



April 3, 2018

Reference No. 086241

Mr. Gregory Jojola  
Environmental Program Manager  
Pueblo of Laguna  
Environmental and Natural Resources Department  
PO Box 194  
Laguna, New Mexico 87026

Mr. Randolph Bayliss  
Energy, Minerals, and Natural Resources  
Department  
New Mexico Oil Conservation Division  
1220 South St. Francis Drive  
Santa Fe, New Mexico 87505

Dear Mr. Jojola and Mr. Bayliss:

**Re: 2018 Work Plan  
Laguna Compressor Station, AP-103  
Cibola County, New Mexico**

GHD Services, Inc. (GHD), on behalf of Transwestern Pipeline Company, LLC (Transwestern) submits this work plan for the Transwestern Compressor Station 6 located in Laguna, Cibola County, New Mexico. The Laguna Compressor Station (Site) is located on property owned by the Laguna Pueblo within Section 7, Township 9 North, Range 5 West (Figure 1). The site is regulated by the Pueblo of Laguna (PoL) Department of Environment and Natural Resources (DENR) and the New Mexico Oil Conservation Division (NMOCD).

## 1. Project Understanding

Based on a review of records, the Site has been in active assessment and remediation since 1990. The primary contaminants of concern (COC) consist of benzene, 1,1 dichloroethane (1,1 DCA), 1,1 dichloroethene (1,1 DCE) and polychlorinated biphenyls (PCBs). The Environmental Protection Agency (EPA) Safe Drinking Water Act Maximum Contaminant Levels for the Site are:

Constituent	EPA Safe Drinking Water Act Maximum Contaminate Level (Parts per Billion [ppb])
Benzene	5
1,1, DCE	7
1,1, DCA	25*
PCB	0.5

\* New Mexico Water Quality Control Commission standard

The depth to groundwater across the Site ranges from approximately 9 to 24 feet below ground surface. The groundwater gradient is to the northeast. The groundwater is believed to be perched above a sandstone unit and travels via fracture flow.

Soil and groundwater at the Site contain 1,1,1 trichloroethane (1,1,1 TCA), 1,1 dichloroethane (1,1 DCA), and 1,1 dichloroethene (1,1 DCE). In the vicinity of monitoring well 6 47 (Figure 2), anaerobic biodegradation of 1,1,1 TCA to 1,1 DCA by reductive dechlorination appears to be occurring; however,



significant biodegradation of 1,1 DCA to chloroethane and ethane does not appear to be occurring. In the vicinity of monitor well 6 44, abiotic hydrolysis of 1,1,1 TCA to 1,1 DCE appears to be occurring. Significant degradation of 1,1 DCE is not occurring because it traditionally degrades very slowly.

It was concluded from a preliminary review of data that in situ enhanced biodegradation (ISEB) under anaerobic conditions may be an effective treatment for the Site. GHD proposed to use an emulsified vegetable oil (EVO) to enhance anaerobic conditions. This would enhance reductive dechlorination of 1,1,1 TCA to 1,1 DCA and stimulate dechlorination of 1,1 DCA to ethane. It should also reduce the formation of 1,1 DCE.

A laboratory treatability study was performed by GHD's Innovative Technology Group (ITG) to test the effectiveness of ISEB under anaerobic conditions to treat the Site soil and groundwater. Microcosms of Site soil and groundwater were set up to assess the potential for treatment by enhanced anaerobic biodegradation. The results of the treatability study indicated that the microcosm that contained soil, groundwater, EVO, yeast extract, and nutrients was conducive to enhancing in situ biodegradation.

After 4 weeks of treatment, 1,1,1 TCA and 1,1 DCE were reduced to below their analytical detection limits in the microcosm that received EVO, yeast extract, and nutrients. An increase in 1,1 DCA in the microcosm showed that biodegradation was occurring.

After 8 weeks, the concentration of 1,1 DCA had not decreased. At this point, additional EVO was added to the microcosm to enhance biodegradation further.

After 12 weeks, 1,1,1 TCA and 1,1 DCE had been reduced to below their analytical detection limits in the microcosm. A slight decrease in concentrations of 1,1 DCA was observed in the microcosm; however, the concentrations remained above baseline levels. These data suggested that complete degradation of 1,1 DCA to ethene and ethane was occurring; however, 12 weeks were not long enough for complete degradation of the 1,1 DCA to occur. These data suggest that complete biodegradation will occur but longer than 12 weeks would be required.

GHD installed monitoring well MW-6-54 (see Figure 2) between existing wells 6-09 and 6-21 on September 7, 2016 to serve as an injection well for an ISEB pilot study.

GHD performed a pilot study injection program to test the effectiveness of ISEB at the Site. Based on the results of the bench scale testing, EVO, yeast extract, and nutrients were injected via monitoring wells into the groundwater on September 8, 9, 14 and 16, 2016 in order to try and enhance the biodegradation of COCs at the Site.

GHD applied the recommended dosage of EVO, yeast extract, and nutrients as prescribed from the ITG treatability study. Approximately 3 pounds of EVO, 0.09 pound of Accelerite (a B12 nutrient similar to yeast extract), 0.03 pound of ammonium sulfate (a fertilizer for alkaline soils), and 0.003 pound of sodium phosphate (a non-toxic water softener) were mixed per cubic yard of saturated matrix.

The solution was injected into monitoring wells 6-09 or 6-54 using a small pump. Monitor wells used to assess the effectiveness of the injection included wells 6-9, 6-13, 6-21B, 6-21C, 6-22B, and 6-22C.



Annual groundwater sampling was performed from August 2 to August 4, 2016 that included 24 monitoring wells and post ISEB treatment groundwater sampling was performed on December 14, 2016 that included seven monitoring wells.

GHD performed a site-wide baseline sampling assessment during the Annual Groundwater Monitoring event in March 2017. The site-wide baseline sampling assessment included all of the on-site wells that could be found. A total of 40 wells (see Table 1) were sampled and the samples submitted to Hall Environmental Analysis Laboratory (HEAL) for analyses of volatile organic compounds (VOCs) by EPA Method 8260 and PCBs by EPA Method 8082. Monitoring well 6-20B was not analyzed for PCBs due to having no detected concentrations above the laboratory reporting limits (LRLs) for 27 rounds of sampling.

Post ISEB treatment/quarterly groundwater sampling that included 8 wells was performed on June 6, September 7, and December 6, 2017. Samples were collected from monitoring wells 6-09, 6-13, 6-14, 6-21B, 6-21C, 6-22B, 6-22C, and 6-40. The samples were submitted to HEAL for analyses of VOCs by EPA Method 8260, PCBs by EPA Method 8082, total organic carbons by EPA Method 9060, and for dissolved ethane, methane, ethane and total organic carbon

The results indicated that total organic carbon concentrations were not increasing significantly. In the injection well (6-9), the TOC was 430 milligrams per liter (mg/l) during the last monitoring event performed in December 2017 (see Table 2). The remaining wells were 44 mg/l or less. In general, the TOC should be 1000 mg/l or more. Based on this data, GHD is proposing to perform additional injections of emulsified vegetable oil (EVO) in an attempt to increase the TOC concentration.

## 2. Proposed Scope of Work

Based upon review of the existing site data, our understanding of the various regulatory programs and conversations with Transwestern personnel, GHD has prepared the follow scope of services for 2018.

### 2.1 2018 Tasks:

#### 2.1.1 Task 1: Project Preparation

This task includes the preparation and submission of this work plan and other project preparation activities that occur after work plan approval, but before fieldwork mobilization. After receiving authorization to proceed from stakeholders, GHD notify Transwestern a minimum of 48 hours prior to the commencement of field activities. Approval from the NMOCD and PoL will not be obtained for this work plan because the proposed scope of work has previously been approved by both agencies.



## **2.1.2 Task 2: Groundwater Monitoring**

### ***Annual Groundwater Monitoring***

GHD proposes to perform an Annual Groundwater Monitoring event to include the 25 wells listed in Table 1. A groundwater sample will be collected from each well that contains enough water to be sampled.

Prior to collecting groundwater samples, an oil/water interface probe will be used to measure groundwater depths and check for the presence of light non-aqueous phase liquids (LNAPL) in each of the Site monitoring wells. Before and after each use, the oil/water interface probe will be cleaned with an Alconox®/deionized water solution and rinsed with deionized water.

Monitoring wells will be purged and sampled using a dedicated, disposable polyethylene bailer. Field parameters including groundwater temperature, pH, conductivity, and oxidation/reduction potential (ORP) will be collected using an appropriate multi-parameter groundwater quality meter.

Following collection, groundwater samples will be labeled, placed on ice, and submitted to Hall Environmental Analysis Laboratory (HEAL) for analyses of volatile organic compounds (VOCs) by EPA Method 8260. Select samples (see Table 1) will be analyzed for PCBs by EPA Method 8082LF, TOC by EPA Method 9060, and sulfate and nitrate by EPA Method 300. The information obtained from this sampling event will be included in the 2018 Annual Report.

Purge water generated during the monitoring event will be placed in drums within secondary containment on Site.

## **2.1.3 Task 3: Additional ISEB Injections and Groundwater Monitoring**

### ***Three Monthly EVO Injections***

Sufficient EVO and nutrient material is available to perform additional injections. Due to the low permeability of the fractured sandstone formation, GHD is proposing to perform monthly injections. GHD is proposing to inject the EVO mixture into wells 6-9 and 6-54 (see Figure 2). Three monthly injections will be performed.

### ***Monthly and Quarterly ISEB Groundwater Monitoring***

Prior to each injection event, groundwater monitoring wells will be sampled to assess if an increase in TOC is observed. Wells to be sampled monthly for three months will include monitoring wells 6-09, 6-13, 6-14, 6-21B, 6-21C, 6-22B, 6-22C, 6-40, and 6-54. The first monitoring event will be coordinated with the annual sampling event to reduce costs. The purpose of the sampling will be to evaluate the effectiveness of the ISEB injections in increasing TOC in groundwater. Monthly monitoring will be conducted as outlined above for annual groundwater monitoring.



Following the injection events, two additional quarterly groundwater monitoring events will be performed on the same wells sampled during the monthly events. Samples will be submitted to HEAL for analysis of VOCs, PCBs, TOC, sulfate, and nitrate.

Results of the quarterly sampling will be included in the 2018 Annual Report.

#### **2.1.4 Task 3: 2018 Annual Report Preparation**

GHD will prepare an annual report summarizing annual and quarterly groundwater monitoring data collected during the 2018 calendar year. The annual report will include tabulated analytical and gauging data, groundwater gradient and isopleth maps for contaminants of concern from the annual event and recommendations for future activities at the Site.

A draft final version of the Annual Report will be submitted to Transwestern for review. The final report will incorporate comments received from Transwestern on the draft final and it will be submitted to Pol ENRD and NMOCD as a final following receipt of comments from Transwestern.

### 3. Schedule

GHD submits a copy of this work plan the PoL ENRD and the NMOCD for their review and files. Fieldwork will be scheduled pending Transwestern approval.

GHD appreciates the opportunity to submit this work plan to assist in the management, assessment, and remediation of the Laguna Compressor Station project.

Please feel free to contact either of us at 505-884-0672 if you have questions or comments.

Sincerely,

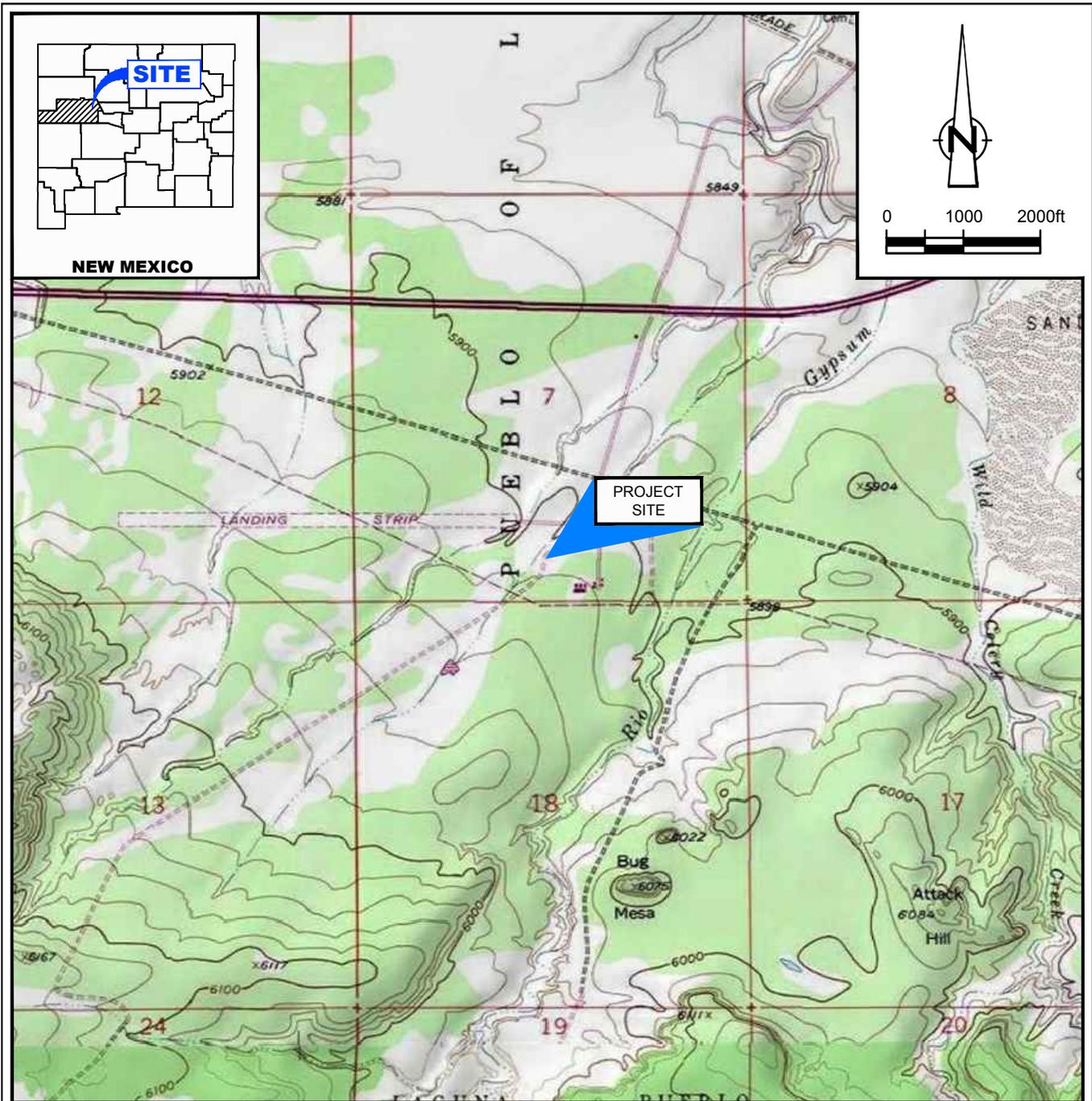
GHD

Alan Brandon  
Senior Project Manager

AB/md/1

Encl.

Bernard Bockisch, PMP  
Senior Project Manager



SOURCE: USGS 7.5 MINUTE QUAD  
"LAGUNA, NEW MEXICO"

LAT/LONG: 35.0170° NORTH, 107.4020° WEST  
COORDINATE: NAD83 DATUM, U.S. FOOT  
STATE PLANE ZONE - NEW MEXICO WEST

Figure 1  
SITE LOCATION MAP  
LAGUNA COMPRESSOR STATION NO. 6  
CIBOLA COUNTY, NEW MEXICO  
*Transwestern Pipeline Company, LLC*





**Table 1**  
**2018 Water Sampling Summary**  
**Laguna Compressor Station No. 6**  
**Cibola County, New Mexico**

Well ID	Annual Sampling				Two Monthly and Two Quarterly Sampling				Comments
	Analysis				Analysis				
	8260B Full List	PCBs	TOC	Sulfate and Nitrate	8260B Full List	PCBs	TOC	Sulfate and Nitrate	
6-07	X								ND for PCB - 3/23/17
6-08	X								ND for PCB - 3/23/17
6-09	X	X	X	X	X	X	X	X	
6-10	X	X							
6-12	X	X							
6-13	X	X	X	X	X	X	X	X	
6-14	X	X	X	X	X	X	X	X	
6-15	X	X							1,1 - DCA 3.4 ug/L, 1,1-DCE 2.0 ug/L
6-16	X	X							
6-18	X	X							Chloroform 2.8 ug/L
6-19	X								ND for PCB - 3/23/17
6-20B	X								27 events all ND for PCB
6-20C	X	X							
6-21B	X	X	X	X	X	X	X	X	
6-21C	X	X	X	X	X	X	X	X	
6-22B	X	X	X	X	X	X	X	X	
6-22C	X	X	X	X	X	X	X	X	
6-36	X								ND for PCB - 3/23/17
6-40	X	X	X	X	X	X	X	X	
6-41	X	X							PCB 15 ug/L - 3/23/17
6-42	X								ND for PCB - 3/23/17
6-44	X								ND for PCB - 3/23/17
6-45	X								17 events all ND for PCB
6-46	X								ND for PCB all 21 events
6-47	X								ND for PCB all 21 events
6-54	X	X	X	X	X	X	X	X	

Table 2

**ISEB Analytical Summary**  
**Laguna Compressor Station No. 6**  
**Laguna, New Mexico**

Well	Date	Benzene (µg/L)	1,1-DCA (µg/L)	1,1-DCE (µg/L)	PCBs (µg/L)	Total Organic Carbon (mg/L)	Methane (mg/L)	Ethane (mg/L)	Ethene (mg/L)
<b>EPA SDWA MCL</b>		<b>5</b>	<b>25</b>	<b>7</b>	<b>0.5</b>	<b>NE</b>	<b>NE</b>	<b>NE</b>	<b>NE</b>
6-9	12/14/16	Not sampled due to presence of EVO in well							
	03/22/17	Not sampled due to presence of EVO in well							
	06/06/17	1.3	<b>34</b>	<b>15</b>	<b>290</b>	630	2.6	<0.0010	<0.0010
	09/07/17	2	<b>43</b>	<b>19</b>	<b>200</b>	170	7.88	<0.0130	<0.0130
	12/06/17	2.1	<b>43</b>	<b>14</b>	<b>130</b>	430	3.9	<0.0010	<0.0010
6-13	12/14/16	3	9.8	<b>10</b>	<b>3.2</b>	55	NA	NA	NA
	03/23/17	2.1	9.3	<b>9.8</b>	<0.25	49	0.0063	<0.0010	<0.0010
	06/06/17	2.3	12	<b>11</b>	<1.0	46	0.007	<0.0010	<0.0010
	09/07/17	3	14	<b>12</b>	<1.0	50	0.025	<0.0130	<0.0130
	12/06/17	2.6	13	<b>10</b>	<1.0	44	0.0052	<0.0010	<0.0010
6-14	12/14/16	1.4	<b>53</b>	<b>20</b>	<b>22</b>	15	NA	NA	NA
	03/22/17	<1.0	20	4.7	<0.25	11	0.56	<0.0010	<0.0010
	06/06/17	<1.0	18	<b>7.1</b>	<b>7.1</b>	12	0.096	<0.0010	<0.0010
	09/07/17	1.6	<b>54</b>	<b>21</b>	<1.0	16	0.69	<0.0130	<0.0130
	12/06/17	1.7	<b>61</b>	<b>24</b>	12	17	0.85	<0.0010	<0.0010
6-21B	12/14/16	2.2	<b>52</b>	<b>14</b>	<b>55</b>	24	NA	NA	NA
	03/23/17	2.6	<b>72</b>	<b>21</b>	<0.25	19	0.002	<0.0010	<0.0010
	06/06/17	2.3	<b>74</b>	<b>21</b>	<1.0	20	0.0081	<0.0010	<0.0010
	09/07/17	1.9	<b>73</b>	<b>21</b>	<1.0	19	0.0288	<0.0130	<0.0130
	12/06/17	<1.0	<b>46</b>	<b>14</b>	<1.0	16	0.0032	<0.0010	<0.0010
6-21C	12/14/16	2.5	<b>82</b>	<b>54</b>	<b>76</b>	17	NA	NA	NA
	03/23/17	1.8	<b>73</b>	<b>44</b>	<b>100</b>	17	1.2	<0.0010	<0.0010
	06/06/17	2	<b>82</b>	<b>56</b>	<b>150</b>	17	3.4	<0.0010	<0.0010
	09/07/17	2.3	<b>89</b>	<b>62</b>	<b>95</b>	17	5.37	<0.0130	<0.0130
	12/06/17	2.1	<b>94</b>	<b>63</b>	<b>91</b>	18	3.9	<0.0010	<0.0010
6-22B	12/14/16	<b>10</b>	<1.0	<1.0	<b>33</b>	22	NA	NA	NA
	03/23/17	<b>9.5</b>	<1.0	<1.0	<0.25	21	<0.0010	<0.0010	<0.0010
	06/06/17	<b>6.8</b>	<1.0	<1.0	<b>4</b>	24	0.34	<0.0010	<0.0010
	09/07/17	<b>3.9</b>	<1.0	<1.0	<b>1.5</b>	20	0.825	<0.0130	<0.0130
	12/06/17	<b>2.6</b>	<1.0	<1.0	<b>1.3</b>	17	0.21	<0.0010	<0.0010
6-22C	12/14/16	2.4	<b>66</b>	<b>37</b>	<b>500</b>	16	NA	NA	NA
	03/23/17	1.9	<b>53</b>	<b>24</b>	<b>410</b>	17	1.2	<0.0010	<0.0010
	06/06/17	1.9	<b>52</b>	<b>28</b>	<b>970</b>	17	3.3	<0.0010	<0.0010
	09/07/17	1.9	<b>50</b>	<b>26</b>	<b>440</b>	17	4.65	<0.0130	<0.0130
	12/06/17	2.4	<b>54</b>	<b>33</b>	<b>350</b>	18	3.8	<0.0010	<0.0010
6-40	12/14/16	1.3	<b>67</b>	<b>29</b>	<b>21</b>	15	NA	NA	NA
	03/23/17	1.0	<b>49</b>	<b>18</b>	<b>13</b>	15	<0.0010	<0.0010	<0.0010
	06/06/17	<1.0	<b>51</b>	<b>19</b>	<b>28</b>	15	0.059	<0.0010	<0.0010
	09/07/17	<1.0	<b>53</b>	<b>18</b>	<b>38</b>	15	0.294	<0.0130	<0.0130
	12/06/17	1.2	<b>64</b>	<b>24</b>	<b>9.2</b>	16	0.18	<0.0010	<0.0010

## Notes:

ug/L = micrograms per liter

EPA SDWA MCL = Environmental Protection Agency Safe Drinking Water Act Maximum Contaminate Level

PCE = Tetrachloroethylene

TCA = Trichloroethane

DCA = Dichloroethane

DCE = Dichloroethene

DCA = Dichloroethane

**BOLD** = concentration exceeds EPA SDWA MCL or NMWQCC standard