pots irrigated with RAW water remained wetter than other treatments.

3.5. Plants heights and SPAD value

Table 3 shows the first measurement, in July, of the height and SPAD value of forage species during the first harvest. Wheatgrass (western) height and SPAD value were higher in diluted RAW irrigated water, than tap and RO treatments (Table 3). This trend was similar for the second measurement in August (Table 3). Alfalfa height was greater in RO treatment while SPAD value was slightly higher in diluted RAW with no significant differences than other treatments (Table 3). No differences were recorded in the second measurement in August for alfalfa heights and SPAD value (Table 3). For bromegrass, the lowest recorded height in July was in RAW irrigated water while the SPAD value was highest in RAW water (Table 3); however, bromegrass irrigated continuously with RAW irrigation died by August. In August, bromegrass SPAD was higher in tap water than diluted RAW and RO (Table 3).

Russian wildrye height was similar in RO, tap, and diluted RAW water while the SPAD value was higher in diluted RAW water than RO and tap water (Table 3). This trend shifted in August when height was greater in the diluted RAW irrigation with no differences observed in the SPAD value (Table 3). Greater tall fescue height was recorded in tap

Table 3
Mean and standard error of plant's heights (cm) and SPAD value irrigated with produced water (first harvest, July and August).

Plant ID	Treatment TDS mg/l	July		August	
		Height (cm)	SPAD	Height (cm)	SPAD
Wheatgrass	231	24.25 ± 2.09 b	4.67 ± 1.60 b	27.05 ± 3.04 b	4.58 ± 0.45 b
	427	31.65 ± 1.84 a	5.87 ± 1.00 b	34.25 ± 1.25 a	15.55 ± 2.93 ab
	1400	32.87 ± 1.98 a	12.42 ± 0.94 a	36.50 ± 1.94 a	25.20 ± 6.33 a
	8610	NA	NA	NA	NA
Alfalfa	231	24 ± 1.22 a	48.62 ± 1.92 a	30.00 ± 2.74 a	51.90 ± 2.30 a
	427	22.77 ± 0.75 ab	45.47 ± 2.54 a	30.25 ± 4.39 a	53.93 ± 2.73 a
	1400	19.37 ± 1.79 b	50.82 ± 2.33 a	28.00 ± 2.86 a	44.13 ± 6.35 a
	8610	NA	NA	NA	NA
Bromegrass	231	21.5 ± 1.51 a	2.85 ± 0.89 b	19.25 ± 2.25 a	8.13 ± 2.87 b
	427	23 ± 0.40 a	6.8 ± 1.14 a	23.63 ± 1.07 a	17.48 ± 2.99 a
	1400	20.75 ± 3.19 a	3.6 ± 0.58 b	23.75 ± 1.65 a	13.85 ± 2.71 ab
	8610	9.75 ± 0.87 b	7.67 ± 1.02 a	NA	NA
Russian wildrye	231	17.75 ± 1.56 a	9.35 ± 1.03 b	22.38 ± 1.55 b	15.83 ± 5.86 a
	427	23.85 ± 1.35 a	6.6 ± 1.10 b	28.50 ± 2.10 ab	17.00 ± 2.87 a
	1400	20.5 ± 3.95 a	32.85 ± 2.06 a	33.05 ± 2.54 a	23.55 ± 4.37 a
	8610	NA	NA	NA	NA
Tall fescue	231	20.3 ± 1.89 ab	8.27 ± 1.41c	22.50 ± 2.22 a	7.43 ± 2.04 b
	427	24.5 ± 1.37 a	16.75 ± 0.91 b	25.00 ± 2.52 a	14.13 ± 2.34 b
	1400	19.62 ± 1.86 ab	8.55 ± 0.73c	23.00 ± 1.22 a	12.53 ± 1.20 b
	8610	16.6 ± 1.80 b	24.82 ± 1.12 a	18.75 ± 2.69 a	22.90 ± 4.13 a

Note: RO = 231 mg/l. Tap = 427 mg/l. Diluted RAW = 1400 mg/l. RAW = 8610 mg/l. TDS = total dissolved solids. Means within columns with same the letter are not significant at $\alpha \leq 0.05$. NA= not available.

Table 4
Mean and standard error of plant heights (cm) and SPAD value irrigated with produced water (second harvest, October and November).

Plant ID	Treatment TDS mg/l	October		November	
		Height (cm)	SPAD	Height (cm)	SPAD
Wheatgrass	231	21.00 ± 1.73 b	23.68 ± 2.65 a	22.75 ± 2.10 b	10.48 ± 4.44 a
	427	27.25 ± 1.93 a	24.83 ± 3.35 a	29.25 ± 3.35 ab	19.83 ± 4.65 a
	1400	29.00 ± 0.91 a	28.95 ± 4.22 a	32.25 ± 2.75 a	21.40 ± 4.26 a
	8610	NA	NA	NA	NA
Alfalfa	231	18.75 ± 0.31 a	41.98 ± 3.80 a	20.75 ± 2.10 a	46.83 ± 4.04 a
	427	26.50 ± 4.35 a	49.78 ± 1.79 a	27.25 ± 3.99 a	34.00 ± 3.20 b
	1400	17.00 ± 4.53 a	30.83 ± 1.58 b	26.25 ± 1.11 a	46.50 ± 3.21 a
	8610	NA	NA	NA	NA
Bromegrass	231	14.00 ± 0.82 a	11.23 ± 1.61 a	15.25 ± 2.72 a	16.68 ± 8.73 a
	427	17.00 ± 1.08 a	19.70 ± 2.82 a	16.75 ± 1.65 a	10.03 ± 4.49 a
	1400	16.25 ± 1.11 a	19.20 ± 4.01 a	18.25 ± 2.10 a	21.15 ± 3.08 a
	8610	NA	NA	NA	NA
Russian wildrye	231	16.50 ± 0.87 b	25.03 ± 2.91 ab	16.75 ± 1.49 a	8.38 ± 2.99 b
	427	21.75 ± 2.50 ab	21.50 ± 3.56 b	21.25 ± 0.85 a	15.55 ± 4.06 b
	1400	24.50 ± 2.72 a	33.45 ± 0.13 a	23.75 ± 3.75 a	27.80 ± 3.00 a
	8610	NA	NA	NA	NA
Tall fescue	231	13.25 ± 0.75 a	14.88 ± 2.46 a	11.5 ± 1.55 b	7.33 ± 3.60 b
	427	13.45 ± 0.63 a	15.83 ± 1.23 a	13 ± 1.41 b	9.73 ± 0.92 b
	1400	13.50 ± 1.32 a	11.58 ± 3.46 a	16 ± 1.08 ab	12.68 ± 4.27 ab
	8610	22.67 ± 2.75 a	29.00 ± 1.73 a	19 ± 3.03 a	22.15 ± 5.52 a

Note: RO = 231 mg/l. Tap = 427 mg/l. Diluted RAW = 1400 mg/l. RAW = 8610 mg/l. TDS = total dissolved solids. Means within columns with the same letter are not significant at $\alpha \leq 0.05$. NA= not available.

Table 5
Mean and standard error of Na, Mg, Ca, and Cl ion concentration (mg/l), SAR, and TDS (mg/l) of first sample leachate water, first harvest of five forages irrigated with produced water.

Plant ID	Treatment TDS mg/l	Na mg/l	Mg mg/l	Ca mg/l	SAR	Cl mg/l	EC mg/l
		Mean ± SE					
Wheatgrass (western)	231	275.70 ± 38.06 b	39.12 ± 13.89 b	229.24 ± 84.42 a	6.53 ± 0.31 b	693.33 ± 180.87 b	666 ± 0.51 b
	427	199.17 ± 6.44 b	47.99 ± 2.82 ab	210.48 ± 21.64 a	4.56 ± 0.07 b	589.33 ± 63.30 b	1624 ± 0.21 b
	1400	2341.47 ± 366.81 a	84.84 ± 22.70 a	391.6 ± 95.43 a	39.71 ± 1.30 a	1250 ± 170.59 a	6652 ± 1.23 a
	8610	NA	NA	NA	NA	NA	NA
Alfalfa	231	382.33 ± 72.86 b	57.41 ± 14.83 a	355.76 ± 97.75 a	7.05 ± 0.34 b	879.33 ± 189.83 b	2741 ± 0.88 b
	427	242.50 ± 23.10 b	80.03 ± 8.96 a	326.73 ± 34.03 a	4.39 ± 0.21 b	848 ± 91.08 b	2426 ± 0.30 b
	1400	2893.83 ± 440.30 a	138.85 ± 43.16 a	533.32 ± 109.09 a	41.38 ± 3.09 a	1526.67 ± 229.35 a	8151 ± 1.90 a
	8610	NA	NA	NA	NA	NA	NA
Bromegrass (Meadow)	231	316.63 ± 40.07 b	35.13 ± 6.42 a	202.44 ± 36.35 b	7.68 ± 0.56 b	651 ± 99.12 b	1762 ± 0.35 b
	427	211.88 ± 2.86 b	59.48 ± 3.66 a	228.18 ± 12.34 b	4.56 ± 0.14 b	627.67 ± 38.22 b	1754 ± 0.08 b
	1400	3371.97 ± 484.11 a	76.47 ± 19.46 a	499.1 ± 116.45 a	52.97 ± 1.00 a	1400 ± 183.79 a	8451 ± 1.82 a
	8610	NA	NA	NA	NA	NA	NA
Russian wildrye	231	787.21 ± 367.18 b	59.42 ± 24.17 b	343.96 ± 142.73 a	13.7 ± 3.68c	1069.67 ± 374.75 b	2524 ± 0.86 b
	427	475.69 ± 248.23 b	104.3 ± 40.08 b	427.77 ± 166.78 a	6.92 ± 2.36c	1019.33 ± 314.85 b	1953 ± 0.29 b
	1400	2538.43 ± 176.79 b	51.11 ± 5.24 b	345.35 ± 24.54 a	47.95 ± 4.77 b	983 ± 30.47 b	6393 ± 0.14 b
	8610	21,617.7 ± 122.97 a	284.47 ± 73.73 a	336.87 ± 22.40 a	292.2 ± 37.97 a	1953.33 ± 214.29 a	10,232 ± 1.21 a
Tall fescue	231	161.09 ± 13.13c	14.63 ± 2.99 d	70.08 ± 10.44 d	6.57 ± 0.76c	216 ± 34.35 d	949 ± 0.17c
	427	227.21 ± 34.65c	56.01 ± 9.72c	231.23 ± 44.60c	4.9 ± 0.31c	570.33 ± 128.07c	1733 ± 0.41c
	1400	3106.57 ± 118.30 a	98.1 ± 7.02 b	541.43 ± 21.34 a	45.66 ± 2.81 b	1170 ± 11.56 b	7424 ± 0.88 b
	8610	21,778.3 ± 815.26 b	293.81 ± 14.70 a	345.25 ± 3.90 b	293.73 ± 15.97 a	2080 ± 46.24 a	17,290 ± 0.75 a

Note: RO = 231 mg/l. Tap = 427 mg/l. Diluted RAW = 1400 mg/l. RAW = 8610 mg/l. SAR = Sodium adsorption ratio; TDS = total dissolved solids. Means within columns with the same letter are not significant at $\alpha \leq 0.05$. NA = not available. EC = Electrical conductivity.

water while the lowest height was recorded in RAW water; whereas the SPAD value was greater in the RAW water in July (Table 3). A similar trend was observed in August (Table 3). Diluted RAW irrigation increased SPAD value of wheatgrass, and Russian wildrye while decreased the SPAD value of bromegrass. Decreases in tall fescue heights as the irrigation water salinity increases.

In the second harvest, first and second measurements in October and November, wheatgrass height and SPAD value were greater numerically in diluted RAW than RO and tap water (Table 4). No differences were observed with regard to alfalfa height in October and November (Table 4) and the SPAD value was the lowest in diluted RAW irrigation and of with tap irrigation in October and November, respectively (Table 4). The observations illustrated no differences among the treatments with regard to bromegrass height and SPAD value for both measurement time (Table 4). Russian wildrye was the tallest and SPAD value was the highest in diluted RAW water in October (Table 4). However, in November, no differences between the grass heights were observed; although, SPAD value remained higher in diluted RAW irrigation than RO and tap (Table 4). Tall fescue grass showed only numerical differences with regard to height and SPAD value with the RAW treatment in October (Table 4). In November, however, the height of 19 cm and SPAD value of 22.15 were recorded with RAW water (Table 4). Wheatgrass, Russian wildrye, and tall fescue height and SPAD value increased with increasing water salinity while alfalfa height and SPAD value decreased with increases in water salinity.

3.6. Leachate ions concentrate

Collected leachate water samples from all the five forage species showed increases in Na, Mg, Ca, and Cl ion concentration in produced water compared with the tap water for the two measurement times during the first harvest (Table 5). Large increases in Na ions followed by Cl from resulted leachate from the pots irrigated with RAW and diluted RAW water. Leachate water of the diluted RAW and RAW irrigation was considered sodic (SAR > 13) and saline (EC > 2800 mg/l) for the two times measurements for the first harvest (Table 5, S1). Similarly, in the second harvest, the ion concentrations were higher in the leachate water samples with increasing salt concentration of the irrigation treatment (Table 6, S2). Similar to the first harvest, leachate water in the second harvest was considered saline and sodic in RAW and diluted RAW irrigation (Table 6, S2). Increases in irrigation water salinity increased the leachate water Na, Mg, Ca, and Cl ions concentration and SAR.

3.7. Plants ion contents

The plant tissue samples, at the end of the first harvest, showed non-significant differences with regard to total N with increasing irrigation water salinity (Table 7). Alfalfa did not show a significant difference in phosphorus content with increasing treatment salinity (Table 7). Nonsignificant differences were observed in bromegrass samples with regard to P, K, Ca, Mn, Fe, and S content with increasing irrigation water salinity (Tables 7, 8). Increasing irrigation water salinity did not significantly affect the content of P, Mg, Fe, and Al in Russian wildrye (Tables 7, 8). Increases in irrigation water salinity had no significant effect on the Mg, Ca, and Zn concentration in tall fescue (Table 7).

Increases in irrigation water salinity (diluted RAW) significantly decreased the concentration of P, K, Mg, Ca, Zn, Fe, and Al in wheatgrass tissue while Mn, S, and Na increased in wheatgrass tissue (Tables 7, 8). With the increases in water salinity (diluted RAW), K, and Ca in alfalfa decreased (Table 7) while Mg, Mn, S, and Na increased (Tables 7, 8). Increases in Mg, S, Zn, and Na content in bromegrass can be observed with increases in water salinity (diluted RAW) whereas B decreased (Tables 7, 8). Russian wildrye showed significant increases in Mg, Mn, S, and Na ion concentrations with increases in irrigation water salinity (from RO to diluted RAW) (Tables 7, 8) while K, Ca, Zn, and B decreased (Tables 7, 8). Tall fescue's Fe, B, Al, S, and Na ion concentrations

increased with increases in water salinity (RAW) (Table 8); however, P, K, Mn, and B decreased (Tables 7, 8).

Tables 9 and 10 show the plants ion concentrations in the second harvest. The second harvest continued to show similar trends as the first harvest with regard to the ion concentration of forage species. Salts accumulation in plant tissues can be observed with increases in salt uptake when comparing the results of the two harvests; however, species survived both harvests and also grew back again after the second harvest with continued irrigation with the same treatments.

3.8. Soil bulk density, organic matter, pH, and electrical conductivity EC

Soil bulk density at the end of the experiment is presented in (Table 11). Within species, the results indicated a slight increase in soil bulk density with continued irrigation with diluted RAW; however, this increase was not statistically significant (Table 11). A significant increase in soil bulk density can be observed in RAW irrigated pots followed by diluted RAW within tall fescue illustrating that increases in irrigation water salinity increased soil bulk density (Table 11). Pots irrigated with RO and diluted RAW showed significant decline in soil OM % compared with the control for wheatgrass, alfalfa, bromegrass, and Russian wildrye species (Table 11). For tall fescue species, the decline in soil OM % continued in RO and diluted water; however, the lowest soil OM % was recorded in RAW water irrigated soil (Table 11). The soil pH trend was near neutral in RO water; however, alkalinity increased as water salinity increased (Table 11). Soil EC increased in diluted RAW for wheatgrass, alfalfa, bromegrass, and Russian wildrye pots. The highest EC recorded was in RAW water in tall fescue followed by diluted RAW (Table 11).

3.9. Soil ions concentrations

For wheatgrass, soil P, Fe, and B decreased with increases in salinity while K, S, Mg, Ca, Na significantly increased (Tables 12, 13). In alfalfa pots irrigated with diluted RAW, soil N, Fe, and B significantly decreased, while K, S, Na increased in pots irrigated with diluted RAW (Tables 12, 13). Reduction in soil K, Mg, Ca, and B ion concentrations resulted in diluted RAW whereas S, Na, increased in bromegrass pots irrigated with diluted RAW (Tables 12, 13). Russian wildrye pots showed increases in soil S and Na with increasing water salinity while K, Mg, and B decreased (Tables 12, 13). Increases were seen in soil P, S, Na, Mn and Fe ion concentrations in tall fescue pots irrigated with RAW water. However, Mg, Ca, and B decreased (Table 13). Soil SAR significantly increased in diluted RAW water pots of wheatgrass, alfalfa, and bromegrass and was considered saline soil but not sodic (Table 13). In tall fescue pots, soil in RAW water was considered saline and sodic (Table 13).

4. Discussion

4.1. Seed germination

Forage species germination results showed differences in their response to the four irrigation treatments. This could be due to their level of tolerance to various levels of saline water. Flores et al. (2015), with regard to germination rate, reported similarities between six halophytic species *X. tritico-secale*, *Atriplex canescens*, *Hordeum vulgare*, *Lepidium alyssoides*, *Distichlis stricta*, and *Panicum virgatum* irrigated with saline water up to 7000 mg/l. As results showed, Russian wildrye germination percentage was the lowest among the species utilized in this study and that might be due to the seeds vitality since it was for all three treatments. As the level of salinity increased, alfalfa, wheatgrass, bromegrass, and Russian wildrye germination percentages decreased and never germinated under RAW water (8610 mg/l) and this emphasized that these species are more sensitive to increases in water salinity. Among the five species, tall fescue species germinated well with RAW

Table 6
Mean and standard error of Na, Mg, Ca, and Cl ion concentration (mg/l), SAR and TDS (mg/l) of first sample leachate water, second harvest of five forages irrigated with produced water.

Plant ID	Treatment TDS mg/l	Na mg/l	Mg mg/l	Ca mg/l	SAR	Cl mg/l	EC mg/l
Wheatgrass (western)	231	460.39 ± 60.36 b	13.65 ± 1.83 b	77.22 ± 10.55 b	17.84 ± 1.29 b	249.00 ± 35.54 b	1573 ± 0.40 b
	427	360.93 ± 59.31 b	34.27 ± 8.01 b	115.84 ± 25.80 b	10.70 ± 0.52 b	416.33 ± 104.29 b	1674 ± 0.19 b
	1400	3725.27 ± 621.55 a	134.17 ± 26.94 a	395.45 ± 41.31 a	57.72 ± 6.32 a	1586.67 ± 268.79 a	6892 ± 1.19 a
	8610	NA	NA	NA	NA	NA	NA
Alfalfa	231	313.42 ± 46.35 c	8.48 ± 1.58 b	57.00 ± 12.05 b	14.60 ± 1.09 b	208.67 ± 36.49 b	2691 ± 0.85 b
	427	846.51 ± 177.99 b	92.52 ± 25.71 a	338.16 ± 133.16 a	15.24 ± 0.49 b	911.33 ± 222.96 a	2532 ± 0.26 b
	1400	1375.70 ± 60.71 a	43.26 ± 3.90 ab	184.77 ± 19.53 ab	33.52 ± 1.14 a	458.33 ± 25.16 ab	8310 ± 1.95 a
	8610	NA	NA	NA	NA	NA	NA
Bromegrass (Meadow)	231	365.40 ± 96.65 b	13.58 ± 3.81 b	78.23 ± 19.52 a	13.96 ± 1.93 b	251 ± 71.27 ab	1783 ± 0.36 b
	427	207.37 ± 27.23 b	25.47 ± 2.06 ab	76.71 ± 9.00 a	7.35 ± 0.60 b	221.67 ± 34.15 b	1793 ± 0.07 b
	1400	1697.47 ± 306.40 a	31.95 ± 6.37 a	163.01 ± 39.54 a	45.07 ± 4.87 a	641.67 ± 180.84 a	8400 ± 1.65 a
	8610	NA	NA	NA	NA	NA	NA
Russian wildrye	231	505.15 ± 178.93 b	13.82 ± 3.88 b	72.42 ± 16.09 b	19.38 ± 4.55 b	314 ± 127.71 b	2524 ± 0.75 b
	427	592.08 ± 60.15 b	52.88 ± 8.11 a	170.99 ± 31.02 ab	14.59 ± 1.99 b	687 ± 125.43 ab	2019 ± 0.24 b
	1400	2402.15 ± 408.01 a	43.50 ± 9.90 a	206.58 ± 48.65 a	56.14 ± 2.95 a	1050 ± 255.71 a	6481 ± 0.20 a
	8610	NA	NA	NA	NA	NA	NA
Tall fescue	231	256.69 ± 9.48 c	14.91 ± 2.36 a	62.49 ± 6.71 c	10.76 ± 0.30 c	210.33 ± 14.33 c	969 ± 0.14 c
	427	281.63 ± 114.34 c	29.45 ± 10.05 a	104.25 ± 35.09 BCE	8.43 ± 1.98 c	366 ± 173.34 BCE	1760 ± 0.36 c
	1400	2011.74 ± 430.18 b	52.50 ± 22.26 a	210.29 ± 68.39 b	46.42 ± 1.68 b	813.67 ± 231.08 b	7512 ± 0.55 b
	8610	13,304 ± 443.29 a	61.13 ± 18.88 a	336.12 ± 2.10 a	247.69 ± 5.98 a	1846.67 ± 63.93 a	17,803 ± 0.80 a

Note: RO = 231 mg/l. Tap = 427 mg/l. Diluted RAW = 1400 mg/l. RAW = 8610 mg/l. SAR = Sodium adsorption ratio, TDS = total dissolved solids. Means within columns with the same letter are not significant at $\alpha \leq 0.05$. NA = not available. EC = Electrical conductivity.

Table 7
Mean and standard error of total N, P, K, Mg, Ca, and Zn ion concentration (mg/l) in shoots of five forages irrigated with produced water (first harvest).

Plant ID	Treatment	TDS mg/l					
		Total N	P	K	Mg	Ca	Zn
		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Mean ± SE							
Wheatgrass (western)	231	11.18 ± 1.04 a	1.54 ± 0.01 ab	13.8 ± 0.70 a	1.97 ± 0.32 ab	4.7 ± 0.71 a	161 ± 13.33 a
	427	10.87 ± 0.29 a	1.92 ± 0.19 a	14.5 ± 0.30 a	2.57 ± 0.20 a	3.97 ± 0.20 ab	50.78 ± 16.53 b
	1400	10.55 ± 0.70 a	1.38 ± 0.08 b	10.6 ± 0.56 b	1.73 ± 0.12 b	2.63 ± 0.17 b	31.45 ± 4.40 b
	8610	NA	NA	NA	NA	NA	NA
Alfalfa	231	21.77 ± 0.79 a	1.04 ± 0.10 a	14.2 ± 0.18 a	2.77 ± 0.12 b	20.23 ± 1.36 a	70.35 ± 14.50 a
	427	21.03 ± 1.02 a	1.07 ± 0.12 a	13.4 ± 0.39 a	3.87 ± 0.46 a	22.37 ± 1.46 a	21.14 ± 4.23 b
	1400	20.4 ± 2.45 a	1.27 ± 0.07 a	7.87 ± 0.58 b	2.97 ± 0.20 ab	15.47 ± 0.67 b	27.37 ± 0.43 b
	8610	NA	NA	NA	NA	NA	NA
Bromegrass (Meadow)	231	11.6 ± 1.00 a	1.95 ± 0.20 a	18 ± 1.07 a	3.17 ± 0.18 b	14.17 ± 3.49 a	47.82 ± 7.66 a
	427	11.61 ± 0.88 a	1.72 ± 0.02 a	19.6 ± 0.83 a	4.4 ± 0.25 a	9.4 ± 0.65 a	21.36 ± 2.42 b
	1400	11.2 ± 0.25 a	1.49 ± 0.14 a	18.7 ± 0.48 a	3.47 ± 0.37 ab	7.2 ± 1.21 a	31.24 ± 4.52 ab
	8610	NA	NA	NA	NA	NA	NA
Russian wildrye	231	16.83 ± 1.73 a	1.94 ± 0.26 a	21.9 ± 0.80 a	3.2 ± 0.25 a	8.13 ± 0.03 a	77.91 ± 3.40 a
	427	29.1 ± 10.54 a	2.02 ± 0.12 a	19.3 ± 0.84 a	4.2 ± 0.32 a	6.3 ± 0.55 b	42.89 ± 12.18 b
	1400	17.2 ± 0.93 a	1.66 ± 0.14 a	15.9 ± 0.70 b	3.23 ± 0.45 a	4.97 ± 0.69 b	42.52 ± 2.16 b
	8610	NA	NA	NA	NA	NA	NA
Tall fescue	231	11.37 ± 0.93 a	2.42 ± 0.12 a	11.7 ± 0.72 ab	7.03 ± 0.47 a	8.6 ± 0.57 a	47.27 ± 7.80 a
	427	12.14 ± 3.21 a	2.41 ± 0.28 a	15.1 ± 1.21 a	7.17 ± 0.90 a	9.7 ± 1.55 a	41.12 ± 5.34 a
	1400	9.38 ± 0.15 a	1.55 ± 0.09 b	9.17 ± 0.77 b	4.53 ± 0.18 a	6.57 ± 0.27 a	29.16 ± 3.87 a
	8610	13.73 ± 0.95 a	1.17 ± 0.28 b	8.73 ± 2.22 b	5.17 ± 1.27 a	17.1 ± 12.13 a	68.7 ± 19.45 a

Note: RO = 231 mg/l. Tap = 427 mg/l. Diluted RAW = 1400 mg/l. RAW = 8610 mg/l. TDS = total dissolved solids. Means within columns with the same letter are not significant at $\alpha \leq 0.05$. NA= not available.

Table 8
Mean and standard error of Mn, Fe, B, Al, S, and Na ion concentration (mg/l) in shoots of five forages irrigated with produced water (first harvest).

Plant ID	Treatment	TDS mg/l					
		Mn	Fe	B	Al	S	Na
		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Mean ± SE							
Wheatgrass (western)	231	79.64 ± 2.68 b	367.85 ± 8.92 a	237.35 ± 2.71 a	214 ± 4.82 a	3.4 ± 0.38 b	7.38 ± 0.60 b
	427	75.61 ± 11.79 b	48.7 ± 8.49 b	14.99 ± 1.60 b	17.15 ± 3.15 b	2.57 ± 0.03 b	7.15 ± 1.14 b
	1400	113.9 ± 6.18 a	28.38 ± 0.97 b	19.18 ± 2.01 b	11.71 ± 0.48 b	5.73 ± 0.43 a	11.5 ± 0.81 a
	8610	NA	NA	NA	NA	NA	NA
Alfalfa	231	217.95 ± 5.80 a	103.45 ± 5.38 a	369.19 ± 5.51 b	45.67 ± 2.68 a	7.5 ± 1.35 b	11.7 ± 2.86 b
	427	65.31 ± 0.53 b	76.62 ± 2.02 b	80.86 ± 2.01 b	36.23 ± 5.06 a	5.97 ± 1.88 b	7.11 ± 2.18 b
	1400	142.6 ± 3.84 ab	87.33 ± 1.32 b	125.84 ± 3.98 a	31.49 ± 1.15 a	22.73 ± 2.02 a	42.7 ± 2.96 a
	8610	NA	NA	NA	NA	NA	NA
Bromegrass (Meadow)	231	186.5 ± 5.59 a	81.08 ± 1.74 a	737.82 ± 4.40 a	55.87 ± 2.02 a	8.7 ± 1.23 b	16.08 ± 1.48 b
	427	134.22 ± 5.91 a	61.76 ± 1.43 a	35.93 ± 1.60 b	45.15 ± 2.39 a	5.93 ± 0.62 b	13.43 ± 0.90 b
	1400	166.98 ± 9.93 a	60.12 ± 6.88 a	101.09 ± 9.76 b	44.08 ± 2.63 a	20.83 ± 2.80 a	44.96 ± 3.70 a
	8610	NA	NA	NA	NA	NA	NA
Russian wildrye	231	119.97 ± 5.58 a	129.78 ± 9.61 a	413.17 ± 5.97 a	94.26 ± 3.18 a	5.97 ± 0.41 b	16.16 ± 1.95 b
	427	64.35 ± 1.80 b	49.4 ± 1.69 a	22.45 ± 0.64 b	31.56 ± 1.58 a	3.43 ± 0.26c	8.20 ± 1.24 b
	1400	130.4 ± 10.21 a	66.35 ± 4.57 a	53.47 ± 2.79 b	44.04 ± 2.42 a	13.57 ± 0.60 a	33.62 ± 3.59 a
	8610	NA	NA	NA	NA	NA	NA
Tall fescue	231	336.14 ± 6.11 b	96.03 ± 4.78 b	306.95 ± 4.94 a	75.09 ± 2.82 ab	9.03 ± 2.07 b	24.27 ± 3.79 BCE
	427	326.84 ± 8.47 b	75.34 ± 1.29 b	35.89 ± 2.36c	60.1 ± 1.96 ab	5.33 ± 1.16 b	15.95 ± 3.66c
	1400	552.8 ± 7.11 a	80.68 ± 5.84 b	77.76 ± 4.57 BCE	48.48 ± 2.34 b	17.33 ± 0.50 b	35.61 ± 1.56 b
	8610	136.33 ± 5.36c	138.46 ± 8.37 a	159.95 ± 8.80 b	94 ± 3.76 a	45.2 ± 15.50 a	70.20 ± 8.12 a

Note: RO = 231 mg/l. Tap = 427 mg/l. Diluted RAW = 1400 mg/l. RAW = 8610 mg/l. TDS = total dissolved solids. Means within columns with the same letter are not significant at $\alpha \leq 0.05$. NA= not available.

Table 9
Mean and standard error of Total N, P, K, Mg, Ca, Zn, and Mn ion concentration (mg/l) in shoots of five forages irrigated with produced water (second harvest).

Plant ID	Treatment	TDS mg/l	Total N mg/l	P mg/l	K mg/l	Mg mg/l	Ca mg/l	Zn mg/l	Mn mg/l
Mean ± SE									
Wheatgrass (western)	231		7.30 ± 0.20 b	1.17 ± 0.09 b	9.5 ± 0.30 b	1.83 ± 0.13 a	5.03 ± 0.34 a	24.32 ± 3.27 a	83.01 ± 5.74 b
	427		8.79 ± 0.45 a	1.53 ± 0.07 a	12 ± 0.55 a	2.2 ± 0.31 a	4.8 ± 0.61 a	22.86 ± 1.35 a	61.56 ± 7.81 b
	1400		8.43 ± 0.36 ab	1.23 ± 0.07 b	9.27 ± 0.38 b	2.03 ± 0.19 a	3.77 ± 0.32 a	18.3 ± 2.21 a	131.55 ± 7.32 a
	8610		NA	NA	NA	NA	NA	NA	NA
Alfalfa	231		31.27 ± 6.33 a	0.95 ± 0.05 b	10.2 ± 1.35 a	2.63 ± 0.24 b	19.47 ± 0.64 b	19.1 ± 3.85 ab	195.14 ± 7.31 a
	427		29.53 ± 2.11 a	0.88 ± 0.07 b	10.7 ± 1.51 a	5.03 ± 0.44 a	30.07 ± 1.32 a	18.28 ± 2.45 b	80.89 ± 1.91 b
	1400		35.53 ± 2.14 a	1.94 ± 0.05 a	10.3 ± 1.74 a	2.3 ± 0.15 b	12.7 ± 1.74 c	30.04 ± 3.33 a	64 ± 1.65 b
	8610		NA	NA	NA	NA	NA	NA	NA
Bromegrass (Meadow)	231		11.7 ± 0.46 b	2.93 ± 0.09 a	20.97 ± 0.38 a	3.27 ± 0.12 b	12.3 ± 0.21 a	19.3 ± 0.90 a	96.1 ± 6.41 a
	427		12.5 ± 0.73 ab	2.21 ± 0.10 b	19.4 ± 0.85 ab	4.87 ± 0.20 a	13.4 ± 0.93 a	16.24 ± 1.87 a	78.53 ± 4.05 a
	1400		13.9 ± 0.46 a	2.46 ± 0.12 b	18.1 ± 0.21 b	3.33 ± 0.29 b	13.37 ± 2.15 a	16.69 ± 4.32 a	90.38 ± 9.96 a
	8610		NA	NA	NA	NA	NA	NA	NA
Russian wildrye	231		11.99 ± 1.22 a	2.04 ± 0.34 a	16.97 ± 0.37 a	3.7 ± 0.17 b	8 ± 0.21 a	16.02 ± 2.46 a	66.23 ± 1.17 b
	427		12.57 ± 0.24 a	1.81 ± 0.16 a	17.83 ± 0.18 a	5.1 ± 0.40 a	9.03 ± 0.56 a	16.43 ± 2.34 a	45.78 ± 3.01 b
	1400		14.43 ± 1.30 a	1.74 ± 0.31 a	16.37 ± 1.2 a	3.73 ± 0.43 b	7.27 ± 1.11 a	17.79 ± 2.79 a	122.08 ± 1.32 a
	8610		NA	NA	NA	NA	NA	NA	NA
Tall fescue	231		10.45 ± 0.96 a	2.07 ± 0.25 a	12.87 ± 1.19 a	4.43 ± 0.33 a	8.9 ± 0.93 a	20.73 ± 1.14 a	232.86 ± 9.79 b
	427		10.39 ± 0.43 a	1.74 ± 0.08 a	12.9 ± 0.44 a	4.3 ± 0.40 a	9.07 ± 0.56 a	19.05 ± 1.54 a	228.77 ± 9.29 b
	1400		15.67 ± 4.27 a	1.96 ± 0.03 a	12.33 ± 1.67 a	3.4 ± 0.36 a	6.93 ± 0.72 a	21.74 ± 1.76 a	616.45 ± 7.41 a
	8610		15.13 ± 1.25 a	1.96 ± 0.27 a	14.8 ± 1.90 a	1.47 ± 0.20 b	4.1 ± 0.32 b	13.45 ± 1.00 b	225.01 ± 5.80 b

Note: RO = 231 mg/l. Tap = 427 mg/l. Diluted RAW = 1400 mg/l. RAW = 8610 mg/l. TDS = total dissolved solids. Means within columns with the same letter are not significant at $\alpha \leq 0.05$. NA= not available.

Table 10
Mean and standard error of Fe, B, Al, S, Cl, and Na ion concentration (mg/l) in shoots of five forages irrigated with produced water (second harvest).

Plant ID	Treatment	TDS mg/l	Fe mg/l	B mg/l	Al mg/l	S mg/l	Cl mg/l	Na mg/l
Mean ± SE								
Wheatgrass (western)	231		105.07 ± 4.13 a	391.68 ± 3.19 a	79.06 ± 5.67 a	1.77 ± 0.07 b	11.9 ± 1.68 a	3.06 ± 0.10 b
	427		40.56 ± 0.19 a	15.96 ± 0.61 b	21.66 ± 1.51 a	2.57 ± 0.53 ab	16.23 ± 0.91 a	4.84 ± 1.92 ab
	1400		43.05 ± 2.72 a	42.31 ± 1.97 b	24.74 ± 2.68 a	4 ± 0.76 a	13.6 ± 0.34 a	10.7 ± 2.35 a
	8610		NA	NA	NA	NA	NA	NA
Alfalfa	231		173.73 ± 7.58 a	520.86 ± 9.65 a	44.99 ± 4.22 a	3.87 ± 0.62 b	13.9 ± 0.55 a	8.43 ± 0.85 b
	427		131.98 ± 2.97 a	132.2 ± 2.93 b	77.74 ± 3.55 a	5.2 ± 0.45 b	14.07 ± 0.94 a	5.82 ± 1.05 b
	1400		150.08 ± 6.90 a	140.57 ± 5.54 b	69.41 ± 3.93 a	12.17 ± 0.93 a	17.17 ± 0.16 a	24.79 ± 4.41 a
	8610		NA	NA	NA	NA	NA	NA
Bromegrass (Meadow)	231		148.65 ± 4.80 a	791.16 ± 9.71 a	102.14 ± 1.52 a	4.97 ± 0.24 b	9.03 ± 0.18 a	7.72 ± 0.65 b
	427		96.33 ± 1.08 a	33.37 ± 3.50 b	92.13 ± 2.21 a	7.1 ± 0.35 b	14.17 ± 0.36 a	13.34 ± 0.66 b
	1400		92.64 ± 1.55 a	92.53 ± 4.20 b	48.86 ± 0.09 a	14.57 ± 2.47 a	25.63 ± 0.71 a	27.78 ± 5.43 a
	8610		NA	NA	NA	NA	NA	NA
Russian wildrye	231		87.98 ± 2.38 a	388.53 ± 8.28 a	42.04 ± 0.50 a	4.4 ± 0.47 a	16.53 ± 0.69 a	11.02 ± 0.97 b
	427		65.82 ± 3.68 a	22.17 ± 0.66 b	48.11 ± 4.31 a	4.5 ± 0.36 a	10.87 ± 0.02 a	11.36 ± 1.08 ab
	1400		72.74 ± 4.48 a	59.65 ± 9.96 b	35.9 ± 0.12 a	7.5 ± 1.51 a	14.6 ± 0.70 a	18.06 ± 3.17 a
	8610		NA	NA	NA	NA	NA	NA
Tall fescue	231		70.18 ± 1.76 a	686.45 ± 6.20 a	39.8 ± 0.10 ab	5.63 ± 0.04 BCE	18.3 ± 0.20 a	10.83 ± 1.54 BCE
	427		72.29 ± 3.45 a	31.79 ± 3.85 b	49.4 ± 0.67 a	4.17 ± 0.12 c	16.1 ± 1.75 a	8.22 ± 1.19 c
	1400		74.8 ± 6.66 a	93.72 ± 4.61 b	38.5 ± 0.25 ab	7.8 ± 0.40 b	76.4 ± 0.03 a	16.55 ± 1.98 b
	8610		75.05 ± 9.23 a	207.58 ± 4.52 b	30.52 ± 0.19 b	12.6 ± 0.91 a	35.57 ± 0.95 a	33.62 ± 4.00 a

Note: RO = 231 mg/l. Tap = 427 mg/l. Diluted RAW = 1400 mg/l. RAW = 8610 mg/l. TDS = total dissolved solids. Means within columns with the same letter are not significant at $\alpha \leq 0.05$. NA= not available.

Table 11
Mean and standard error of soil bulk density (g/cm³), Organic matter OM (%), pH, and EC (mg/l) irrigated with produced water.

Plant ID	Treatment TDS mg/l	Soil bulk density	OM %	pH	EC mg/l
		g/cm ³			
		Mean ± SE			
Wheatgrass (western)	231	1.30 ± 0.05 b	0.67 ± 0.03 b	7.53 ± 0.15 b	401.3 ± 91.76 b
	427	1.49 ± 0.03 a	0.93 ± 0.03 a	8.3 ± 0.06 a	140 ± 25.26c
	1400	1.51 ± 0.06 a	0.77 ± 0.07 b	8.4 ± 0.00 a	877.3 ± 67.86 a
Alfalfa	231	1.51 ± 0.03 a	0.67 ± 0.03 b	7.63 ± 0.20 b	165.6 ± 30.36 b
	427	1.53 ± 0.05 a	1.07 ± 0.03 a	8.27 ± 0.03 a	135.3 ± 16.84 b
	1400	1.52 ± 0.10 a	0.77 ± 0.03 b	8.4 ± 0.00 a	938 ± 112.20 a
Bromegrass (Meadow)	231	1.54 ± 0.06 a	0.60 ± 0.00 b	7.63 ± 0.12 b	233.3 ± 100.77 b
	427	1.56 ± 0.03 a	0.90 ± 0.06 a	8.1 ± 0.06 a	177.3 ± 18.24 b
	1400	1.60 ± 0.01 a	0.53 ± 0.03 b	8.27 ± 0.03 a	1064 ± 37.08 a
Russian wildrye	231	1.58 ± 0.03 a	0.60 ± 0.00 b	7.67 ± 0.09 b	133 ± 4.04 b
	427	1.54 ± 0.03 a	0.90 ± 0.06 a	8.17 ± 0.03 a	172.6 ± 14.20 b
	1400	1.60 ± 0.04 a	0.60 ± 0.00 b	8.23 ± 0.09 a	966 ± 71.58 a
Tall fescue	231	1.56 ± 0.01 ab	0.80 ± 0.00 ab	8.23 ± 0.03 a	165.6 ± 24.72c
	427	1.50 ± 0.03 b	0.90 ± 0.10 a	8.13 ± 0.09 a	205.3 ± 26.94c
	1400	1.60 ± 0.01 ab	0.63 ± 0.03 BCE	8.17 ± 0.03 a	1008 ± 50.53 b
	8610	1.61 ± 0.04 a	0.50 ± 0.00c	8.13 ± 0.03 a	1726.6 ± 61.80 a

Note: RO = 231 mg/l. Tap = 427 mg/l. Diluted RAW = 1400 mg/l. RAW = 8610 mg/l. TDS = total dissolved solids. EC = Electrical conductivity. Means within columns with the same letter are not significant at $\alpha \leq 0.05$.

Table 12
Mean and standard error of N, P, K, S, Zn, and Mn ion concentrations in soil irrigated with produced water.

Plant ID	Treatment TDS mg/l	N	P	K	S	Zn	Mn
		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Mean ± SE							
Wheatgrass	231	3.57 ± 0.13 b	4.67 ± 0.67 b	60.67 ± 0.67 b	41.33 ± 2.34 b	0.61 ± 0.11 a	0.87 ± 0.19 a
	427	6.3 ± 0.75 a	8 ± 0.00 a	112 ± 11.55 a	34 ± 11.55 b	0.55 ± 0.06 a	0.43 ± 0.07 a
	1400	4.4 ± 0.81 ab	6.3 ± 0.88 ab	114.33 ± 6.18 a	494.67 ± 41.24 a	1.21 ± 0.34 a	0.93 ± 0.24 a
Alfalfa	231	12.6 ± 3.14 a	5.33 ± 1.33 a	56 ± 7.01 b	25 ± 1.53 b	1.31 ± 0.58 a	2.13 ± 0.15 a
	427	6.67 ± 0.86 ab	4.67 ± 0.67 a	100.33 ± 6.34 a	21 ± 1.16 b	0.84 ± 0.07 a	3.33 ± 1.84 a
	1400	4.23 ± 0.37 b	4.33 ± 0.33 a	105.33 ± 7.81 a	288 ± 31.99 a	0.36 ± 0.03 a	1.93 ± 0.47 a
Bromegrass	231	3.6 ± 0.36 a	4.33 ± 1.33 a	66 ± 2.52 b	31.33 ± 1.45 b	0.85 ± 0.27 a	0.93 ± 0.07 a
	427	5.63 ± 0.50 a	8.67 ± 2.19 a	111 ± 7.78 a	42.67 ± 4.92 b	0.80 ± 0.13 a	0.70 ± 0.10 a
	1400	5.8 ± 0.95 a	8 ± 1.00 a	81.67 ± 0.33 b	323.33 ± 20.43 a	0.51 ± 0.06 a	1.40 ± 0.65 a
Russian wildrye	231	2.97 ± 0.12 a	5.33 ± 0.67 b	63.33 ± 4.92c	30 ± 3.79 b	0.40 ± 0.01 a	0.83 ± 0.23 a
	427	5.67 ± 2.04 a	9.67 ± 0.88 a	127.67 ± 2.91 a	33.67 ± 3.85 b	0.62 ± 0.16 a	0.53 ± 0.09 a
	1400	5.53 ± 0.27 a	8.33 ± 0.33 a	90.33 ± 1.86 b	295.33 ± 76.08 a	0.52 ± 0.06 a	1.10 ± 0.15 a
Tall fescue	231	2.73 ± 0.22 a	5.33 ± 1.33 b	80.67 ± 51.00 a	51 ± 13.13c	0.84 ± 0.03 a	0.57 ± 0.12 b
	427	5.07 ± 2.22 a	5.33 ± 0.33 b	96.33 ± 10.68 a	50.33 ± 26.99c	0.90 ± 0.41 a	0.60 ± 0.00 b
	1400	4.8 ± 0.93 a	7 ± 0.58 b	81.33 ± 2.97 a	211.67 ± 73.87 b	0.73 ± 0.19 a	0.97 ± 0.17 b
Tall fescue	8610	4.73 ± 0.12 a	10.3 ± 0.67 a	99.67 ± 7.06 a	982.67 ± 20.19 a	0.60 ± 0.05 a	1.93 ± 0.23 a

Note: RO = 231 mg/l. Tap = 427 mg/l. Diluted RAW = 1400 mg/l. RAW = 8610 mg/l. TDS = total dissolved solids. Means within columns with the same letter are not significant at $\alpha \leq 0.05$.

Table 13
Mean and standard error of Mg, Ca, Na, Fe, and B ion concentrations and SAR in soil irrigated with produced water.

Plant ID	Treatment	TDS mg/l	Mg mg/l	Ca mg/l	Na mg/l	SAR	Fe mg/l	B mg/l
					Mean ± SE			
Wheatgrass	231		105.67 ± 0.88 b	849.67 ± 25.74 b	267.33 ± 25.16 b	3.25 ± 0.34 b	11.2 ± 1.71 a	3.87 ± 0.24 a
Wheatgrass	427		277.67 ± 38.83 a	2393.6 ± 291.88 a	187.33 ± 37.40 b	1.38 ± 0.30 c	5.1 ± 0.36 b	0.90 ± 0.06 c
Wheatgrass	1400		254.67 ± 33.93 a	2191 ± 245.19 a	1173 ± 18.93 a	9.01 ± 0.61 a	5 ± 0.20 b	2.10 ± 0.15 b
Alfalfa	231		119.67 ± 5.21 c	1008 ± 170.03 b	220.33 ± 30.05 b	2.52 ± 0.46 b	21.13 ± 2.27 a	2.43 ± 0.29 a
Alfalfa	427		360 ± 19.70 a	2692 ± 194.99 a	186.33 ± 13.26 b	1.26 ± 0.07 c	11.8 ± 1.85 b	0.73 ± 0.07 c
Alfalfa	1400		259.67 ± 36.60 b	1909 ± 310.77 a	1047 ± 74.01 a	8.51 ± 0.42 a	9.73 ± 2.14 b	1.70 ± 0.17 b
Bromegrass	231		108.67 ± 3.76 b	963 ± 97.97 b	209.33 ± 12.16 b	2.41 ± 0.06 b	10.47 ± 0.62 a	3.07 ± 0.13 a
Bromegrass	427		312 ± 30.04 a	2417.6 ± 223.78 a	250.67 ± 25.79 b	1.79 ± 0.10 b	8.60 ± 1.40 a	0.77 ± 0.09 c
Bromegrass	1400		130 ± 7.10 b	1050.67 ± 72.50 b	874.67 ± 54.61 a	9.61 ± 0.82 a	8.30 ± 2.18 a	1.37 ± 0.09 b
Russian wildrye	231		101.33 ± 5.90 b	785 ± 13.44 c	203 ± 18.79 b	2.56 ± 0.23 a	9.97 ± 1.97 a	3.03 ± 0.20 a
Russian wildrye	427		301.67 ± 20.54 a	2359.3 ± 183.15 a	243 ± 28.97 ab	1.79 ± 0.26 a	6.33 ± 1.09 a	0.80 ± 0.10 c
Russian wildrye	1400		145.67 ± 8.96 b	1397.3 ± 189.28 b	782 ± 272.71 a	7.89 ± 3.19 a	6.07 ± 1.59 a	1.60 ± 0.26 b
Tall fescue	231		219 ± 13.07 ab	1766 ± 65.01 ab	265.33 ± 45.75 c	2.22 ± 0.34 c	7.13 ± 0.32 ab	4.67 ± 0.57 a
Tall fescue	427		283.67 ± 49.93 a	2248 ± 423.53 a	234 ± 62.37 c	1.72 ± 0.34 c	6.43 ± 0.73 b	0.80 ± 0.10 c
Tall fescue	1400		150.67 ± 8.66 BCE	1162.3 ± 46.16 BCE	666.6 ± 166.89 b	6.84 ± 1.62 b	8.17 ± 1.20 ab	1.33 ± 0.23 c
Tall fescue	8610		39 ± 4.36 c	920.67 ± 27.32 c	1974 ± 7.65 a	24.5 ± 0.27 a	10.37 ± 1.44 a	3.17 ± 0.15 b

Note: RO = 231 mg/l. Tap = 427 mg/l. Diluted RAW = 1400 mg/l. RAW = 8610 mg/l. TDS = total dissolved solids. SAR = Sodium adsorption ratio. Means within columns with the same letter are not significant at $\alpha \leq 0.05$.

water which shows suitability of this species for irrigation with RAW water.

4.2. Plant dry biomass

Within species, alfalfa biomass decreased with diluted RAW; however, compared with other species, alfalfa produced higher dry biomass in RO, tap and diluted RAW water. This could be due to the rapid growth of alfalfa aboveground biomass compared with the other grass species. This agrees with a previous study comparing the growth of alfalfa and triticale irrigated with various levels of saline water up to 5600 mg/l where alfalfa growth decreased with increasing irrigation water salinity (Kankarla et al., 2019). Barley (*Hordeum vulgare*) grew well with high biomass as the irrigation treatment salinity increased (Katerji et al., 2009). In contrast, with increasing water salinity, Khan and Glenn (1996) reported reduction in barley biomass. Tall fescue grew well in RAW up to 8610 mg/l; therefore, it can be considered a halophyte. Kankarla et al. (2019) and Ozturk et al. (2018) reported no reduction in triticale biomass irrigated with 5600 and 7000 mg/l saline water, respectively, which agrees with our finding for tall fescue species.

4.3. Evapotranspiration

Continuous irrigation with saline water caused decreases in cumulative ET for all five species and resulted in decreased plant growth and biomass. Yang et al. (2020) reported related results when ET of tomato decreased with increasing irrigation water salinity ranged between 1400 and 4200 mg/l. On accord with this study, decreases in pecan ET with increasing irrigation water salinity up to 5600 mg/l have been reported (Ben Ali et al., 2021). However, no changes in plant biomass and ET were reported when irrigation up to 7000 mg/l was applied to halophytic species (Ozturk et al., 2018).

4.4. Plant height and SPAD value

The results indicated no significant changes in the forage species with continued irrigation with diluted RAW and tall fescue with RAW water irrigation. On the contrary, Pessarakli (2011) reported decreases in salt-grass species *Distichlis spicata* L. shoot length with increasing water salinity. SPAD value was higher in tap and diluted RAW water irrigated plants than with RO treatment. A decrease in chlorophyll content was reported on pecan leaves irrigated with water up to 5600 mg/l (Ben Ali et al., 2020). Tomato chlorophyll content decreased with increases in salinity (Taffouo et al., 2010; Zhang et al., 2016). Li et al. (2018) reported decreases in chlorophyll content of *Eremochloa ophiuroids* irrigated with NaCl dominant saline water.

4.5. Plant ion contents

Three major tools to distinguish ions toxicity are plant analysis, soil testing, and field observations (McCauley et al., 2009). The irrigation water showed increases in Na, Ca, Mg, and Cl with increasing salinity of water. These ions respond in one of paths: leach out of the soil, accumulate in the soil, or accumulate in plants tissue by root water uptake. As the results indicated, Na, Ca, Mg, and Cl ions presented in the plants' tissues increased as the treatment salinity increased. Wheatgrass, alfalfa, bromegrass, Russian wildrye, and tall fescue gained and accumulate Na and Cl and which may have led to the decreases in the biomass by increasing water salinity. These results are consistent with a previous study that applied saline water on alfalfa and triticale (Kankarla et al., 2019). Pica et al. (2017) reported that produced water with a Na concentration of 1156 mg/l inhibited sweet wormwood and switchgrass growth.

Tall fescue thrived and grew back after the two harvests despite the Na content in RAW water being 59 times greater than in the control,

demonstrating that tall fescue is more tolerant to high Na levels than other species. A previous study reported that the tolerance of tissue to accumulated Na or Cl, osmotic stress tolerance, and Na or Cl exclusion are the three adaptation types of plant to salinity stress (Munns and Tester, 2008), and plants differ in their response to Na and Cl accumulation (Tavakkoli et al., 2010). Ca performs a significant role in mitigating salt toxicity, which is associated with the selective effect of K/Na by controlling the flow of Na through non-selective ion channels (Rahneshan et al., 2018). The results showed decreases in Ca in RAW irrigated species meaning that tall fescue might have the potential of utilizing Na for growth while higher Ca might assist wheatgrass, alfalfa, bromegrass, and Russian wildrye to reduce the toxic effects of Na on their growth. This role might be the reason for the grasses' survival since the increases in Na were higher with increases in the treatment's salinity; however, these plants might have a mechanism that controls the increases in Na and Cl by sequestering these ions in the vacuoles to manage low concentrations in the cytoplasm therefore resulting in good metabolism (Kankarla et al., 2019).

Nitrogen is responsible for Nucleic acid, chlorophyll, and protein production (McCauley et al., 2009). Magnesium has a key role on enzyme activation and is related to chlorophyll content (Ben Ali et al., 2020). In our study, Mg declined as the irrigation water increased, which might explain the increases in chlorophyll content by increasing water salinity. A previous study mentioned that increased Mg decreased chlorophyll content of pecan trees irrigated with saline water up to 5600 mg/l (Ben Ali et al., 2020). Phosphorus reduction causes interruption in cell signaling and protein synthesis (Epstein and Bloom, 2005). Our results showed decreases in P concentration in the forage tissues with increasing water salinity. These results agreed with a previous study (Hussain et al., 2014).

Potassium's role is to activate enzymes contributed with ATP production and to regulate photosynthetic presses (Epstein and Bloom, 2005). The increases in Na might eliminate plant K uptake and interrupt photosynthesis regulation (Hussain et al., 2014). In this study, K decreased in wheatgrass, bromegrass, and tall fescue tissues with increased Na concentration. The sulfur ion is important for chlorophyll and protein synthesis (McCauley et al., 2009). Our results showed increases in S ions when water salinity increased. Zinc is used primarily for internode elongation and chlorophyll therefore any deficiency can affect the plants growth (McCauley et al., 2009). The forage species presented reduction in Zn as the irrigation water salinity increased; however, growth was not affected.

Iron is a principal element for plant respiration (McCauley et al., 2009). Fe decreased with increased water salinity; however, the plant's growth was not clearly affected. Manganese is important in chloroplasts where photosynthesis takes place (McCauley et al., 2009). In this study, Mn declined with increased water salinity with all the forage species. Boron has a role on cell wall formation and reproductive tissue (McCauley et al., 2009). Boron can be toxic to plants; however, plants are varied in acceptable concentrations that they can manage (McCauley et al., 2009). Even with the increases in B concentration in the forages irrigated with RO and RAW, plant species did not show any signs of B toxicity such as chlorosis and necrosis, meaning that the plants could have managed the increase in B concentration. One exception was with bromegrass showing signs of B toxicity due to the increases in B concentration with RO irrigation treatment.

4.6. Soil bulk density, organic matter, pH, and EC

As the water salinity increased with continuous irrigation, soil bulk density increased. This was due to salt precipitation in the soil pores with attendant decreases in the pores size. In contrast, Al-Nabulsi (2001) reported decreases in soil bulk density when irrigated with 7700 mg/l sodic drainage water while Ben Ali et al. (2021) reported no differences with continuous irrigation with saline water up to 5600 mg/l. Our results indicated significant reduction in soil OM % as the salinity

increased. In agreement with our findings, Zhang et al. (2019) also reported a reduction in OM % and increases in alkalinity with increasing salinity. Results indicated that as the irrigation water salinity increased, soil EC significantly increased. This increase, however, was not as large as expected and this was due to the leaching fraction, which ranged between 40 % and 50 % of the irrigation water amount which prevented salt build up in the soil. According to Ayres and Wescot, (1985) leachate of 50 % could control salt build up in the soil reflecting in reduced salt accumulation in plants. In consent with this study, previous greenhouse studies reported greater increases in soil EC than ours along with continued irrigation with brackish water (EC 2870 – 7000 mg/l) to irrigate halophytic species (Flores et al., 2016; Ozturk et al., 2018).

4.7. Leachate and soil ion concentrations

Leaching, accumulation, and root uptake are the three major pathways for water and soil ion transport. Irrigation with produced water could increase salinity and sodicity, which can be observed on leachate water results collected from the pots. As the water salinity concentration increased, the leachate became more saline and sodic. The increase in treatment salinity led to leaching of Mg, Ca, Na, and Cl in the collected leachate samples. Comparable results were reported with alfalfa species irrigated with various levels of saline water (Kankarla et al., 2019). Compared to the control irrigated soil, soil Na concentration was five times higher in diluted RAW water in wheatgrass and alfalfa pots while it was around three times in bromegrass and Russian wildrye pots. Due to the increases in Na ion concentration as the water salinity increased, soil SAR increased and reached 24.46, which is highly sodic. From the observed data, tall fescue had the ability to utilize Na ions to build up its biomass in RAW water and that might explain the decline in Na ions in RAW water irrigated soil compared to other species. Bromegrass and alfalfa could not maintain an adequate Ca/Na ratio and that resulted in the decline in biomass in diluted RAW water compared to the control. Potassium has been reported to increase the soil microporosity resulting in increases in soil moisture capacity (Zaker and Emami, 2019). This was observed in the greenhouse in tall fescue pots irrigated with RAW water and those pots remained wet for longer durations than other pots. In consent with our results, soil irrigated with reverse osmosis concentrate remained wet for longer than control treatment (Ben Ali et al., 2021). To control salt build up in plant tissues, plants might reduce the root water uptake as a mechanism to survive the unpreparable conditions (Munns and Tester, 2008).

Toxicity is usually related to boron, sodium and chloride concentrations (Ayres and Wescot, 1985). Toxic and excessive levels of boron has been reported in arid and semi-arid regions (Padbhushan and Kumar, 2017). Based on soil saturated extract, 5–10 mg/l soil boron concentration represent semi-tolerant and tolerant plants respectively while the toxicity threshold begins at 2 mg/l soil boron concentration for sensitive plants (Gough et al., 1980). Our boron results exceeded the threshold of 2 mg/l, as reported previously, in RO, diluted RAW, and RAW for all species; however, toxicity signs were observed in bromegrass species. A previous study reported reduction in boron toxicity in wheat, numerous vegetables, and rootstock with increasing in salinity (Henry Ezechi et al., 2012). This could be what happened with those plants with increases in salinity, thus surviving two harvests. Munns and Tester (2008) reported that in soil, 40 mM (\approx 2800 mg/l) of NaCl concentration is toxic for most of the plants species. Soil sodium concentration, in this study was about 1974 mg/l in RAW water in tall fescue pots, which is the highest concentration among all the species. Toxicity level differs among plants species and depends on the plant's sensitivity for salts type and concentration; thus, some plants are sensitive to Na while others are more sensitive for Cl (Ayres and Wescot, 1985). Some water, plant, and soil ion concentrations thresholds are included in (Table S3). To confirm our results, continuous irrigation with the same treatments, after the second harvest, resulted in those species growing well again for two more full harvests. This provides the evidence of the

feasibility to utilize desalinated and diluted produced waters for irrigating forage plants.

5. Conclusion

The present study investigated the effects of irrigating western wheatgrass, alfalfa, meadow bromegrass, Russian wildrye, and tall fescue with RO desalinated produced water, Tap water, diluted RAW produced water, and RAW produced water as a valuable source of water in arid areas. Desalination of produced water reduced the salt buildup in soil and plants. ET decreased with increasing water salinity but wheatgrass, alfalfa, bromegrass, and Russian wildrye grew well during two harvests of the experiment and grew back again with continued RO, tap, and diluted RAW irrigation after the second harvest; however, tall fescue survived even the RAW irrigation. Alfalfa biomass decreased in diluted RAW water while tall fescue was a tolerant species and can be irrigated with higher salinity water. Increasing soil salinity is a major issue when considering irrigation with produced water; however, a good leaching ratio, especially in areas where water tables are deep, can reduce Na, Cl, and other ions from building up in the rootzone and in plant tissue. Boron toxicity symptoms were noticed only in the meadow bromegrass. There was no sign of toxicity regarding Na and Cl in all the surviving plants in this study with continued irrigation with saline water. The research results promote the feasibility of using desalinated and diluted produced water to irrigate forage grasses; however, an effective monitoring system is required especially when RAW or diluted RAW is used for irrigation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability

Data will be made available on request.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.agwat.2022.107966.

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